

*ApproTEC*

**Super-MoneyMaker PRESSURE PEDAL PUMP  
IMPACT ASSESSMENT IN UTILISATION, JOB  
CREATION AND INCOME GENERATION**

**MONITORING VISIT CONDUCTED IN CENTRAL, EASTERN,  
RIFT VALLEY AND NYANZA PROVINCES OF KENYA**

**28<sup>TH</sup> JUNE TO 25<sup>TH</sup> JULY 1999**

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## EXECUTIVE SUMMARY

**Objective:** To assess impact the Super-*MoneyMaker* micro irrigation pump have had on the entrepreneurs in terms of job and income generation. Also to assess impact of training on the entrepreneurs. Job and income generation through setting up of vibrant SME (small and Micro Enterprises) are widely used as some indicators of economic growth and development, which is the ApproTEC mission.

**Sample Characteristics:** 44 pumps owners were interviewed in 16 districts in Eastern, Central, Rift Valley and Nyanza provinces from 28<sup>th</sup> June to 25<sup>th</sup> July 1999. Eastern, Central and parts of Rift Valley represented MicroPED region while Nyanza and North Rift Valley represented Western region. Of the 44 pumps, 84% were men owned and 16% were women owned. 91% were married couples, 9% single. Women managed 72.5% while men managed the rest. The respondents were 41% men, 43% women and 16% a combination of men and women. 52% had been trained, all from MicroPED region.

### **Findings**

#### **Promotion**

##### ***Where first heard/saw the pump***

Word of mouth and live demonstrations had 30% each. 16% saw in the Shows with Nairobi topping the list. 9% saw in the ApproTEC office and 7% on the KBC television during 1998 Nairobi Show. Nation newspaper reached 5% of the respondents while promotion fliers 2%.

##### **What convinced entrepreneurs buy the pump**

Live demonstrations at dealers' sites convinced 55% of the respondents and 23% by word of mouth. Shows reached 11% while 9% were convinced by visiting ApproTEC offices.

##### **Where else have the entrepreneurs seen the pump**

39% of the respondents later saw demonstrations at dealers' sites, 23% truck demonstrations, 7% heard from others and 5% saw the pump in the Shows.

#### **Source of capital**

68% of the respondents used past savings and 18% sold conventional crops. 5% used income from sale of irrigated crop (*MoneyMaker* micro irrigation pump), while another 5% used retirement fund. Sale of milk and livestock had 2% each.

#### **Pump use**

- Average age of the pumps visited was 8 months
- 43% were using streams as their source of water, 38% were using wells, with an average depth of 14 ft (4.3 meters) dug at an average fee of Ksh. 130/- per foot. 8% had both streams & wells, 10% were using dams while other 3% were using swamps.
- 91% of the pumps had been used. 7% will be put to use soon.
- Of those in use, 98% were irrigating. Other uses were for domestic water and feeding the livestock.
- On average, each pump sold is used for 2.8 hours/day for 119 days in a year.

#### **Pump Operators**

Pump operators are those people directly involved in peddling the pump, holding the hosepipe to direct water, scooping water from drums to take to the crop or arranging sprinklers.

- Each pump sold is operated by 2.9 people. 41% are women and 59% men.
- Of the 2.9 operators, 34% are waged while the rest 66% are family members.

#### **Job creation on owners farm**

ApproTEC defines a job as that activity which engages an individual for 150 days in a year, 5 hours daily (750 hours a year)

#### **Watering jobs**

- Each pump sold creates 1.7 jobs, 41% for women and 59% for men through watering.
- 36% of the watering jobs are waged while 64% are for the family members.

- 30% of the respondents doing bucket irrigation before they bought the pump initially were creating 1.2 jobs through watering. After buying the pump these increased by 0.5 jobs to 1.7 jobs.
- 70% were not irrigating before buying the pump. They have now created 1.7 jobs through watering.

#### **Other activities**

- For each pump sold there has been an increase in other farm activities (land preparation, harvesting and marketing), which has resulted to 0.6, increase jobs from 0.1 to 0.7.
- For the 30% who were doing irrigation before, there was an increase of 0.3 from 0.4 jobs to 0.7.
- For the 70% not doing irrigation before, there was an increase of 0.7 from 0 to 0.7.

#### **Total new jobs on owners farm**

- On average each pump sold created a total of **1.87 new jobs** on the owners farm as a result of increase from 0.46 before to 2.33 now.
- The 30% doing irrigation before realised 0.8 new jobs from 1.6 before to 2.4 jobs now.
- The 70% not doing irrigation before had 2.4 new jobs.

#### **Additional jobs in other farms**

- In addition 31% of the pumps sold were being lent out for irrigation (none was hired for a fee).
- Each pump sold is lent out to an average of 0.55 household units. Therefore each pump sold is used by an average of 1.55 household units.

#### **Irrigation**

- The 30% doing irrigation before **increased area under irrigation by 0.13 ha** from 0.1 ha to 0.23 ha, a 132% increase.
- The 70% not doing irrigation before **increased their area by 0.24 ha** from 0 to 0.24 ha.
- On average each pump sold lead to **0.21 ha increase in new area under irrigation** from 0.03 ha to 0.24 ha, a 700% increase. The figure is expected to rise with increased use of the pump over time.
- The average frequency of irrigation per week was 3.09 times.
- 78% of active pumps use hose irrigation method. 10% combine bucket with hose while 5% use sprinkler method. 2.5% combine hose with raised tank and another 2.5% use hose combined with furrow irrigation.
- Crops grown were: (% of the respondents) tomatoes 55%, Kales 52.5%, and Cabbages 30%. Other crops grown included, French beans 17.5%, cut flowers, passion fruits, green maize and onions each 5%. Potatoes, cowpeas, carrots, tea nursery, coffee, coriander, watermelon, spinach and okra each 2.5%.
- On average each pump sold leads to 2.34 horticultural crops cycles a year, a 1.14 increase from 1.20 to 2.34 (95%) increase.
- Those doing irrigation before increased their crop cycles by 0.08 from 2.69 to 2.77 per year while those not doing irrigation before increased by 1.53 from 0.60 to 2.13 crop cycles for horticultural crops only.

#### **Income**

- Each pump sold allows for an average crop cycle sales income of Ksh.46,031/-.
- Average production cost for each pump sold was Ksh. 5,943/- per crop cycle. Wages took Ksh. 2,101/- while other input costs took Ksh. 3,842/-.
- Profit per crop cycle for each pump sold is Ksh. 40,088/- (Sales income less production costs). This means that each pump sold generates Ksh. 93,800 per year.
- Total benefit attributed to each pump sold is Ksh. 42,189/- (profits by MSE and operator wages) per crop cycle. The yearly total benefit for each pump is Ksh. 98,700/-

#### **Training**

- Only entrepreneurs in MicroPED region had been trained. Topics taught included, pumps operation and maintenance (100%), effective use of the pump (52%), record keeping (43%), irrigation methods (9%) and crop production (9%).

- 70% of those trained can operate and maintain their pumps better, 22% increased area under irrigation. 17% increased number of crops under irrigation and 13% started keeping records. The trained entrepreneurs were doing a lot of promotion for the pump in their respective areas. They shared their pumps more than those not trained. The training needs (topics) for those not trained corresponded with those already given to the trained group.
- There was no significant difference in terms of jobs and income generation between those trained and not trained.

### **Problems**

- 22.5% of the respondents were using pressure pipe, which had too small a diameter.
- Some other 22.5% had problems with bottom valves coming out. Other minor problems mentioned included limited head (both suction and pressure) for the pump, low water output, losing prime, friction between the chain and pedals and oval cylinders. Some pumps had poor welds. Each of these problems was mentioned by less than 5% of the respondents.

### **Other Benefits**

- The pump has led to increased sources of income and made it more dependable. It has made irrigation easy, led to increased area under irrigation and created employment at the farm level.
- Entrepreneurs have invested in other areas using income generated from irrigation. The pump has opened new horizons for the entrepreneurs at a time when the Kenyan economy is in poor state.

### **Evaluators recommendations**

- Aggressive marketing where promoters work together with old clients (case studies, visits and training)
- Carry out more intensive promotion in the Machakos and Makueni districts (very high potential)
- Produce and market a cheaper pump and start hire purchase program to target the poorer people.
- There is high demand for a pump with greater head.
- Those who have already bought the Super-*MoneyMaker* pump would want a pump with higher output.
- Supply rubber cups and bottom valves to all dealers.
- More training for the entrepreneurs on pump use and changing of the bottom valves.

## 1.0 BACKGROUND INFORMATION

The Super-*MoneyMaker* Irrigation pump is an evolution of the *MoneyMaker* pump that was an adaptation from a model developed in India. The pump was fully designed and developed by ApproTEC with Owner Operation and Maintenance (OO&M) concept in mind. The Super-*MoneyMaker* micro-irrigation pump was first launched during the 1998 Nairobi show where it proved to be an instant success with 45 pumps sold in the show ground. Within the first three days, 104 pumps had been sold. By the end of 1998, 633 Super-*MoneyMaker* micro-irrigation pumps had been sold. The number rose further to 1,718 by the end of June 1999 when the Impact assessment was done. When the pump was launched it reduced the sale of the predecessor, the *MoneyMaker* by almost 100% leaving only a few sales mainly from outside Kenya (Uganda and Tanzania).

When the Super-*MoneyMaker* pump went into the market, ApproTEC had about 30 dealers in Kenya. The number has since risen to over 60 by the end of August 1999.

There are five manufacturers producing the pump, 4 in Nairobi and 1 in Kisumu. Each manufacturer's monthly average production capacity is over 100 pumps although the actual production figures are less than this capacity. ApproTEC has trained each of these of these manufacturers at a fee on the production of the pump. ApproTEC personnel check the quality of each at the manufacturer level. The quality of the pump (just like other ApproTEC technology) is maintained and propagated by use of standard jigs and fixtures (tooling equipments) provided on loan by ApproTEC to each manufacturer after the training. ApproTEC provides a one-year guarantee from the date of purchase against any manufacturing defects.

The Super-MoneyMaker pump is foot operated and uses the principle of atmospheric pressure to create a partial vacuum. The partial vacuum allows it to suck water from a depth of up to 20 feet (6 meters). It has a pressure chamber that can create a pressure head of 43 feet (13 meters). The pump has a total head of 43 feet (13 meters). On a flat surface it can push water for a distance of 600 feet (200 meters). The pump has a maximum pumping rate of 1.5 litre per second, can power up to 5 sprinklers and irrigate up to 1 ha (2.4 acres). It weighs 20 kilograms.

The pump uses a rigid suction pipe and a flexible pressure hosepipe, which are sold as accessories by the dealers.

## **2.0           ApproTEC MISSION AND THE OBJECTIVES OF THE VISIT**

ApproTEC's mission is to promote sustainable economic growth and employment creation in Kenya and other countries. It does this by designing, developing and promoting technologies, which can be used by dynamic entrepreneurs to establish and run small-scale enterprises. It is ApproTEC's belief that self-motivated entrepreneurs managing small-scale businesses are the most effective agents for developing the emergent economies and that it is hard for them to identify viable business opportunities, access the required technologies and widely market new products. To address this situation, ApproTEC uses a six-step approach. First it identifies high potential small-scale enterprise opportunities through market and sub-sector studies. Second ApproTEC designs appropriate technologies that are required to utilize such business opportunities. Thirdly, it trains private manufacturers to produce the technologies in large quantities and retailers to sell them to the potential entrepreneurs. Fourthly, ApproTEC creates demand for the designed technologies through vigorous media and field promotion. Fifth, it offers back-up system through training, which aims at building the capacity of the enthusiastic small-scale business entrepreneurs to utilise the technologies better, market the products and enhance their business skills. The sixth step, involves the Monitoring and Reporting Unit designing a process of routine data collection at various levels, which is kept in a database. The data is then analysed to provide information that acts as a feedback into the action cycle. This enables ApproTEC to learn and change the process of the project implementation and therefore improve performance. Periodically, the Monitoring and Reporting Unit makes extensive field visits to assess the impact of the technology intervention especially in terms of income generation, jobs creation and other social benefits.

New jobs and increased family income through establishment of dynamic small micro-enterprises leads to sustained economic growth and development. This is the ApproTEC's mission.

It is in above light that the Monitoring and Reporting Unit carried out an extensive field visit for the Super-MoneyMaker micro irrigation pump.

The Super-MoneyMaker had been out in the market for ten months by the end of June 1999.

Entrepreneurs who bought the pump within the first four months had used it for one season (four months) There were also a total of 167 entrepreneurs who had been trained on various aspects of the pump use and improvement of their business in the MicroPED region. It was therefore necessary at this early stage to conduct some impact assessment to get an indication of the performance of the technology and the training leverage offered to the entrepreneur.

## **3.0           METHODOLOGY, DATES AND PLACES**

A detailed questionnaire was designed before the visit was made. The questionnaire was administered to 44 entrepreneurs in 16 districts of Kenya. 13 in MicroPED region (Makueni, Machakos, Kitui, Thika, Kiambu, Maragua, Murang'a, Nyeri, Embu, Laikipia, Nyandarua and Nakuru districts) and 3 in Western Kenya (Kisumu, Uasin Gishu and Trans Nzoia districts).

The Monitoring & Reporting Officer and the Monitoring and Reporting Assistant administered the questionnaires. The combination of the two proved to be very useful because it made it possible for one to lead the interview while the other recorded the proceedings. It also made it easier to administer the

questionnaire in the rural set-up where more often, the women were the respondents and the managers of the pump. The interview involved both qualitative and quantitative methods in order to get maximum information from the entrepreneurs. General observations and in certain situations actual measurements were taken. Most of the interviews were carried out in the farms where the pump has been used so as to enhance the quality of the data. The detailed questionnaire used is attached in Appendix 11. The questionnaire covered the following areas of interest:

- General information on the owner and respondent,
- Information about the pump(s),
- Sources of capital to purchase the pump,
- Effective promotion methods through which the owner first came to know about the pump, the one which convinced them to buy and others they have seen latter,
- Pump uses and sources of water with possible details of depths of wells and cost of digging them,
- Periods of pumps use and employment creation by gender for the operators,
- Irrigation activities with and without the pump,
- Comparison between activities in the farm with and without the pump,
- Crops under irrigation and income generation,
- Marketing and distribution of the irrigated crop,
- Use of the pump for the sale of water,
- Renting and lending of the pump,
- Training received, used and needs,
- Investments made from income generated through the use of the pump,
- Social benefits attributable to the pump use,
- Problems faced by the entrepreneurs,
- Suggestions for the improvement,
- Irrigation system in place,
- Any other observation.

The visit was schedule to start from the 28<sup>th</sup> June and end on the 25<sup>th</sup> July 1999. This plan went on as arranged. The MicroPED region field visit was undertaken between the 28<sup>th</sup> June and 14<sup>th</sup> July covering the following districts; Makueni, Machakos, Kitui, Thika, Kiambu, Maragua, Murang'a, Nyeri, Embu, Meru, Laikipia, Nyandarua and Nakuru. The region east of Rift Valley (Western Kenya) was covered between the 20<sup>th</sup> July 1999 and 25<sup>th</sup> July 1999. The full itinerary for the field visit is attached as Appendix 1.

The entire area had been divided into 6 clusters, four in MicroPED area and two in Western Kenya. These cluster areas were in the following districts.

Cluster I	Makueni, Machakos, Kitui
Cluster II	Thika, Kiambu, Maragua, Murang'a
Cluster III	Nyeri, Embu, Meru
Cluster IV	Laikipia, Nyandarua, Nakuru
Cluster V	Kisumu
Cluster VI	Uasin Gishu, Trans Nzoia

#### 4.0 PUMPS VISITED IN DIFFERENT CLUSTER AREAS

##### 4.1 Cluster areas and number of pumps visited

By the end of June 1999, a total of 1,718 Super-*MoneyMakers* had been sold. For the purpose of assessing impact, only pumps sold by the end of February 1999 were considered. This would allow most of the entrepreneurs to have used the pump for at least one season. This also falls within the dry period of January to March where the pump would have been put to a lot of use thus testing its potential and limits.

Once the pumps are sold through the dealers, it takes some times before the details of the user gets to the monitoring office and to be put into the database. By the time the visit was planned, there were 903 pumps in the database. 721 (80%) of these pumps were in the MicroPED region while the rest 176 (19%) were in the Western Kenya region. All the trained entrepreneurs were in the MicroPED region 136 (15%) of these pumps were in cluster I, 225 (26%) in cluster II, 118 (13%) in cluster III, 164 (19%) in cluster IV, 13 (1%) in cluster V and 51 and VI. The rest 196 pumps were outside the cluster areas. In terms of training, 34 (20%) people were in cluster I, 49 (29%) were in cluster II, 38 (23%) in cluster III and 37 (22%) in cluster IV. Some other 9 (5%) were outside the visited areas (Kirinyaga and Mbeere districts).

52 (6%) entrepreneurs were selected for the visit out of which 22 (2.4%) were trained and the rest were not. Of these, 41 (8%) were from the MicroPED region and 10 (19%) from Western Kenya. When the visit was made, it was not possible to see all the 52 selected but 44 were visited and interviewed, 35 (80%) in MicroPED region and 9 (20%) in Western Kenya.

None of the people visited had two pumps but 3 (7%) had the *MoneyMaker*, 2 (5%) in the MicroPED region and 1 (2%) in Western Kenya. Since the sample visited was randomly selected, it therefore means that for the 1,718 Super-*MoneyMaker* pumps, there are approximately 120 of them who also own the *MoneyMaker* micro-irrigation pumps.

#### **4.2 Active pumps**

Of the 44 pumps visited 40 (91%) had been used at least once since they were bought. These have been referred to as “active pumps” or “pumps in use” in this report.

Various different personal reasons for not using the pump were given by each of the respondents. In the first case the well was very deep throughout the period when the pump was owned and thus the owner had not used it even once. It does not look very likely that the pump will be used in the near future.

In the second case, the owner wanted to dig up a well since the water table in the area is high and then start using the pump. The owner lives in town and has to wait until he gets his annual leave in order to dig the well.

In the third case the owner lost her employee just before she started using the pump. She was still looking for one when this visit was made. There is a river next to the farm, which she intends to use. In the fourth situation, the owner had three wives. He had not decided who among the three wives would use the pump. He was planning to have a common farm where the pump would be used so that none of the three wives would take advantage over the others. He intended to buy a pump for each of the wives latter.

All the trained people have used their pumps at least once.

### **5.0 OWNERS, MANAGERS AND RESPONDENTS BY GENDER**

#### **5.1 Owners**

The owner is defined as the persons whose name appears in the ApproTEC database. This is the person who gave his/her name at the time the pump was bought. It is the name, which had been randomly picked during the sampling process.

Out of the 44 owners selected, 37 (84%) were men while 7 (17%) were women. Out of the 44 entrepreneurs, 40 (91%) were married while 4 (9%) were single (two single women and 2 single men). The income generated from the use of the pump would go to these kinds of household set-ups. In most cases for the married entrepreneurs, the initiative to buy the pump came from the women who are mainly the ones managing the pumps in the farm.

#### **5.2 Managers**

The manager is the person who makes decision on what the pump would be used for on day-to-day basis. This person is not always the one who makes the decision on how the money

generated will be used but there is a high relationship. The majority of the managers are the same people who make decisions on how the money will spent.

Women managed 72.5% (29) of the 91% (40) active pumps. Men managed the other 27.5%

### 5.3 Respondents

The respondent is the person who answered to the questions administered by the Monitoring unit team. Of the 44 entrepreneurs interviewed 18 (41%) respondents were men, 19 (42%) were women and the other 7 (16%) were a combination of women and men. There were more women than during the previous survey that had 62% men, 32% women and 8% a combination of men and women when the interview was conducted by the Monitoring and Reporting Officer (male) alone. This time round, women came out more for the interview possibly because there was a woman in the interview team.

## 6.0 EFFECTIVE PROMOTION METHODS

### 6.1 Where the owner first saw/heard about the pump

Majority of the people first saw or heard about the pump from a friend/relative/neighbour (word of mouth) or in a permanent demonstration at dealers premises. Each of these comprised 30% of the sample. The two were followed by Shows, which had 16%, then ApproTEC office with 9%. Kenya Broadcasting Corporation (KBC) Television (during 1998 Nairobi Show) made it possible for 7% of the buyers to hear and see the pump for the first time while 5% saw it in the Daily Nation newspaper (The adverts only appeared for a few days during the period). Some 2% saw the pump on the promotion leaflet fliers. 2% could not tell where they first saw/heard about the pump. 100% of respondents in Maragua and Kiambu , 67% in Nyeri and 57% in Thika districts first heard/saw the pump through the **word of mouth (friends)**.

100% of respondents in Embu, Kitui and Nyahururu, 67% in Machakos, Murang'a and Nanyuki, 50% in Eldoret and 17% in Nairobi saw the pump for the first time in a **live demonstrations**.

100% of the respondents in Kitale, and 83% in Nairobi saw the pump at the ASK Shows.

100% of the respondents in Karatina and 75% in Kisumu saw the pump at the ApproTEC offices. 50% of respondents in Eldoret, 33% in Murang'a and 14% in Thika hear about the pump on the Kenya Broadcasting Corporation (**KBC) Television** during the 1998 Nairobi Show.

33% of respondents in Machakos and 14% in Thika saw the pump in the **Nation Newspaper** (during the 1998 Nairobi Show special advertisement).

14% of respondents in Thika first saw the pump on the **promotion leaflets**.

*The following table shows where the entrepreneurs saw/heard about the pump for the first time*

	<b>How pumps owners saw/heard about the pump (first time)</b>								
<b>Location</b>	<b>Friends</b>	<b>Leaflet</b>	<b>Nation Newspaper</b>	<b>ApproTEC Office</b>	<b>*Demo</b>	<b>Show</b>	<b>KBC TV</b>	<b>Not Known</b>	<b>Total</b>
<b>Eldoret</b>	0	0	0	0	1	0	1	0	<b>1</b>
<b>Embu</b>	0	0	0	0	1	0	0		<b>1</b>
<b>Karatina</b>	0	0	0	1	0	0	0	0	<b>1</b>
<b>Kiambu</b>	1	0	0	0	0	0	0	0	<b>1</b>
<b>Kisumu</b>	1	0	0	3	0	0	0	0	<b>4</b>
<b>Kitale</b>	0	0	0	0	0	2	0	0	<b>2</b>
<b>Kitui</b>	0	0	0	0	2	0	0	0	<b>2</b>
<b>Machakos</b>	0	0	1	0	2	0	0	0	<b>3</b>

<b>Maragua</b>	3	0	0	0	0	0	0	0	<b>3</b>
<b>Murang'a</b>	0	0	0	0	2	0	1	0	<b>3</b>
<b>Nairobi</b>	0	0	0	0	1	5	0	0	<b>6</b>
<b>Nakuru</b>	1	0	0	0	0	0	0	0	<b>1</b>
<b>Nanyuki</b>	1	0	0	0	2	0	0	0	<b>3</b>
<b>Nyahururu</b>	0	0	0	0	2	0	0	0	<b>2</b>
<b>Nyeri</b>	2	0	0	0	0	0	0	1	<b>3</b>
<b>Thika</b>	4	1	1	0	0	0	1	0	<b>7</b>
<b>Total</b>	<b>13</b>	<b>1</b>	<b>2</b>	<b>4</b>	<b>13</b>	<b>7</b>	<b>3</b>	<b>1</b>	<b>44</b>
<b>Percent</b>	<b>30%</b>	<b>2%</b>	<b>5%</b>	<b>9%</b>	<b>30%</b>	<b>16%</b>	<b>7%</b>	<b>2%</b>	<b>100%</b>

*\*Permanent demonstration at dealers' sites*

## 6.2 Promotion method which convinced entrepreneurs to buy the pump

The most convincing promotion methods were the word of mouth, demonstrations at the ApproTEC offices, permanent demonstrations at the dealers' sites and Shows. What was found to be very common was that in almost all situations, the clients had to see the pump in operation before they could make the decision to buy. When people see the pump in operation or when they hear about it from people they know, trust or associate with, they become easily convinced. 55% of the respondents made their decision after seeing permanent demonstrations at the dealers' sites. This was followed by the word of mouth, which contributed 23%, then Shows with 11%. Fourth was the ApproTEC Offices, which convinced 9% of the respondents. Some 2% did not know what convinced them since the respondent was not the one who bought and therefore could not tell what convinced them.

*The table below shows the promotion method, which convinced entrepreneurs to buy the pump and town*

<b>Location</b>	<b>Various promotion methods which convinced entrepreneurs to purchase the pump</b>					<b>Total</b>
	<b>Friends</b>	<b>ApproTEC Office</b>	<b>*Demo</b>	<b>Shows</b>	<b>Not Known</b>	
<b>Eldoret</b>	0	0	2	0	0	<b>2</b>
<b>Embu</b>	0	0	1	0	0	<b>1</b>
<b>Karatina</b>	0	1	0	0	0	<b>1</b>
<b>Kiambu</b>	1	0	0	0	0	<b>1</b>
<b>Kisumu</b>	1	3	0	0	0	<b>4</b>
<b>Kitale</b>	0	0	1	1	0	<b>2</b>
<b>Kitui</b>	0	0	2	0	0	<b>2</b>
<b>Machakos</b>	0	0	2	0	0	<b>2</b>
<b>Maragua</b>	2	0	0	0	0	<b>2</b>
<b>Murang'a</b>	0	0	3	0	0	<b>3</b>
<b>Nairobi</b>	0	0	1	4	0	<b>5</b>
<b>Nakuru</b>	1	0	0	0	0	<b>1</b>
<b>Nanyuki</b>	1	0	3	0	0	<b>4</b>
<b>Nyeri</b>	1	0	0	0	1	<b>2</b>
<b>Thika</b>	3	0	7	0	0	<b>10</b>
<b>Nyahururu</b>	0	0	2	0	0	<b>2</b>
<b>Total</b>	<b>10</b>	<b>4</b>	<b>24</b>	<b>5</b>	<b>1</b>	<b>44</b>

<b>Percent</b>	<b>23%</b>	<b>9%</b>	<b>55%</b>	<b>11%</b>	<b>2%</b>	
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*\*Permanent demonstration at dealer's sites*

### **6.3 Where else the entrepreneurs have seen/heard about the pump**

After the entrepreneurs had bought the pumps, they continued to see or hear about them through various promotion methods, which ApproTEC has put in place.

The permanent demonstration sites at the dealers premises continued to lead with 17 (39%). 10 (23%) saw truck demonstrations. 3 (7%) got to get more information about the pump through the word of mouth after they had bought. Some 2 (5%) had seen the pump being demonstrated at various Shows. 1 (2.3%) saw the pump on the newspaper after they had bought.

*The table below shows various promotion methods through which entrepreneurs' saw/heard about the pump after purchase.*

<b>Promotion methods</b>	<b>1<sup>st</sup> place</b>	<b>2<sup>nd</sup> place</b>	<b>Total</b>	<b>Percent</b>
<b>Permanent demonstration</b>	12	5	17	39%
<b>Truck demonstration</b>	9	1	10	23%
<b>Word of mouth</b>	3	0	3	7%
<b>Show</b>	2	0	2	5%
<b>Newspaper</b>	1	0	1	2.3%
<b>Total</b>	28	8	33	76.30%

### **7.0 SOURCES OF CAPITAL TO BUY THE PUMP**

Over two thirds (68%) of the entrepreneurs bought their pumps using savings. There were those who have formal employment and they had saved money over time to get to Ksh 5,490/- needed to buy the pump. There are also those who have no formal employment but work in their farms and overtime have been saving in their own small ways.

The second best source of capital was sale of crops in the farm. There was 18% of the respondent in this category. This is a situation where one sold crop for one season and got enough money to buy the pump. The crops ranged from wheat, maize, potatoes, French beans, tomatoes, flowers and cabbages. They saw the pump as a tool through which they would enhance their farming systems and techniques thereby increasing their income from the farm.

5% of the respondents bought their pumps from retirement benefits. 50% of these cases got their final retirement fund while the other 50% got their National Social Security Fund (NSSF), which they then used to buy the pump.

Some other 5% had been using the *MoneyMaker* pump to irrigate their crop and out of the income they got from the enterprise bought the *Super-MoneyMaker* pump. One of these people had been borrowing the *MoneyMaker* from a neighbour and had even agreed to buy it from this neighbour when the *Super-MoneyMaker* came to the market.

The table below shows sources of income for entrepreneurs in different cluster areas

Sources of capital	Number of respondents in various cluster areas							Total	Percent
	I	II	III	IV	V	VI			
Own saving	7	7	3	5	4	4	30	68%	
Retirement fund	1	1	0	0	0	0	2	5%	
Sale of milk	0	1	0	0	0	0	1	2%	
Sale of livestock	0	0	0	1	0	0	1	2%	
Sale of crop (maize, wheat, horticulture etc)	0	4	1	2	0	1	8	18%	
Sale of irrigated crops using <i>MoneyMaker</i>	0	0	1	1	0	0	2	5%	
<b>Total</b>	<b>8</b>	<b>13</b>	<b>5</b>	<b>9</b>	<b>4</b>	<b>5</b>	<b>44</b>	<b>100%</b>	

## 8.0 PUMP OPERATION

### 8.1 Age of the pump

The Super-*MoneyMaker* pump was launched during the 1998 Nairobi Show, which starts at the end of September and pills over to the first week of October. This means that the oldest pump in the field at the time the visit was made was 9 months. On average the age of the pumps visited was 8 months with youngest being five months and the oldest 9 months. 15 (34%) of the pumps were 9 months old, 12 (27%) were 8 months old, 5 (11.5%) were 7 months old, 7 (16%) were 6 months old while 5 (11.5%) were 5 months old.

The table below shows the ages of the pumps

Age of the pump ((months)	Number of the pumps	Percent
9	15	34%
8	12	27%
7	5	11%
6	7	16%
5	5	11%
<b>Total</b>	<b>44</b>	<b>99.00%</b>

### 8.2 Sources of water

Most of the people were getting water from streams. Out of the 44 pumps visited, 17 (39%) get water from streams. 15 (34%) use wells.

There were 4 (9%) getting water from dams. This was mainly in the relatively flat places. There were some other 3 (7%) who had a well and stream. Only 1 (2%) was using a swamp. Some 4 (9%) of the pumps had not been put to any use. 2 (5%) will eventually use streams, 1 (2%) well. The well of the last one is too deep for the Super-*MoneyMaker* pump to suck from.

It therefore means that most of the people who buy the Super-*MoneyMaker* pump get their water from either streams, wells or both.

The table below shows the various sources of water for entrepreneurs

Source of water	No. of pumps	Percent
Stream	17	39%
Wells	15	34%
Dam	4	9%
Stream/Wells	3	7%
Swamp	1	2%
Not used	4	9%
<b>Total</b>	<b>44</b>	<b>100.00%</b>

The average depth of the wells used with the pump was 14 feet (4.3 meters). The level of water was lower than 14 feet. It would also vary with the availability of water, such that when it is very dry the level would be high but low during the wet periods.

Within the areas visited the average depth of wells was 29 feet (8.83 meters). Many of these are not used with the pump. The wells are dug at an average cost of Ksh. 130/- per foot.

Generally the depths of the wells that the farmers were using were less than the normal depth of well in various areas thus the farmers' suggestions that ApproTEC design a pump with higher suction head.

The following table shows the average depth of wells used by farmers, average depth of wells in the areas and the cost of digging a well (Ksh. /fee)

Cluster area	Avg depth of farmers well (feet)	Ave depth of wells in the area (feet)	Ave cost of digging a well in the area (Ksh/feet)
<b>I</b>	7	23	70
<b>II</b>	9.2	28.3	150
<b>III</b>	12	Could not establish	Could not establish
<b>IV</b>	30	43	200
<b>V</b>	20	35	120
<b>VI</b>	18.6	22.5	30
<b>Average</b>	<b>14</b>	<b>29</b>	<b>130</b>

### 8.3 Pump uses

Of the 44 pumps visited, 40 (91%) were active. 97.5% of the active pumps were used for irrigation. Some 3 (7.5%) had been used for getting water for domestic use and another 3 (7.5%) were used in feeding the livestock. However, 35 (87.5%) were used for irrigation only, 1 (2.5%) for irrigation, livestock, and domestic water.

The table below shows the various uses the pumps have been put into

Pump use	Number of pumps	Percent
<b>Irrigation</b>	35	80%
<b>House use</b>	1	2%
<b>Irrigation &amp; Livestock</b>	2	5%
<b>Irrigation &amp; House use</b>	1	2%
<b>Irrigation &amp; Livestock/House use</b>	1	2%
<b>Not Used</b>	4	9%

<b>Total</b>	<b>44</b>	<b>100%</b>
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#### 8.4 Quarters used since October 1998

The Super-MoneyMaker pumps had been used for three quarters within the 9 months they had operated.

During the first quarter of Oct 98 to Dec-98, 64% of the pumps were operating. This figure increased to 77% during the Jan-99 quarter. During the April-99 to June-99 period, the figures went down to 55%. This was during the long rain season when most of the farmers were dependent on the rains for their crops. 9% of the pumps were not used at all for any of these quarters.

22.5% of the pumps were used for 1 quarter, 40% for 2 quarters and 37.5% for all the three quarters.

*The table below shows the use of pumps for different quarters*

<b>Cluster</b>	<b>Oct-98</b>	<b>Dec-98</b>	<b>Jan-99</b>	<b>Mar-99</b>	<b>Apr-99</b>	<b>Jun-99</b>	<b>Not Used</b>
I	38%		88%		63%		0%
II	79%		93%		57%		0%
III	60%		60%		60%		20%
IV	63%		50%		50%		13%
V	50%		50%		25%		50%
VI	80%		100%		60%		0%
<b>Total</b>	<b>64%</b>		<b>77%</b>		<b>55%</b>		<b>9%</b>

*The following table shows the extent of pump use*

<b>Quarters in use</b>	<b>Number of pumps</b>	<b>Percentage</b>
<b>3</b>	15	34%
<b>2</b>	16	36%
<b>1</b>	9	20%
<b>0</b>	4	9%
<b>Total</b>	<b>44</b>	<b>100%</b>

#### 8.5 Hours used daily

On average each pump sold is being used for 2.75 hours daily. Cluster VI had the highest daily average use of 4.00 hours. It was followed by cluster I with 3.63 hours, then cluster II with 2.71 hours and cluster V with 2.13 hours. Cluster IV had 2.06 hours daily use while cluster III had the lowest daily use of 1.80 hours.

This therefore means that pumps were used for more hours daily in Western Kenya than in the MicroPED region. Western region had an average of 3.07 hours while MicroPED region had an average of 2.55 hours daily average use. This is possibly explained by the fact that there was very little promotion done in the Western Kenya and thus those who had bought the pump are the real risk takers with far much higher possibility of using the pump. In the MicroPED area, a lot of promotion had been done and therefore, the statistical distribution of the entrepreneurs was such that there was a combination of the high-risk takers and the average users of the pump. The other explanation could be that MicroPED area is slightly cooler and thus one is able to achieve good water coverage within a short time as compared to the slightly warmer areas of

Western Kenya. The hourly use for the Super-*MoneyMaker* is lower than that of the *MoneyMaker* which was 3.43 hours daily. This could be due to the better performance of the Super-*MoneyMaker*, which has a pressure head and thus can irrigate a bigger piece of land within the same period. The area under irrigation with *MoneyMaker* was also higher.

## 8.6 Number of days used since it was bought

On average the pump had been with the respondents for 8 months. Within this period, the pump was used on average for 79.4 days. If this is extrapolated to a year, then it means that the pump is used on average for 119 days per year.

Cluster III had the highest figure of 96.8 days for 8 months giving a yearly usage of 145 days.

Cluster VI was the second with 96.4 days use for 8 months giving a yearly use of 145 days.

Third was Cluster II that had an average of 87.1 days use for 8 months giving a yearly use of 131 days. Fourth was Cluster I with 81 days use for 7 months giving a yearly use of 139 days. Cluster V was fifth with an 8 months average of 61.25 days giving a yearly average of 92 days. Last was Cluster IV with a 7 month average of 52 days, which calculates, to 89 days in a year.

*The following table shows the average time the pump was used in hours and days for one year*

Cluster	Hours/day	Days used since bought	Average age (months)	Days/year
<b>I</b>	3.63	81.00	7	139
<b>II</b>	2.71	87.14	8	131
<b>III</b>	1.80	96.80	8	145
<b>IV</b>	2.06	52.00	7	89
<b>V</b>	2.13	61.25	8	92
<b>VI</b>	4.00	96.40	8	145
<b>Average</b>	<b>2.75</b>	<b>79.43</b>	<b>8</b>	<b>119</b>

## 9.0 JOB CREATION

ApproTEC defines a job as a task that occupies an individual for 150 days a year, 5 hours daily. In case of the jobs created by the technologies ApproTEC considers the jobs created by the technology using the period that the individual was directly using the machine.

Majority of the pumps were operated by family members instead of hiring from outside. This is especially so in situations where the family is dependant on the farm as their main source of income and employment. In other situations where some members of the family have other employment, some people are hired to operate the pump. On the farm, the pump made it possible for the number of workers to increase. For those who were doing irrigation before, the number of people involved in watering may have gone down but the total number of people involved in the farm activities went up.

### 9.1 Number of watering operators

An operator is the person who is directly involved in the peddling, directing or scooping water from a drum and pouring it onto the crop. There are various methods of irrigation and each of them requires different number of people to accomplish. Where a hosepipe is used directly, there

must be two people involved at any given time, one peddling and the other directing water. Other situations where the water is first put into a drum or any other containers, there were many people involved. One person would be peddling and some others (there could be even six) are scooping water and pouring onto the crop. All these people are considered as operators.

On average, each pump sold has 2.89 operators. These were made up of 1.18 women and 1.70 men operators. This means that, women constituted 41% of the pump operators while men formed the rest 59%. Out of this 0.98 were waged operators, which means that 33% of the pump operators were waged workers and the rest 67% were family labour.

Cluster VI had the highest number of operators with 4.20 per pump while cluster V had the lowest with 1.25 operators.

In situations where the family members operated pumps, children were involved in peddling activity. In a number of cases two children would peddle the pump together in order to achieve higher output. Women were very involved in directing water to the crops. Many operators said that they enjoyed peddling the pump since it gave them a chance to exercise apart from providing a business opportunity in their farms. Some interesting situations were found where a woman would pedal together with children. The child would stand in front of the mother on the pedals and both would start pedalling while the man (father) does the directing of the water. This helps to bring the family closer since the mother had to keep good coordination with the child while the father is involved on the other side. This kind of situation created by the pump produced very happy family with different duties being shared with ease. Many farmers were not using sprinklers because of water shortage. They complained that sprinklers use a lot of water thus there were at least two people operating the pump: one peddling while the other would be directing the water.

*The table below shows the average number of operators in different cluster areas*

<b>Cluster</b>	<b>Female operators</b>	<b>Male operators</b>	<b>Total operators</b>	<b>Waged operators</b>
<b>I</b>	1.13	2.25	3.38	1.25
<b>II</b>	1.07	1.86	2.93	1.14
<b>III</b>	1.20	1.20	2.40	0.20
<b>IV</b>	1.00	1.63	2.63	1.00
<b>V</b>	0.25	1.00	1.25	0.75
<b>VI</b>	2.60	1.60	4.20	1.00
<b>Average</b>	<b>1.18</b>	<b>1.70</b>	<b>2.89</b>	<b>0.98</b>

## **9.2 Pump jobs**

On average, each pump sold creates 1.69 jobs in the farm through watering only. 0.70 (41%) of these jobs are through operation by women and 0.99 (59%) are for men. This is an increase from the 1.62 jobs created by the *MoneyMaker* pumps (*September 1998 MoneyMaker ApproTEC Monitoring visit*), which gives an increase of 0.07 jobs representing a 4% increase in job creation.

Cluster VI had the highest number of jobs per pump sold with 3.46 jobs followed by Cluster I with 2.14 jobs/pump. Third was Cluster III with 2.01 jobs, and fourth was cluster II with 1.41 jobs. Fifth and sixth respectively were cluster V and IV with 1.08 and 0.71.

The following table shows the distribution of jobs in various clusters

Cluster	Female jobs/pump	Male jobs/pump	Total jobs/pump
<b>I</b>	0.70	1.44	<b>2.14</b>
<b>II</b>	0.42	1.00	<b>1.41</b>
<b>III</b>	1.01	1.01	<b>2.01</b>
<b>IV</b>	0.28	0.43	<b>0.71</b>
<b>V</b>	0.18	0.90	<b>1.08</b>
<b>VI</b>	2.29	1.17	3.46
<b>Average</b>	<b>0.70</b>	<b>0.99</b>	<b>1.69</b>

Apart from Cluster VI having the highest number of pump jobs it also had the highest number of female jobs 2.29 and 1.17 respectively. This was followed by cluster III with equal number of male and female jobs.

Compared with the *MoneyMaker*, the *Super-MoneyMaker* had increased number of female jobs from 0.63 to 0.70 an increase of 0.07 jobs, which represent an 11% increase. Male jobs remained constant at 0.99 jobs/pump. In absolute terms, women have increased their involvement in the pump operations by 52.5<sup>1</sup> hours per year for every pump sold while man involvement have remained fairly constant. It therefore means that women benefited more than men in terms of jobs creation through the introduction of the *Super-MoneyMaker*. The pump tends to balance out the involvement of men and women in small-scale commercial agriculture.

## 9.2 Waged Jobs

Through direct operation of the pump (peddling and directing of the water to the crops, each pump sold creates 1.69 jobs. Some of these jobs are taken by the family members while some people are hired to take up the rest. There were on average 0.60 paid jobs for each pump sold. These represent 36% of the operating jobs.

Cluster I had the highest number of paid jobs with 0.78 while the last was cluster IV with 0.25.

## 9.3 New jobs in the farm (operating and other activities)

With the introduction of the irrigation system in the farm, activities like land preparation, spraying, harvesting and marketing increased. This meant that either more people were used to carry out these activities or those who were there spent more time than before carrying out these activities. This has a net increase in farm employment at various levels. A comparison has been made between the situations before the pump was bought and after. Those who were not doing irrigation have been taken to have had zero jobs from irrigation process before they bought the pump.

Out of the 44 respondents, 13 (30%) were doing irrigation before they bought the pump. It therefore means that over two thirds (70%) of the people buying the pump have created completely new jobs in the area of commercial irrigation.

On average those doing irrigation before had been creating 1.22 jobs through watering the crop. When they bought the pump the watering jobs went up to 1.69. In the other activities (land

<sup>1</sup> One job is equivalent to 750-hour use per year. Therefore, an increase of 0.14 jobs is equal to 0.14 X 750, which gives 105 hours per year. Similarly an increase of 0.1 jobs indicates 0.1 X 750 giving an increase of 75 hours.

preparation, harvesting, marketing and spraying) there were 0.35 jobs before. This went up to 0.69 after they bought the pump. There was therefore a total increase of jobs in their farms from 1.57 to 2.38 after buying the pump, which gives 0.81 new jobs.

70% of the sample was not doing any irrigation before they bought the pump. There were therefore no dependable jobs generated through the micro-irrigation sector. On average these people create 1.69 jobs through watering and another 0.63 through other horticultural farm activities. They therefore created a total of new 2.32 jobs in the farm.

For the entire sample (every pump sold) before the pump was bought there were an average of 0.36 watering jobs in the farms. This went up to 0.64 jobs, which gives some 0.54 new jobs.

In total the introduction of the pump in the farm raised the number of jobs in the micro-irrigation sector from 0.64 to 2.33, which gives 1.87 new jobs.

**These therefore means that each Super-MoneyMaker pump sold, creates 1.87 new jobs in the farm.**

For those who were not doing any irrigation before, cluster 6 had the highest increase in job creation with some 5.56 new jobs in the farm after the introduction of the pump. This was followed by cluster III with 3.25 jobs per pump. Cluster 5 and 6 were close to each other with 2.66 and 2.55 jobs respectively. Cluster 2 had 1.94 and lastly cluster 4 had 1.59 new jobs/pump.

The high increase in jobs in the farm after the introduction of the pump indicates the vital role that availability of water or lack of it affects farming in the developing countries and the important role that appropriate technology has played in utilisation of this business opportunity which is otherwise very erratic, undependable and unpredictable in many areas of the tropics.

The role played by the technology comes out more strongly when one looks at the other activities beyond watering. More people become more involved in all other activities after the pump opens up the opportunity.

*The following table shows the new jobs created by the introduction of the pumps in the farm*

<b>Cluster</b>	<b>Average new jobs for those doing irrigation before buying the pump</b>	<b>Average new jobs for those not doing irrigation before buying the pump</b>	<b>Average new jobs fore ach pump sold</b>
<b>I</b>	3.82	2.55	<b>2.86</b>
<b>II</b>	0.52	1.94	<b>1.23</b>
<b>III</b>		2.60	<b>2.60</b>
<b>IV</b>	0.06	1.32	<b>1.01</b>
<b>V</b>		1.33	<b>1.33</b>
<b>VI</b>	(0.42)	5.56	<b>3.17</b>
<b>Average</b>	0.81	<b>2.32</b>	<b>1.87</b>

#### 9.4 **Waged workers and wages paid**

Out of the 44 respondents, 22 (50%) had waged employees. This is equivalent to 55% of the active pumps.

For each pump sold, there are 0.98 waged operators who create 0.60 jobs. These figure only covers those who were doing watering. It does not cover those involved in other activities like land preparation, spraying, harvesting and marketing.

Clusters I had the highest number of waged operators with 1.25 for each pump sold. Cluster III had the lowest with 0.20 waged operators for each pump sold.

Each of the 0.98 workers was paid an average wage of Ksh. 2,101/- month. This would calculate to Ksh. 2,144/- per season per 1 full worker for each pump. The wage paid for every pump sold per year was Ksh. 6,007/-, which calculates to Ksh. 6,130/- per year per full worker per every pump sold. Cluster I paid the highest wages with an yearly average of Ksh. 8,192/- while cluster III had the lowest wage of Ksh. 2,730/-

*The table below shows the average total operators, waged and none waged operators, seasonal and yearly wages for each pump sold*

<b>Cluster</b>	<b>Avg. total operators</b>	<b>Waged operators</b>	<b>None waged operators</b>	<b>Wage/Season</b>	<b>Wage/year</b>
I	3.38	1.25	2.13	2,814	8,192
II	2.93	1.14	1.79	1,976	5,610
III	2.40	0.20	2.20	1,092	2,730
IV	2.63	1.00	1.63	2,235	6,442
V	1.25	0.75	0.50	1,900	4,435
VI	4.20	1.00	3.20	2,267	4,901
<b>Average</b>	<b>2.89</b>	<b>0.98</b>	<b>1.91</b>	<b>2,101</b>	<b>6,007</b>

## **10.0 IRRIGATION**

### **10.1 Area under irrigation**

42.5% of the 91% pumps in use had streams as their source of water while 37.5% got water from wells. Most of the irrigation was done either near the streams or around the well. There were only 10% who were getting water from dams, which allowed them to irrigate a relatively big area due to the large flat area around the dam.

30% of the respondents were doing irrigation before they acquired the pumps. The average area under irrigation before was bought for each pump sold was 0.03 ha. This area went up to 0.24, a 700% increase.

For the 30% doing irrigation before their area under irrigation went up from 0.1 to 0.23 ha a 130% increase.

The 70% who were not doing any irrigation before had zero land under irrigation before. These went up to 0.24 after buying the pump. This area is expected to go up with continued use of the pump since the survey was done when the average age of the pump was 8 months<sup>2</sup>.

Actually majority of the respondents said that they would increase the area with time. There was an instance where an entrepreneur who is growing cut flowers for export wants to uproot some tea bushes to extend the area under irrigation after realising that the income generated by irrigated cut flowers far outweighs the income generated by the tea bushes. In some other instances, some virgin land was being opened up with the hope of increasing area under irrigation.

The process of increasing this area takes time given that majority of the pump owners have very limited capital and thus expansion of the area for irrigation takes time.

<sup>2</sup> Last year, a similar survey indicated that after 14 months of the MoneyMaker pump in the field, the area under irrigation was 0.36 ha. The Super-MoneyMaker is expected to give higher figures than this due to its ease of use.

The following table shows the average area under irrigation before and after buying the pump for those doing irrigation before, not doing irrigation and the sample.

Cluster	Average area for those doing irrigation before buying the pump			Average area for those not doing irrigation before buying the pump			Average area for each pump sold		
	Now	Before	Change	Now	Before	Change	Now	Before	Change
<b>I</b>	0.47	0.25	0.22	0.25	0	0.25	<b>0.30</b>	<b>0.06</b>	<b>0.25</b>
<b>II</b>	0.20	0.04	0.16	0.22	0	0.22	<b>0.21</b>	<b>0.02</b>	<b>0.19</b>
<b>III</b>				0.33	0	0.33	<b>0.33</b>	<b>0</b>	<b>0.33</b>
<b>IV</b>	0.08	0.05	0.03	0.15	0	0.15	<b>0.14</b>	<b>0.01</b>	<b>0.13</b>
<b>V</b>				0.06	0	0.06	<b>0.06</b>	<b>0</b>	<b>0.06</b>
<b>VI</b>	0.26	0.22	0.04	0.55	0	0.55	<b>0.43</b>	<b>0.09</b>	<b>0.34</b>
<b>Average</b>	<b>0.23</b>	<b>0.10</b>	<b>0.13</b>	<b>0.24</b>	<b>0</b>	<b>0.24</b>	<b>0.24</b>	<b>0.03</b>	<b>0.21</b>

### 10.2 Frequency of Irrigation per week

The frequency of irrigation went down slightly after the acquisition of the pump. Although the change was not very significant but it was felt that this was due to the large amount of water given to the crop at any given time. It is now possible to achieve higher late of application with fewer times per week. Farmers now find it easy to carry out the irrigation process unlike before when it was a difficult task. The pump allowed farmers to think about the quality of their crops, which is generally enhanced by increased amount of water. A case in point is a flower farmer in Thika district whose flowers had been rated the best at market place due to adequate water supply. Other farmers who were using buckets to water their flowers had not given them enough water, which reduced their quality thus fetched lower prices.

For those who were doing irrigation before they bought the pump, the frequency of irrigation per week, was 3.31 times per week. When using the pump the average frequency of irrigation per week is 3.23 times per week. This means that the frequency of irrigation went down by 0.08 times per week. On average for each pump sold, the frequency of irrigation went up from 0.98 times a week to 3.09 times a week. The large difference was due to the large number of people who were not doing irrigation before they bought the pump.

The table below shows the change in frequency of irrigation per week before and after buying the pump

Cluster	Average frequency per week for those doing irrigation before buying the pump			Average frequency per week for those not doing irrigation before buying the pump			Average frequency for each pump sold		
	Now	Before	Change	Now	Before	Change	Now	Before	Change
<b>I</b>	1.05	1.05	0	3.00	0.00	3.00	<b>2.63</b>	<b>0.38</b>	<b>2.25</b>
<b>II</b>	2.71	3.14	(0.43)	4.29	0.00	4.29	<b>3.50</b>	<b>1.57</b>	<b>1.93</b>
<b>III</b>				1.80	0.00	1.80	<b>1.80</b>	<b>0.00</b>	<b>1.80</b>
<b>IV</b>	5.00	2.50	2.50	2.60	0.00	2.60	<b>3.25</b>	<b>0.63</b>	<b>2.63</b>
<b>V</b>				3.50	0.00	3.50	<b>3.50</b>	<b>0.00</b>	<b>3.80</b>
<b>VI</b>	5.00	6.50	(1.50)	3.67	0.00	3.67	<b>3.40</b>	<b>2.60</b>	<b>0.80</b>
<b>Average</b>	<b>3.23</b>	<b>3.31</b>	<b>(0.08)</b>	<b>3.17</b>	<b>0.00</b>	<b>3.17</b>	<b>3.09</b>	<b>0.98</b>	<b>2.11</b>

### 10.3 Pump hire

Super-MoneyMaker was widely lent out to friends, neighbours and relatives. In many situations, the pump was used by up to four different families each in turn. Some of these users were living away from each other and the pump had to be transported by bicycles (the monitoring team came across such situations in Laikipia, Nyeri, Murang'a and Machakos districts where one pump was being used by up to 4 different families within a radius of about 5 kilometers). Of the 44 respondents, 14 (32%) were lending out the pumps. For the 32% being lend out, there was an average of 1.7 other household units using the pump besides the owner. On average 0.55 other household units borrowed each pump bought. This therefore means that each pump sold is on average used by 1.55 household units. The pump benefits would then go beyond the household that bought the pump but to some 55% more. Some 3 borrowers were visited and were found to have no difference in terms of the areas under irrigation, usage of the pump and jobs creation with the actual owners.

Apparently were no cases of entrepreneurs renting out the pump for a fee. It was being given out free. This was interesting since the owners wanted to encourage the friends, neighbours and relatives to buy their own. There were situations where other farmers had been borrowing the pump for a period of time and then the owners due to their increased requirements stopped lending the pump out. This led to the other farmers to buy their own pumps since they did not want to turn back to their old bucket irrigation system. Lending out of pumps to others acted as a major promotion method since most of these people did not require any further persuasion to buy their own. This also acted as a learning process between the community members whenever the pump had any problem, they would come together and try to look for a solution. The "older" in terms of buying the pump becomes the "teacher" and in many situations is trusted by the others. Within a particular group, this person would be a higher risk taker and is seen by them as an innovator.

### 10.4 Irrigation methods

Majority of those interviewed were using hose irrigation method. There were 39 of those doing irrigation since one respondent was using the pump solely for domestic use.

31 (78%) were using the hose irrigation system where they would connect the hosepipe straight from the pump to the farm. Farmers found this to be easy since it allows them to get the water directly to the crop with very little loss. Farmers said that the method allows for better use of the water and time spent on the irrigation activity.

4 (10%) were combining the use of the bucket with the pump. The arrangement would be such that the water is pumped directly to a bucket or a drum then poured onto the crop. In this arrangement, there would be at least two people one doing the pedalling while others pours the water to the crops. This is especially used in area where farm is sloppy.

2 (5%) of the respondents used sprinkler system for irrigation. Some other people argued that, this methods wastes a lot of water and it takes long before one can give crops enough water. This could be the reason why it had very few users. The good bit of it is that it allowed for few operators, which reduced the cost of production. The farmers complained about the sprinklers, which are sold together with the pump. They easily break and do not withstand the hard field conditions like the pump. However those who used the sprinkler method liked it and felt that they would want to continue with it. 1 (2.5%) were using hose and raised tank methods for

irrigating their farms. This is a situation where water would be pumped into a raised tank then a hose would be connected to the raised tank which would then take the water to the farm.

1 (2.5%) were using furrow irrigation where a hosepipe would be connected to the pump then the loose end would be placed at the end of the furrow. Once one furrow is full, the hosepipe would be shifted to the next and the process would continue.

## 11.0 INCOME GENERATION

### 11.1 Crops grown

The three most important crops were recorded for each of the respondents. There were a total of 13 different crops, which the farmers were growing in different quantities and combinations. Farmers prioritised various crops differently. Tomatoes, Kales (*sukuma wiki*) and cabbages were the only crops whose respondents exceeded 25%.

**Tomatoes:** Of the 40 active respondents 22 (55%) were growing tomatoes. 12 (30%) of these were growing it as the priority crops. 9 (22.5%) were growing tomatoes as a second priority crop while the other 2 (5%) considered tomatoes as the third priority crop. Tomatoes were sold both from the farm and in the nearest markets. They were measured in either 20kg buckets (or crates) or in 50kg crates. There were two exceptional cases where they were measured in bags of about 100kgs. In some few instances, marketing was a problem either due to large quantities in the market or poor infrastructure. When a tomato plant becomes physiologically ready for harvesting, and the first fruits are picked, the other fruits ripen so fast that one has to continuously harvest at least twice every week. Farmers in some remote parts of Thika district (Kakuzi division) had a lot of difficulties selling their tomatoes due to the poor roads.

The wholesale price of tomatoes ranged between Ksh. 8/- and Ksh. 12/- per kilogram depending on place and season. The retail price depending on place and season ranged between Ksh. 10/- and Ksh. 20/- a kilogram/ Farmers who managed to get a crop during the January – March dry period got better prices.

**Kales:** The second most important crop was kales (*sukuma wiki*) with 21 (52.5%) respondents. Of the 52.5% growers, 10 (25%) considered kales as their priority crop, 5 (12.5%) second priority crop and 6 (15%) of growers, third priority crop. Some of the respondent felt that Kale is a very good crop since once it is ready one continues to harvest for a long time. One particular farmer estimated that from one individual crop, one can harvest at different times leaves worth Ksh. 50/-. The crop is sold either directly from the farm in small units of Ksh. 5/- to 10/- or in bags where a bag would fetch between Ksh. 300/- to Ksh. 1,200/-

**Cabbages:** Third in the line was cabbages with 12 (30%) respondents with 8 (20%) taking it as the priority crop, 3 (7.5%) were growing cabbages as the second priority crop and 1 (2.5%) as third priority crop. The price of the cabbage would depend on the size of the head, season and the place. In Nyeri district (along Mt. Kenya) and Nyandarua district, the price of cabbages is low with some medium size heads costing as low as Ksh. 5/-.

Other crops grown but by fewer entrepreneurs than 25%. included; **French beans** with 17.5%, **cut flowers, passion fruits, green maize** and **onions** each with 5%. Other crops were **potatoes, cowpeas, carrots, tea nursery, coffee, coriander, watermelon, spinach, sugar snaps** and **okra** each with 2.5%.

While tomatoes are more difficult to grow, they fetch high income due to their high prices and the amount harvested and sold within a very short period.

The new crop in the horticultural business for the micro-irrigation pump owners are the cut flowers whose demand for the export market is going up at a very high rate. Around Thika and Maragua districts, farmers have started growing various species of cut flowers. There is ready market in Thika town where farmers deliver the cut flowers twice every week during the high season (winter in Europe) and once during the low season (summer in Europe). Prices differ from one variety to the other. For flowers whose planting material is bulbs and roots, there is high demand for them by farmers who are new in the business. This is only possible with good supply of water and this makes the pump an important tool for the business.

**French beans** were grown for export markets. These were grown in Thika, Maragua and Murang'a districts. There are collection centres in the shopping centres where the farmers take their crop. 1 kilogram is bought on average at Ksh. 27/-. The crop matures within 45 days from the day they are planted with one square meter yielding approximately 1 kilogram within one season. Most of the buyers do supply the growers with the required inputs (seeds, fertilizers and pesticides) whose costs are deducted at the time of paying the produce.

Other crop grown for export market is **Sugar snaps**. It is grown in the high altitude and colder areas around the mountains. It is marketed the same way as French beans but the price is higher. The farm-gate per kilo was Ksh. 40/-. It requires high amount of water and high quality management.

Some few people are growing **passion fruits** for local market. They require a lot of water to grow and to produce fruits. The market for the fruit is good.

**Green maize** is quite favoured by some farmers who want to have two crops in a year instead of one like those who wait until harvest the maize when it is dry. They plant together with other farmers in the first cycle then when the maize is ready they sell the crop. During this first cycle the pump is used to give the crop more water making it grow faster than the rain-fed crop. It is therefore possible to get this crop to the market earlier and thus get better prices. The maize cob is also bigger as compared to that of the rain-fed one due to the high amount of water. The farmer then plants the second crop after selling the first through irrigation. This fetches more money than the first since it gets to the market when there is minimal supply. One maize cob would be sold at an average price of Ksh. 5/-.

**Onion** is grown for the local market. It is sold in nets, which carry up to 10 kilograms. The price of onions is generally high and farmers harvest a lot of onions in a relatively small area. The farm gate price ranges between Ksh. 25/- and 30/- per kilograms with a small area of about 150 square meters (10 X 15 meters) yielding up to 5 bags each weighing 100 Kgs.

Potatoes are grown mainly with other crops and as the main crop for the people who are using the *Super-MoneyMaker* pump. The pump makes it possible for the farmer to have potato crop throughout the year.

**Cowpeas** are grown either to be used as vegetables (where leaves are harvested or the green pods are harvested and sold when still green) or as a pulse. Most of the farmers doing irrigation prefer selling it as a vegetable.

**Carrot, Coriander, spinach, watermelon and okra** are grown for the local market. Their prices fluctuate very much depending on the season and the area.

Of special mention is **tea nursery**, which was found in the tea growing areas. For one to establish a tea nursery a lot of water is needed and the crop is kept in a shade. This makes it a little bit difficult for many farmers to be involved in the business of growing it. However, the demand for the tea seedlings during the March-April period is very high for the farmers who want to establish tea plantations. Each seedling sells at between Ksh. 5/- and 7/-. In an area of

approximately 400 square meters (20 x 20 meters) it has 12,000 seedlings, which would fetch between Ksh. 60,000/-. The sheds, which these farmers use, are made from banana leaves and polythene papers, which are cheap, this lowering the total cost of production. The seedlings take a year to be ready for transplant.

In Uasin Gishu one particular respondent was very happy with the pump since he would have lost his entire coffee crop due to the extended drought. It was possible to irrigate his two acre coffee farm at a time when the coffee was very young and thus saved it from drying up.

The following table shows the crops grown, respondents responses and the percentage growing

Crops	Respondents priority responses			Total respondents	Percentage of the active pumps
	1	2	3		
Tomatoes	12	9	2	22	55%
Kales ( <i>sukuma wiki</i> )	10	5	6	21	52.5%
Cabbages	7	4	1	12	30%
French beans	4	3		7	17.5%
Flowers	2			2	5%
Passions fruits	1	1		2	5%
Green maize		1	1	2	5%
Onions		1	1	2	5%
Potatoes	1			1	2.5%
Cowpeas		1		1	2.5%
Carrots		1		1	2.5%
Tea nursery		1		1	2.5%
Coriander		1		1	2.5%
Super snaps		1		1	2.5%
Coffee		1		1	2.5%
Spinach			1	1	2.5%
Melon			1	1	2.5%
Okra			1	1	2.5%

## 11.2 Number of crop cycles

The number of cycles depends on the crops grown and the region. In the relatively warmer places, crops grow faster and thus farmers have many crop cycles than in the colder places where crops grow slowly and therefore farmers have fewer crop cycles. Before the introduction of the pump there were an average of 1.20 crop cycles for the farmers throughout the sample area. After the pump was introduced the average went up to 2.34 per year. For those who were doing irrigation before, there was an increase from 2.69 to 2.77 cycles per year. This represents a 3% increase. Those who were not irrigating and therefore depended on rain to grow their crops or did not grow horticultural crop at all increased crop cycles from 0.60 to 2.13. This shows that those not doing irrigation before that represents 70% benefited most.

Other advantage associated with increased number of crop cycles, was “timing” so as to have the crop at a time when it fetches the highest price. Before the introduction of the pump farmers had to wait until the rain fell and thus plant the crop just like everybody else. All these farmers would then harvest at the same time thus lowering the prices. For those who have acquired the pump, they can plant slightly earlier than the rest such that their crop would hit the market before the rest and fetch higher prices. Their crop is also of higher quality due to the amount of water given to them. They grow fast and thus escape a lot of pest and disease attack, which leads to improved quality.

The following table shows the average number of crop cycles now and before for each cluster

Cluster	Average crop cycles for those doing irrigation before buying pump			Average crop cycles for those not doing irrigation before buying the pump			Average new jobs for each pump sold		
<b>I</b>	2.50	1.50	1.00	3.00	0.83	2.17	<b>2.88</b>	<b>1.00</b>	<b>1088</b>
<b>II</b>	2.86	3.00	(0.14)	2.50	1.43	1.071	<b>2.68</b>	<b>2.21</b>	<b>0.46</b>
<b>III</b>				1.30	0.00	1.30	<b>1.30</b>	<b>0.00</b>	<b>1.30</b>
<b>IV</b>	3.00	3.00	0.00	2.00	0.60	1.40	<b>2.38</b>	<b>1.13</b>	<b>1.25</b>
<b>V</b>				1.25	0.00	1.25	<b>1.25</b>	<b>0.00</b>	<b>1.25</b>
<b>VI</b>	2.50	2.50	0.00	2.33	0.00	2.33	<b>2.40</b>	<b>1.00</b>	<b>1.40</b>
<b>Average</b>	<b>2.77</b>	<b>2.69</b>	<b>0.08</b>	<b>2.13</b>	<b>0.60</b>	<b>1.53</b>	<b>2.34</b>	<b>1.20</b>	<b>1.14</b>

### 11.3 Sales income per season

The income generated is dependent on the use the pump (each pump sold) has been put into and the crops grown.

On average, the sales income for the entire population was found to be Ksh. 46,031/- season. Cluster I had the highest income with Ksh. 75,987/- sales income followed by cluster II with Ksh. 46,402/-. Third was cluster IV with sales income of Ksh. 43,969/- while fourth was cluster VI with a seasonal sales income of Ksh. 37,280/-. The last two clusters were III and V with Ksh. 34,900/- and Ksh.13,800/- respectively.

These figures for the Super-*MoneyMaker* are 75% higher than for the *MoneyMaker* pump, which had made it possible for farmers to realise sales income of Ksh. 26,265/-.

### 11.4 Cost of production per season

The cost of production involves paying wages and buying the main inputs, which include planting seeds, fertilizers, pesticides and transport cost.

On average the total cost of production per season for each pump sold was Ksh. 5,943/-. Of these 2,101/- was in form of wages which accounts for 35%.

Cluster II had the highest cost of production with Ksh. 7,474/- per season followed by cluster I with Ksh. 6,520/-. Third was cluster IV with Ksh. 5,904/- then cluster VI with Ksh. 5,093/-. Fifth and sixth were cluster III and cluster V with Ksh. 4,460/- and Ksh. 2,425/- respectively.

The cost of production was generally high due to high costs of fertilizers and pesticides. In some areas of the country there had been heavy attack of the armyworms during the period April-May that caused heavy damage to the horticultural crops. The number of times that a crop is sprayed has gone up as compared to before due to the insects developing resistance and the drought.

### 11.4 Profit per season

The profit per season is calculated as the income sales for the season less wages paid and inputs costs during the same period. On average each of the pump sold generated Ksh. 40,088/- in profits. Cluster I was leading with an average of Ksh. 69,467/- per season followed by cluster II with Ksh. 38,928/-. Third was cluster IV with Ksh. 38,065/- while fourth was cluster VI with a profit margin of Ksh. 32,186/-. The last two clusters were III and V with Ksh. 30,440/- and Ksh. 11,375/- respectively. The profits generated by the Super-*MoneyMaker* is higher than that generated by the *MoneyMaker* by Ksh. 21,137/- which was 90% increase. This could have been due to the improved prices of the crop. When the survey for the *MoneyMaker* was done, El Nino

rains had been experienced which made it possible for farmers to have plenty of vegetables in their farms. This depressed the prices thus yielding lower profits for the farmers.

### 11.5 Total benefits

Total benefits are considered to be actual amount of money that is put into people's pocket at the farm-level. These would include the entrepreneur and the waged workers. This figure is calculated as the profit made by the farmer plus the wages paid to the hired workers for who the pump is creating jobs.

On average each pump sold generated Ksh. 42,198/- per season.

*The following table shows the sales income, input costs, wages paid, production cost, profits, and total benefits per season by clusters (all figures in Kenya shillings)*

Cluster	Sales Income	Inputs costs	Wage/season	Total production cost/season	Profits/season	Total benefits (Profits + wages)
I	75,988	3,706	2,814	6,520	69,467	<b>72,281</b>
II	46,402	5,498	1,976	7,474	38,928	<b>40,904</b>
III	34,900	3,368	1,092	4,460	30,440	<b>31,532</b>
IV	43,969	3,669	2,235	5,904	38,065	<b>40,300</b>
V	13,800	525	1,900	2,425	11,375	<b>13,275</b>
VI	37,280	2,827	2,267	5,094	32,186	<b>34,453</b>
<b>Average</b>	<b>46,031</b>	<b>3,842</b>	<b>2,101</b>	<b>5,943</b>	<b>40,088</b>	<b>42,189</b>

## 12.0 TRAINING

At the time the visit was made, there were 167 entrepreneurs in the MicroPED region who had been trained in various areas of micro-irrigation business improvement. Some of these people were completely new in the irrigation business before they bought the pump while others were doing some irrigation before although on a smaller scale which may not have been commercial. The purpose of the training was to bring some noticeable incremental in the business by enhancing the operation and utilisation of the technology and making better forward and backward linkages bases on some recorded fact of the business. The MicroPED project target to train up to 1,000 enterprises (these would include all technologies promoted by the project which currently are, *MoneyMaker*, *Super-MoneyMaker* and Oil press) by the end of life span, which is August 2000. These trained enterprises should show some higher output as compared with those not trained.

### 12.1 Topics taught

In the sample of the 44 respondents, 23 of them had been trained. These formed 50% of the sample and 14% of the trained population. For these respondents the main areas, which had been covered during the training, were, pump repair and maintenance (100%), effective use and operations (52%), record keeping (43%), irrigation methods (9%) and crop production techniques (9%).

### 12.2 Areas of improvements

In terms of using the knowledge acquired some people had already benefited directly from it and had made some changes in their farms. Others had not had an opportunity of using the knowledge yet especially because, training took place when they had a crop in the farm and they

were waiting until the crop is harvested for them to implement what they learnt. The other problem was lack of water in some areas, which had made it difficult for some of these people to use the knowledge. For those who had used the knowledge learnt, 16 (70%) could operate and maintain their pumps better. Some of these people had acted as trainers to their neighbourhood who bought the pumps after them thus passing on what they had to others in the neighbourhood. This group has had a lot of influence in promoting the pumps around their areas. Neighbours have seen the pump work and the entrepreneur being trained on its maintenance and operations. They are excited. An individual made the following comment, *“these people are very serious about their work, have you seen even the motor vehicle selling companies following buyers to show them how to use the car. Their pump will get many buyers and people will have a lot of trust in it!”* Some 5 (22%) had increased area under irrigation since they were trained, while other 4 (17%) had increased the number of crops under irrigation as a result of training. 3 (13%) had started keeping records, which they bought had helped to keep good track of their expenses and times of various activities. Other areas where the respondents had shown improvements in were, reduction in the hours spent in irrigation after learning better irrigation methods, increased number of employees and improved crop spacing and crop husbandry each with 5% of the respondents.

One unexpected output of the training program is the kind of promotion it has done to the respondents and those in the neighbourhood. There was no single pump, which had not been used for those who have been trained. Training therefore raises the percentage of the pumps in use and makes them more useful in terms of the owners knowing the technology better. Those who have been trained have a more positive attitude towards the pump and clearly understand its ability and limitations. They also realise the circumstances under which the pump works best. This is unlike those who have not been trained who even though they may have seen the manual that shows different irrigation methods, they do not understand how to best use any of them. Training also provoked the minds of the entrepreneurs to think more keenly about the pump and in case of any problem they are more confident in dealing with such a problem. It also made it possible for farmers to differentiate between a problem that would require pump replacement and those, which they can fix at home. Cases of bearings coming out (rocker or pedal) and farmer assuming that this is a major problem were found. Training made it possible for farmers to know what they can do for themselves and what they cannot. Use of wrong sizes of pressure pipe makes the pump harder to operate and some people thought that this was a problem with the pump. However, once they were trained they understand the operation mechanism of the pump and change the pressure pipe making the pump operate better.

Using job creation and income generation indicators, no significant difference was found between those trained and not trained. It is because after training, there is the learning period.

### **13.3 Fee entrepreneurs are willing to pay for future training**

Initially when the training was started, the system used involved farmers being called into a hotel for some few days and trained on certain specific topics. They would be charged a fee of not more than Ksh. 200/- per entrepreneur. Farmers who come from the same district would be invited through a letter to a central town for such training. This method was found to be undesirable for many farmers who cannot leave their farms for more than a day to attend a course. There was also the problem of some farmers feeling that the things they have been trained on are not new to them and thus would be left feeling that their time and money have been wasted. The third problem was that of not getting the right farmers. Only those who can

afford in terms of time and money would attend such a course. The method was therefore changed and an on-farm raining method adopted. This is a situation where the trainers would walk into a farm, find whoever is using the pump, assess what they need to be trained on and give that training. In that kind of a system, one would not expect the farmers to pay any fee since they were not expecting the trainers. But it had more effect since the actual problems rather than the assumed one would be tackled. It was therefore more effective although fewer people are reached within a given period.

It is against this background that the monitoring team wanted to establish the amount of money these people would be willing to pay if they were to be given a second training.

Out of the 23 trained farmers only one felt that the training should be free. The rest expressed the willingness to pay in future since they had already benefited from the first one.

On average farmers were willing to pay Ksh. 146/ for the training. Cluster III was willing to pay the highest amount of Ksh. 175/-, then cluster II with Ksh. 158/- then cluster I and VI with Ksh. 125/-.

#### **12.4 Training needs**

While some people have been trained on various aspects of business improvement, there are some people who want to be trained on other areas. Top on the list of the training needs was:

**Pump operations and maintenance** with 11 (27.5%) respondents of those using the pump. The entrepreneurs were happy that the pump comes with a manual, which allows them to understand the pump better, however there are some problems, which they are not able to solve by the use of manual. They therefore felt that training on the pump maintenance would cover all the possible areas where the pump may need to be repaired. It also made it possible for people to repair the simple areas that could otherwise be assumed to be manufacturing defects, or was beyond the farmers' ability. Once the farmers are trained, they appreciate the simplicity of the pump in its repair at the farm level.

**Record keeping** had 3 (7.5%). These entrepreneurs expressed the need to have the knowledge of record keeping so as to know the best crop and whether they are operating at a profit or loss.

**Timing** with 2 (5%) of the respondents. Timing was seen to be very important since it has to do with planning of the farm activities, seasonality of the crop in consideration and the times when rains are expected. This would give the farmers some indications on the crops to grow at different times.

**Crop production.** There were 2 (5%) who indicated that they wanted to be trained on crop production. This is especially so for horticultural crops that are sensitive to changes in weather and susceptible to pest attack.

**Marketing strategies and effective use of the pump** had 1 (2.5%) respondent each.

#### **13.0 PROBLEMS EXPERIENCED BY THE Super-MoneyMaker OWNERS**

Some problems expressed by the owners are beyond ApproTEC mandate and ability, however they form some of the bottlenecks, which inhibit the entrepreneur from getting the best out of the pump. Some others are due to ignorance of the entrepreneur and these can easily be tackled by training or some short visits by the promotion team to the pump owners. The analysis have been done in such a away that the most important problem to a particular individual is given 3 points, second in priority is a 2 points and third in priority is given 1 points. These are then added for

each individuals to get the total points for each problem. The order in which the respondents gave the problems was assumed to be the order in which the farmers perceive them as important. It is hoped that this way, the analysis will bring out the most pressing problem not only in terms of number of the respondents but also in terms of the effect which the entrepreneurs believe they have been affected.

***Use of small diameter pressure pipes.*** This was the most prevalent problem with a total of 9 (22.5) respondents, 8 giving it as the most important and 1 as second important. This gave the problem 26 points. The problem was found in all cluster areas except III. The entrepreneurs tend to use hosepipes that are of smaller diameter or they insert the correct diameter at the beginning then introduce one of smaller diameter further on. With a small diameter pressure pipe, the pump becomes hard to peddle and a lot of water flows out from the cylinders. This is due to the fact that the suction pipe is about 1 inch in diameter and sucks water that should be pushed into 1-inch pressure pipe. Once this does not happen. The excess water pushes the rubber caps up and makes it difficult to pedal and the excess overflows over the caps and pours out. A number of entrepreneurs thought that this was a manufacturing problem and in some few cases, the farmers were planning to return the pump to the dealers.

***Bottom valves coming out.*** There were (22.5%) respondents who said that bottom valves comes out when the pump is in use. 3 ranked this problem as the most important problem and 6 ranked it as the second most important. This problem therefore attracted 21 points making it the second most important problem. The valves were coming out due to the poor material, which had been used with the first pumps, which were manufacture. The latter pumps do not have this problem. Farmers found it difficult to replace the valves when they come out since they did not have the tools to put them back once they have been removed. There is particularly 1 farmer who had learnt how to replace the valves using the rigid suction pipe. This was very creative and could be taught to other farmers so that the process becomes easy for them.

***Seasonal water sources:*** 6 (15%) of the respondents had problems with their water sources. These were especially those using the dams or deep wells. During the dry season when it is very profitable to use the pump, the dam would dry up or the water level in the wells go down. The pumps are therefore not used during these periods thus reducing the income the farmer would have otherwise made.

***Pest and diseases:*** 5(12.5%) felt that pest and disease were problems. 3 of them felt that this was their major problem while the other 2 gave it as a third priority problem. This gave this problem 11 points ranking fourth in terms of priority. The main pests, which had affected farmers most, were armyworm. There was a wave of the pest around the country just before the monitoring visit was made.

***Market for the crops:*** Some farmers had problems marketing their crops. These were mainly tomatoes, which are sometimes too many in the market and must be harvested once they are ready. The prices go down and make it difficult for the farmers to sell. This was found to be a problem in areas where the road infrastructure is very poor. There were a total of 4 (10%) respondents who indicated that this is a serious problem 1 as the first priority problem while the other 3 as a second priority problem. This gave it 9 points in the ranking scale.

**Limited suction head:** Some 3 (7.5%) thought that the 20 feet suction head that the pump provides is very limited given the depth of many wells in this country. They suggested that ApproTEC should design a pump with higher suction head. Some of these people only use their pumps for a limited period of time when the level of water is high. When the water goes down either due to too much pumping or during drought period, the pump is rendered useless.

**Middlemen frustrations/low prices:** In many areas, the middlemen buy agricultural products from the farmers. Some of these middlemen frustrate the efforts of the farmers very much and offer very low prices. Many of the farmers barely break even. Out of the 40 respondents who were using the pump, 3 (12.5%) expressed these problem. 1 gave it as the biggest problem, 1 as the second most important and the other 3 as the third most important problem. This gave the problem 8 points.

**Lack of entrepreneurial spirit:** some 3 (7.5%) felt that they lacked the necessary entrepreneurial spirit in order to utilise the pump well. These hindered their planning capacity and implementation of any new ideas. This was due to either environmental or personal problems. One case in particular was for a woman who lost her job with a bank after they went on strike. She had worked for these bank for 19 years and has never known any other employer or job. She felt frustrated that she has to wait for a whole season before she gets some money unlike what she had been used to. The other people whose entrepreneurial spirit was low were those in areas where the environment is harsh for business to survive. For example the road infrastructure could be so bad that selling the farm produce is difficult. The farmers become frustrated and their morale goes down.

**Poor welding at the handle slot:** Out of the 40 farmers visited, 2 (5%) have had problems with their pumps breaking at the slot. Some farmers have ended up taking the pump to a welder to reinforce this area. These 5% cases gave these as a major problem in the pump use thus giving it some 6 points.

**Hard to operate:** Some other 5% of the respondents said that the pump is hard to operate. This could be due to use of the wrong sizes of the pipes, or the pressure side bottom valves popping our when pumping. This problem attracted 5 points with 1 person ranking it as the most serious problem and another 1 ranking it as number two.

**Theft of the produce:** Some 5% of the respondents had problems with thieves stealing their produce. In one particular case, the situation was so bad that it had almost made the entrepreneur stop growing crops for commercial purposes. In the other case, the farmer stopped growing cabbages, which was mostly targeted crop by the thieves. In the first case, the situation was made worse by the fact that the farmer is a teacher who stays away from home and therefore the employees easily steal without any fear of being caught. In the second instance the area had been struck by famine and the few people who had anything in the farm had rough time keeping thieves out. Even when the farmer tried to keep guard at night, thieves still found a way of getting to the farm unnoticed.

**Salty water:** in cluster I, there is a big problem of salty water. This makes the pump rusty and then corrodes the metal. The rubber caps are the first casualties where they fail to create a partial

vacuum in the cylinders making it difficult for the pump to operate. The salt also tears the bottom valves. Dealers in these areas should have more frequent supply of the rubber caps and bottom valves since the farmers requires more often than the other areas. This problem scored 3 points, although the case is thought to be widespread than what was found during the visit.

***Sloppy land:*** Some farms especially in the MicroPED region are very sloppy. This creates a number of problems. One, when the homestead is built at the highest point (which is normally the case), taking the pump from the house to the lower side where water is generally found becomes difficult and unless there is a strong person in the family or there is a hired person, when it becomes difficult to use the pump. Coupled with this, is the difficult of getting the crop from the lower sides for marketing since in almost all cases there are no roads that go to the bottom of the valleys. The other problem is that, one can only irrigated a limited area since the pump heads (both suction and pressure) is not big. One covers the 13 meters vertical height that the pump can deliver within a very short horizontal distance. Setting up good irrigation farm in the sloppy farm is also difficult and one faces many challenges, either laying down the pipes or setting the sprinklers and setting up the pump on a very sloppy ground. There were 2.5% of the respondents who gave this problem but it was the major problem thus on the point scale getting 3 points.

***Limited area of irrigation:*** The power of the pump only allows for use in a limited area of the farm unlike the motorized ones. Some people thought that for somebody who wants to do irrigation on a higher scale the manual pump is not idea. There were 2.5% who gave it as the major problem thus getting a total of 3 points.

***Lack of knowledge of good irrigation methods:*** Some people had little knowledge of the pump's operational mechanisms, which made it difficult for them to know which irrigation methods would work best. It was especially difficult for people to perceive the use of sprinklers and how to put them in their own farm setting. There were 2.5% of the respondents with this problem.

***Owners' ill health:*** There has been a problem in families where some of the productive members get into long periods of sickness. This is especially so where AIDS cases are involved. While the respondents many not have come out clearly and stated that their family members were suffering from AIDS, the description given indicated that this might have been the case. In one particular case the owner of the pump had died two days before the monitoring team visited her. The vivid story narrated by the relative who was living with the deceased before her death and others in the neighbourhood indicated that the death may have been AIDS related. There were other cases where this was not given as one of the three major problems but it comes out in the general discussion as one of the factors that have affected agricultural activities in the farm. However it is only 2.5% of the case that this was mentioned as the major problem affecting pump use thus earning a total of three points.

***Loosing prime:*** Some 2.5% complained that the pump kept on loosing prime. In these cases somebody had to keep a water can near the pump so as to keep on adding water. In another case the operator had connected a small pipe, which was then directed back to the pump cylinders so as to keep a constant supply of water back to the pumping system. This could have been due to the foot valve letting water to flow back or loose connection within the suction pipe. This proved

to be difficult since every time the operator left the pump it had to be primed again.. This scored 3 points.

***Lack of Labour:*** In some 2.5% farmers expressed lack of labour as hindering factor to high use of the pump. This attracted 2 points on the priority scale.

***Friction between the pedal and the chain:*** Some 2.5% of the entrepreneurs complained that there is very high friction between the pedal and the chain thus weakening both the chain and the pedal. This could finally lead to one of them breaking. The pump also produces irritating noise when this rubbing together of two metals continues. It was suggested that this be rectified in in-order to improve the life span of the pump and to make it more comfortable to work with.

***Poor infrastructure:*** In some areas poor infrastructure have affected the use of the pump due to poor access to the large market where the irrigated crop is sold. There were 2.5% of the cases, which had this problem scoring 2 points.

***Oval cylinders:*** Some 2.5% of the respondents complained that the shape of the cylinders was not round but oval. This made it difficult for the rubber caps to cover tightly the entire sides of the cylinder and thus create partial vacuum. In some situations it might not suck water at all. The problem takes time before it is noticed and thus the operator keeps on wondering why the pump is not working as it should. The problem scored 2 points on the priority scale.

***Heavy to carry:*** There were a 2.5% of the respondents who said that the pump is heavy to carry. This is especially important in the sloppy areas where one cannot use a wheelbarrow to carry the pump downhill or situations where there is no wheelbarrow and those in the family are not strong enough to carry the pump on their shoulders.

***Poor quality of planting seeds:*** There were some farmers who have some problems with vegetable seeds they have been planting making horticultural farming difficult. It is especially serious for the kales and cabbages when one goes to buy one and discovers latter that they got the other after they germinate. There were 2.5% of the respondents who gave this in cluster II. The problem scored 1 point.

### **13.0 SUGGESTIONS FOR IMPROVEMENT**

The respondents were also asked to give suggestions, which they thought would improve the micro-irrigation business. Some of the suggestions made to ApproTEC with the hope that if certain things are put in place then it would be easier for them to get the best use out of the pump or other people who have not bought the pump might find it more attractive.

The suggestions have been given points in order to priority so as to indicate the importance of each of them. The most important suggestion given by the entrepreneur gets three points, the second in importance gets two points while the third would gets 1 point.

The entrepreneurs gave many suggestions but only the three most important were considered for analysis.

***Training on pump operations and Maintenance:*** 8 (20%) of those who have not been trained on pump operation and maintenance wanted to be trained on pump operation and maintenance. They felt that if they are trained on this aspect, it would be easier to repair the pump in the farm without having to go to the dealer. These would also save a lot of farmers' crops since there are sometimes when a pump would have simple problems that the farmer could solve but since they do not know how to repair neither do they have money at that moment to take the pump to dealer while the crop is at a stage where it seriously needs water. There were 7 respondents who ranked it first, and 1 ranked it second. The total score was 23 points.

***Design a pump with higher output:*** 6 (15%) of those interviewed felt that the Super-MoneyMaker pump is very good but it does not produce as much water as they would wish. They therefore suggested that ApproTEC design a more powerful pump that would suck much more water (they suggested 2 to 3 inch suction and pressure pipes diameter). These would make it possible for farmers to have higher acreage of irrigated land. There were 5 respondents who gave it as the most important suggestion, and 1 as second suggestion thus scoring a total of 17 points.

***Training on crop production:*** 3 (7.5%) suggested that ApproTEC offer training on crop production. These would improve their ability to grow more crops and thus use the pump more often and effectively. Two ranked it first while one other ranked it second thus giving it a total of 8 points.

***More monitoring visits:*** Some 7.5% felt that they would benefit more by having more monitoring visits. They thought this was an addition to the training. 2 respondents gave this the highest rank while 1 ranked it third thus scoring a total of 7 points.

***ApproTEC to assist in marketing:*** Marketing of the horticultural crops is sometimes quite difficult because the farmers are not sure of what crop is needed where. They are easily exploited by the middlemen who have more information than they do. These people thought that ApproTEC could assist in marketing their crops and thus give them an upper edge. They thought that one way of doing this is by organising those who have pumps into groups like cooperatives through which they would be to sell their crops. The groups would give them a higher bargaining power than individuals. 7.5% were of this view with 1 person ranking it highest and 2 as second thus giving it a total of 7 points.

The problem with such an arrangement is the amount that each entrepreneur would get from their farm, timing, management and meeting orders when consumers place them. It would be easy if all entrepreneurs were growing the same crop since one would be looking for a market for one crop. However when there are too many crops the market becomes diverse, making it difficult for one to assist them.

***Provide loan facilities:*** Some 5% of the respondents that ApproTEC should provide loan facilities to enhance the activities of the farmer. In certain times, it is difficult working on a reasonable piece of land due to the high cost of the inputs. If there was a loan facility where one would pay with the income from the farm after the harvest, then this would improve their methods of farming, crop quality and increase acreage. Two people gave this as the most important suggestion thus earning a total of 6 points.

***Design a wind driven pump:*** There are those of the entrepreneurs who wanted ApproTEC to extend its research and development work as to incorporate a mechanism that would allow the pump to be driven by wind. These they thought would allow for higher mechanical advantage and in the areas where there are strong winds one would get a lot of water without using any human energy for peddling. The people who expressed this suggestion could not tell how this kind of pump would be assembled and sold like the *Super-MoneyMaker*. They could also not say whether they would still afford the modified fashion if it is possible since it could be quite expensive initially. This suggestion scored 6 points.

***Make people aware of the pump limitation:*** Some people felt that the information provided at the time of sale is not detailed enough to give a potential buyer a clear indication of all the pumps limitations. They therefore may have bought the pump with higher expectations than they finally achieved from the pump. This suggestion scored 4 points with two people ranking as the second most important input.

***Re-design the pump to avoid friction between the chain and the pedal:*** There are those who complained that there was friction between the chain and the pedals of the pump. They suggested that the pump be re-designed so as to completely eliminate this friction. This could be done by setting the chains slightly out of the pedals. These scored 3 points with 1 person giving it as the suggestion of the highest priority.

***Pump to be sold with the bottom valve replacement kit:*** There were suggestions that the pump should be sold with the replacement kit. This was because these people had experienced problems trying to replace them. One particular individual in Makueni who bought the pump during the Nairobi show could not replace the bottom valves when they were destroyed by salty water. When he visited one of the dealers he was shown the wires, which had been provided, to the dealer for changing the valves. However, this person could not take the pump all the way from Makueni to Nairobi and he did not know how to make his own wires. He felt frustrated. However, in another situation a farmer had learnt by himself how to change the bottom valves using the suction pipe as his tool. These could probably be the better solution rather than selling the pump with tool kit. This scored 3 points from 1 respondent who gave it as the major suggestion.

***Make the pedals longer:*** Some respondents felt that the pedals should be made longer so as to have more than one person pedalling and to also increase the mechanical advantage. This they thought would increase the pressure head thus increasing the effectiveness of the pump. These scored 3 points from 1 respondent.

***Insert threads in the outlet/inlet pipes of the pump:*** Threads should be put on the inlet and the outlets of the pumps so as to guide the user on the exact size of the pipe to use, it was suggested. This would also serve to hold the pipe into place instead of pushing the pipes inside and then tie with rubber bands. It would also reduce the leaks at the points where the rubber bands are used. This scored 3 points from 1 respondent.

***Replace the foot valve plastic mesh with a wire mesh:*** The plastic mesh in the foot valve is easily torn when the pump is put into use. It is also easily torn when the pump is being

transported. 2.5% of the respondents felt that if this is replaced with a wire mesh then it would survive more difficult situations and would not be easily torn. This scored 3 points.

***Provide spares parts at the time of sale:*** Some 2.5% of the respondents felt that spares like the rubber caps and the bottom valves should be provided at the time of sale so that when the ones in the pump get worn out one does not have to start looking for replacement then. If these is done, they argues, there will be no time when the pump would have to be out of use as the owner looks for spares. This scored 3 points.

***Carry out more demonstration to create more awareness:*** It was suggested by 2.5% of the respondents that more demonstrations be held in areas of high potential so as to create more awareness. This would increase the number of pumps bought in such areas. The suggestion got 2 points.

***Offer hire purchase facility:*** Some entrepreneurs suggested that ApproTEC should organise some form of hire purchase program since many people who are willing to buy the pump cannot raise the required amount at once. They argued that such an arrangement would make it possible for many people in the rural area especially at this time when the economic performance is very poor to own a pump. These were 2.5% and this suggestion scored 1 point.

***Improve welding:*** Some people said that some parts of the pump were not well welded and when put under intense use, the parts easily breaks. They therefore suggested that the welding work be done better. These formed 2.5% of the respondents getting 1 point.

## **15.0 BENEFITS.**

Entrepreneurs who have bought the Super-*MoneyMaker* pump have experienced varied benefits from owning the pump. Some of them had foreseen these benefits before they bought the pump hence the decision to buy the pump.

***Source of income:*** Out of the respondents who were using the pump 48% of them saw the pump as a source of income. The respondents cut across the board through all the cluster areas. The respondents were happy that the irrigation businesses have served as an alternative source or the major source of income for the household.

***Made irrigation easy:*** With the acquisition of the pump, irrigation became easy for 36% of the respondents who are using the pump. Using buckets was very difficult and some times made the entrepreneur angry and frustrated. It was very tiring and one could only do small portion of land. With the pump one can easily irrigate a big area and still manage to do other things.

***Employment creation:*** For some 30% of the respondents, the pump has created employment either for the family members or paid up jobs. The employment that the pump has created is more dependable has higher returns than what the recipients had before. It is also quite good for the school leavers who may not have had much to do but with the pump at home it creates employment and gives them some income.

***Food for the family:*** The pump has provided food for family. This was said by 20% of the respondents. They especially gave examples of the dry seasons when it has been very difficult to get food for the family but those with the pump can get food in their farm. Those who have planted horticultural crops do inter-crop with other crops like potatoes, maize or beans, which are not their major crops. These crops get water as the main crop are being irrigated thus at the end of the season the farmer gets more than just the cash crop but a food crop for the family.

***Does not use fuel:*** 16% of the respondents felt that the pump has been very good since it does not use fuel. This is especially good since it takes a long time in between when the crop is planted and when one gets any returns. If one is using a fuel pump the cost of the fuel alone might be prohibitive to many of the farmers and thus the crop could be lost on the way before it is fully ready. One also needs another source of money to maintain such a pump in the first few seasons. The respondent also felt that since the Super-MoneyMaker does not need any oil, which would make the machine to be sensitive since, any use of unskilled persons without the oil would lead to immediate breakdown.

***Provide money for domestic use:*** The pump allows the respondents especially the women to have easy access to money for domestic use. 11% of the respondents felt that since they bought the pump they have not had problems getting money for use in the house.

***Increased area under irrigation:*** 11% of the respondent had increased the area under irrigation. These are some of those who were doing irrigation before they bought the pump. This was due to ease of irrigation and the high water output by the pump.

***Started growing high value crop:*** For some 7% of the respondents, buying the pump allowed for the introduction of high value crops in their farms. This meant that agriculture in the farm was from then onwards considered a real business.

***Easy to operate:*** 7% of the respondents said that the pump is easy to use and makes irrigation very easy. The pump is easy for children to pedal and even in a situation where they are very small, two of them operate together.

***Increased crop cycles:*** 5% of the respondents said that the pump has allowed them to increase the crop cycles since they do not have to depend on the rains any more. They can have a crop any time of the year as long as there is market for it.

***Made farming dependable:*** 5% of the respondents felt that, the Super-MoneyMaker has made farming more dependable than it was before. This is because, as long as there is water in the farm, the farmer would always have crop growing.

***Happy for being of service to others:*** 2% of the respondents were very happy when they see customers coming to them to buy vegetables. Any time when clients come to the homestead to buy the vegetables, the respondents felt that they were being of service to others. This made them feel satisfied.

***Improved the quality of the crop (Flowers):*** 2% of the respondents were very happy that since they started using the pump the quality of the crops went up and started fetching high prices. The client who buys the flowers has since been so impressed by the respondent's flowers that he tells other flower growers about him and his pump.

***Started irrigating:*** Some 2% were happy that the pump allowed them for the first time ever to get to the irrigation business.

***Gives exercise to operator:*** Some 2% were also using the pump as a way of getting body exercise. This they said was particularly good since in normal circumstance these people would not either get time for such exercises or they would shy off from them. The pump therefore gave them an opportunity of not only earning some income but to exercise their bodies.

## **16.0 INVESTMENTS**

Beyond benefits described above, some respondents had made some investments in other areas. The following are some of the investments made by the respondents:

***School fees:*** Some 9% of the respondents had paid school fees. For some people, the bulk of the money came from the sale of the irrigated crop, which amounted to as high as 60 of the total fees paid.

***Started a tele-video business:*** Some 2% of the respondents had started a tele-video business where they would go after they leave the farm. This has increased the level of income for the family since there is more than one source of income.

***Livestock farming:*** 2% of the respondents had bought some livestock, which were an extra investment made from the sale of the irrigated crop.

***Coffee farming:*** 2% of the respondents had bought some coffee seedlings and started growing coffee as an extra business from the sale of the irrigated crop.

***Constructed a rental house:*** From the sale of the irrigated crop using the Super-MoneyMaker Irrigation pump some 2% of the respondents were able to construct a rental house, which earns them some income.

***Constructed an extra wing for the house:*** 2% of the respondents added an extra wing of their house using the money made from irrigation. The added wing actually looks better than the older house.

***Bought a motorised pump:*** 2% of the Super-MoneyMaker owners have moved to higher level where they have bought a motorised pump from the sale of the crops irrigated by the Super-MoneyMaker. This shows that the pump has made it possible for the person to get into higher level of irrigation.

Built a water tank: 2% of the respondents had constructed water tank for holding more water during the dry season. This was after they got the money from the sale of the irrigated crop. It was possible for this people to store water for longer periods than before when the source dries up.

## 17.0 RECOMMENDATIONS

1. While the media has been very efficient in getting to very many potential buyers of the pump, it is the actual demonstration either at the dealer, on the truck or at the show that creates the desire and action is taken to purchase the pump. It is therefore recommended that live demonstrations be continued and be enhanced as much as possible in order to create the picture that the end users can easily associate themselves with for increased sales.
2. Whenever media promotion is used, a systematic process of changing the message and fashion should be adopted so that the potential customers are not bored by seeing the same message the same day and for getting to a wider range of people. This is generally because people respond to different messages differently. Some people get messages easily through pictures, others through pictures, others through case studies, while others through monetary gain messages. Therefore it would be necessary to change the message and the way it is presented from time to time with the view of capturing all these people.
3. There is very high potential of micro-irrigation in Machakos, Makueni and some parts of Kitui districts. At the time of this monitoring visit little promotion had been done in this areas (as compared to the Mt. Kenya region and the west). There is need to have more promotion in this areas targeting the market centres, administrative towns so as to tap this potential. People in these areas travel long distances for various services and once a good demonstration is set in such centres these people will see them.
4. In Makueni, there is a dealer at Kathozweni, which is a very active agricultural market, but it is not centrally placed in terms of services like banking and administrative matters, which make people, travel long distances. Another dealer should therefore be put up in place at Wote, which is a big agricultural market, administrative headquarters for the district, and there is more money circulation than Kathozweni.
5. Bottom valves and rubber caps should be made available to all dealers so that the entrepreneurs can easily access them. Each dealer/promotion assistant should be fully trained on how to change the bottom valve using simple tools like the rigid suction pipe (and not the specially designed wire which is complicated for many farmers).
6. With the economic hardships that Kenya is undergoing at present, it has been difficult for many people to get the 5,490/- required to purchase the pump. This was noted through the deep desire expressed by those who were borrowing pumps to one day own theirs if only they will afford. It was also noted that almost all the pump owners are married people who may have higher possibilities of saving so as to buy the pump. An efficient, effective pump just like the *Super-MoneyMaker* but cheaper would be good for these people if it is introduced into the market. A hire purchase system could be introduced in the dealership network at least one in each of the major towns so that the more poor people are able to buy from these places. ApproTEC could also talk to its dealers so that they (dealers) can arrange with potential customers for partial payments but the customer only takes the pump after it is fully paid. This would take care of those who have no access to the hire purchase program due to the collateral required.
7. ApproTEC could corroborate with organisations, which have credit facilities. This would be necessary in buying the right pump accessories and farm inputs, which would boost the income of the farmers.

8. Some parts of the pump have been poorly welded and were found to break after some use. These include, the slot for the handle, the piston disc, the connection between the cylinder and the pressure chamber. ApproTEC should follow up with the manufacturers to reinforce the welding work. There are some pumps whose cylinders are oval; this should also be addressed so that the pump remains efficient and effective.
9. The pedals in future could be made longer to increase the leverage. Threads could also be added (or a cork) both in the inlet and outlet side to facilitate easy connection and give a clear guide on the size of the pipes to use. The correct pipe size to be used with pump should be clearly indicated on the users manual and a warning of what happens if the wrong diameter of the pipe is used.
10. For most of the pumps the serial number is not visible due to contact with the ground. If possible the number should be put on the side of the frame so that it can remain visible during the pump's life span.
11. There is high demand for deep well pump since there are many wells whose depth the Super-*MoneyMaker* pump would not draw water from. People with deep wells don't mind a slightly more expensive manually operated pump, which would serve the purpose. These would be especially good if it is portable. If ApproTEC can design such a pump it would reach many micro irrigation clients.
12. There is also huge demand for a pump whose output is higher than the Super-*MoneyMaker*. There were suggestions to enlarge the cylinders by the respondents. Probably the TecDev would look at such a possibility so as to more efficiently use the human energy.
13. There was no significant different in terms of jobs created and income generated between those who have been trained in the MicroPED and those not trained. However, there was great difference in terms of future planning for the use of the pump, actual knowledge of use and operation and the trained entrepreneurs were doing a lot of promotion in their areas. It would therefore be good if the training programme is incorporated in all pump promotion projects, which would enhance the promotion strategy on the ground. The word of mouth would be more effective and be less expensive in future. Training does not have to be done by a special training team like in MicroPED project where budgetary provision had been made. The promoters themselves could occasionally visit some entrepreneurs in areas where they have gone for promotion and "sees" how the owners are using the pump. During such visits, the promoters would share with the owners some ideas on the usage of the pump and this would act as training. It is very important for a s many entrepreneurs to completely understand the pump operation, best usage, repair and maintenance of the pump. They would in turn train others. The ApproTEC Monitoring Unit would ensure that names of clients who have bought pumps in a particular area area given to the promoters when they are going out to such areas.
14. More monitoring visit needs to be undertaken at different average ages of the pump to determine the actual growth in usage and to clearly provide a profile of the clients who buy the pump. This would allow for better targeting of various operations especially promotion, designing and development of new products.

Annual Monitoring & reporting technology visit  
List of the Super-MoneyMaker pump owners to be visited from 28<sup>th</sup> June 25<sup>th</sup> July 1999

Cluster no. 1

**Makueni District**

Grace Mbithi  
Box 19299, Nairobi  
Kibwezi Div., Kikbumbulyu Loc., Ngandani Sub  
Loc., Kevanda Vill., Kasemeni Mkt. Near Redemed  
Gospel Church.  
Bought on 10/98 (Not Trained)

Onesmus Nzeilli  
Box 30260  
Tel: 723101  
Kaiti Div., Kilala Loc., Kaumoni Sub Loc., Kisyongii  
Vill., Kilala Mkt near Kaumoni Catholic Church  
Bought on 9/10/98 (Not Trained)

**Machakos District**

Joseph Mutiso Maoki  
Box 369 Mutituni,  
Central Div., Mumbuini Loc., Kasinga Sub loc.,  
Mukuni Vill., Tumba Mkt near Kyanguli Primary  
School  
Bought on 9/2/99 (Trained)

Julius Gitau  
Box 109 Donyo Sabuk,  
Matungulu Div., Kiboko Loc., Mithi-ini Sub loc.,  
Mithi-ini Vill., Donyo Sabuk Mkt. Near Donyo  
Coffee Primary School  
Bought on 16/11/98 (Trained)

Benedict Muinde  
Box 56 Ndonyo Sabuk  
Matungulu Div., Kyeleni Loc., Keyleni Sub loc.,  
Kisekini Vill., Ndonyo Sabuk Mkt  
near Kwasyokimanza Primary School  
Bought on 16/2/99 (Not Trained)

Mutuku Makao  
Box 286 Mutituni  
Central Div., Mutituni loc., Mutituni Sub loc.,  
Muvae Vill., near Mutituni Primary School  
Bought on 1/12/98 (Not Trained)

**Kitui District**

Solomon Wambua Mbuvi  
Box 243, Kitui,  
Kitui West Div., Kyangwithia Loc., Tungutu Sub  
Loc., Ithookwe Vill., Tungutu Mkt., near Ithokwe  
Primary School/All Souls Church  
Bought on 12/2/99 (Trained)

Francis Kariuki  
Box 57 Kitui,  
Tel: 0141 22734  
Kyangwithia Div., Kalundu Loc., Township Sub  
Loc., Kitui Town near Central Primary School.  
Bought on 14/11/98 (Not Trained)

**Cluster no. 2**

**Thika District**

Elijah Kabugu Joshua  
Box 592 Thika,  
Gatanga Div., Kigoro Loc., Ndunyu Cege Sub., Loc.,  
Kiumu Vill., Ndunyu Cege Mkt., near Kamunyaka  
Primary School  
Bought on 5/11/98 (Trained)

James Mwangi Ng'ang'a  
Box 91 Gatura,  
Gatanga Div., Kariara Loc., Kiarutara Sub Loc.,  
Kiarutara Vill., Kiarutara Mkt., near Kiarutara  
Primary School  
Bought on 4/11/98 (Not Trained)

Joseph Kinyanjui Kimani  
Box 87 Thika  
Kakuzi Div., Mitumbiri Loc., Kakangi Sub Loc.,  
Gikono Vill., Kenol (Makutano) near Kangangu  
Primary School  
Bought on 30/11/98 (Trained)

Patrick Njoroge Koigi  
Box 537 Kalimoni  
Ruiru Div., Juja Loc., Kiaura Sub. Loc., Gacororo  
Vill., Gacororo Mkt near Gacororo Catholic Church  
Bought on 11/11/98 (Trained)

James Wainaina Gichuhi  
Box 1391 Swani  
Thika Div., Mitumbiri Loc., Katwekera Sub Loc.,  
Katwekera Vill., Makongeni Mkt. near Swani  
Primary School  
Bought on 16/12/98 (Trained)

Francis Mburu  
Box 1210 Thika  
Thika Div., Gatuanyaga Loc., Gatuanyaga Sub  
Loc., Thika River Village near PEFA Mugua  
Bought on 29/10/98 (Not Trained)

**Kiambu District**

Paul Kuria Njoroge  
Box 98 Kukuyu  
Kikuyu Div., Karai Loc., Sub Loc., Kamangu Vill.,  
Mugumo Mkt near Wambaa Primary School  
Bought on 9/10/98 (Not Trained)

Paul Kamau Kuria  
Box 130 Kikuyu  
Kikuyu Div., Karai Loc., Karai Sub Loc., Kamangu  
Vill., Mugumo Mkt near Wambaa Primary School  
Bought on 11/11/98 (Not trained)

**Maragua District**

Sebastian Ngugi Ngige  
Box 716 Thika  
Tel: 503666  
Kandara Div., Gaichanjiru Loc., Kagumo-ini Sub  
Loc., Gatura Vill., Kagumo-ini Mkt near Wangai  
Primary School  
Bought on 25/1/99 (Trained)

Moses Waithaka  
Box 301 Thika  
Dandara Div., Gaichanjiru Loc., Githunguri Sub.,  
Loc., Karaia Vill., Githunguri Mkt. Near Githunguri  
Secondary School  
Bought on 29/1/99 (Trained)

Samson M. Muiruri  
Box 53 Sabasaba  
Kandara Div., Nguruwe-ini Loc., Maria-ini Sub.,  
Loc., Maria-ini Vill., Karugia Mkt near Kamae  
Catholic Church  
Bought on 23/10/98 (Not Trained)

**Murang'a District**

Maina Kimenderi  
Box 177 Kiria-ini  
Mathioya Div., Kamacharia Loc., Kamune Sub.,  
Loc., Kamune Vill., Kamune Vill., near Kamune  
Primary School  
Bought on 31/10/98 (Trained)

Joseph Ndenyeka Ngari  
Box 177 Kiria-ini  
Mathioya Div., Kamacharia Loc., Kamune Sub.,  
Loc., Kamune Vill., Kamune Mkt near Kamune  
Primary School  
Bought on 19/1/99 (Trained)

Peter Njoroge Thuna  
Box 35 Kangema  
Tel: 0151 21846

Kangema Div., Muguru Loc., Ndani Sub., Loc.,  
Gakira Vill., Gakira Mkt near ACK Muguru Church  
Bought on 24/10/98 (Not Trained)

**Cluster no. 3****Nyeri District**

Joseph Gathuri Kamugo  
Box 223 Kiganjo  
Kieni East Div., Kabarú Loc., Ndathi Sub Loc.,  
Mbiriri Vill., Mbogo-ini Mkt near Mbiriri Primary  
School  
Bought on 5/11/98

Peter Ndirangu Kuruga  
Box 46661 Nairobi  
Tel: 713800  
Mathira Div., Kirimukuyu Loc., Kiangoma Sub.,  
Loc., Kiangoma Vill., Kiangoma Mkt near  
Tumutumu Primary School  
Bought on 27/11/98 (Not Trained)

Michael Wachira Wamugu  
Box 7 Kiganjo  
Tel: 74  
Kieni East, Kabarú Loc., Ndathi Sub Loc., Mbiriri  
Vil., Ndathi Mkt near Mbiriri Primary School  
Bought on 15/10/98 (Trained)

Joseph Gathuri Kamugo  
Box 223 Kiganjo  
Kieni East, Kabarú Loc., Ndathi Sub loc., Mbiriri  
Vil., Ndathi Mkt near Mbiriri Primary School  
Bought on 5/11/98 (Trained)

**Embu District**

David Kahuthu Githinji  
Box 96 Karurumo  
Rnunyenjes Div., Kagari Loc., Kiringa Sub  
Loc., Muthathara Vi., near Karurumo Primary  
School  
Bought on 25/9/98 (Trained)

Harun Njeru Ngige  
Box 38 Embu  
Runyujes Div., Kagaari South Loc., Nthagana Sub  
Loc., Kanduri Mkt, near Kanduri Primary School  
Bought on 3/12/98 (Not trained)

**Cluster no. 4****Laikipia**

Dominic Waweru  
Box 537 Nanyuki  
Central Div., Weru-ini Loc., Matanya Sub loc.,  
Ndemu Vil., Matanya Mkt near Meru-ini Primary  
School, Bought on 1/12/98 (Trained)

Mzee Ndovu Wanyonyi  
Box 201 Nanyuki  
Tel: 22933  
Central Div., Muthaiga Loc., Muthaiga Sub  
Loc., Nanyuki River Vil., Nanyuki River Mkt near  
Nanyuki Secondary School  
Bought on 11/2/99 (Trained)

Benjamin Rono  
Box 747 Nanyuki  
Central Div., Daiga Loc., Umande Sub Loc., Mwereri  
Vil., Mairo Inya Mkt near Bingwa Primary School  
Bought on 24/12/98 (Not Trained)

#### **Nyandarua**

Moses Mwangi Kiarie  
Box 46 O. Jororok  
Oljororok Div., Gitimu Loc., Gitimu Sub Loc.,  
Nyakariang'a Vill., Nyakariang'a Mkt near  
Jacaranda Primary School  
Bought on 25/11/98 (Trained)

James Kiragu Murage  
Box 1345 Nyahururu  
Tel: 22658  
Oljororok Div., Oljororok Loc., Oljororok Sub Loc.,  
Oljororok Vill., Oljororok Primary School  
Bought on 30/11/98 (Trained)

Simon Kanyingi Muraya  
Box 265 Kinamba  
Ng'arua Div., Tandare Loc., Tandarei Sub Loc.,  
Tandare Vill., Tandare Mkt near Tandare Primary  
School  
Bought on 6/11/98 (Trained)

#### **Nakuru**

Gideon Wanyotu  
Box 60 Rongai  
Rongai Div., Rongai Loc., Batra Sub Loc., Rongai  
Mkt near Rongai Primary School  
Bought on 7/1/99 (Trained)

Lucy Njeri  
Box 26 Rongai  
Rongai Div., Rongai Loc., Rongai Sub Loc., Rongai  
Vill., Rongai Mkt near Rongai Primary School  
Bought on 8/1/99 (Trained)

#### **Cluster no. 5**

##### **Kisumu**

Samson Otieno Obila  
Box 77 Akala  
Kombewa Div., West Seme Loc., Reru Sub. Loc.,  
Okuto Vill., Okuto Mkt near Okuto Primary School  
Bought on 7/12/98 (Not Trained)

Peter Olima Ayoma  
Box 31 Akala  
Kombewa Div., West Seme Loc., Reru West Sub  
Loc., Korango Vill., Reru Vill., near Ramoya  
Primary School  
Bought on 27/10/98 (Not Trained)

Margaret Maragia  
Box 2176 Kisumu  
Tel: 22749  
Winam Divv., Kajulu Loc., Wathorego Sub Loc.,  
Mamboleo Vill., Mamboleo Mkt Opp. Sugar  
Research Station  
Bought on 18/9/98 (Not Trained)

Joseph Onyango Hongo  
Winam Div., Nyakera Loc., Bar B Sub Loc.,  
Kwamudhi Vill., Dago Mkt near Bondt Thim  
Primary School  
Bought on 13/1/99 (Not Trained)

#### **Cluster no. 6**

##### **Uasin Gishu**

Robinson N. Asira  
Eldoret  
Municipality Div., View Loc., Elgon View  
Sub Loc., Elgon View Vill., Behind Hills School and  
near IFC Church  
Bought on 12/10/98 (Not Trained)

Rebecca Lagat  
Box 1179 Eldoret  
Soy Div., Sirikwa Loc., Sirikwa Sub. Loc., Kaprotwa  
Vill., Ziwa Mkt, near Sirikwa Primary School  
Bought on 6/11/99 (Not Trained)

Joscah Chelashaw  
Box 118 Eldoret  
Soy Div., Soy Loc., Kipsangui Sub loc., Merewet  
Vill., Merewet Mkt near Lorwa Primary School  
Bought on 9/10/99 (Not Trained)

#### **Trans Nzoia**

Joshua Murage  
Box 3818 Kitale  
Kiminini Div., Nabiswa Loc., Baraton Sub., Loc.,  
Kiungani Vill., Kiungani Mkt near Kiungani Primary  
School  
Bought on 12/11/98 (Not Trained)

Francis O. Owino  
Box 48231 Nairobi Tel: 02-228453  
Kiminini Div., Sikendu Loc., Sikendu Sub., Loc.,  
Mucharage Vill., Mucharage Mkt near Mucharage  
Primary School  
Bought on 11/1/99 (Not Trained)

## Case study 1

### James Mwangi Ng'ang'a

He is popularly known as Jimmy in his home area but of late, friends and relatives have put an addition to his name and they now call him *Jimmy wa mahua* (James of flowers). He hails from Thika district, Gatanga division, Kiarutara location near Kiarutara market and primary school. In early 1998 Jimmy decided to get into the lower business. He knows there is good market in Thika town where somebody buys but flowers for export and pays promptly. There is a small stream of water at the foot of his family farm, which he thought would be a good source of water.

After these considerations, he went out and got his first planting material and started the business. He soon realised that was not easy since he had not given the process of watering any serious thought. He had only thought of marketing. This almost crippled his business. He was wondering loudly what to do next when he was informed by a friend about a neighbour who owns a manually operated pump that does not use any fuel, you just peddle, the *MoneyMaker* pump. This brightened his hope and he immediately went and talked to this neighbour. The neighbour agreed to lend him the pump for a number of days every week. He liked the pump and even built a platform for it. After using the pump for some days he decided that he must convince this neighbour to sell it to him. He tried and slowly the neighbour gave in and they struck the deal. However, just some few days before he paid for the pump, he saw the Daily Nation newspaper advertisement for the super-*MoneyMaker* micro irrigation pump. This excited him and immediately decided that he would check with the Thika dealer. When he saw the pump and it was demonstrated to him by the dealer, he liked it at once. He bought the pump.

As he arrived home friends, relatives and neighbours did not know what it was he was carrying. Some thought it was a video camera, this made him more happy and was just waiting to get to the house and do a demonstration to them. The first thing that he did was to suck and push some water from some small drums and push it up to a raised tank. His mother could not believe her eyes. In her excitement she gave him Ksh. 1,000 there and then and said "Even though I don't know the price of that thing, take this as my contribution since to me this looks like a lost child who has been found. I will call her '*rugano*' (story). It has come back home, I say welcome. I see I will no longer have to pay somebody to draw water for me.

Jimmy's life changed from that point on. With the availability of water assured, he increased the area under flowers and increased the varieties in the farm. The quality of his flowers went up in the market and the buyer was telling everybody else how the Super-*MoneyMaker* could also change the grades of their flowers. His were always grade 1 or 2. He manages to grow them for 2 cycles each earning him not less than 40,000/-. He also started targeting farmers where he grows roots and bulbs during the dry periods and then sell them as planting materials. The buyer in Thika assists Jimmy to get to the other farmers. This earns him about Ksh. 20,000 a season and he hopes to increase in each of this with time.

Together with his brother, they started a tea nursery with 15,000 seedlings, which they sell at between Ksh. 6/- and 7/- earning them at least Ksh. 90,000 a year. (These are sold to farmers who want to start tea farms).

Jimmy now plans to uproot the old tea plantation in their family to grow flowers.

Using money from the pump he has rented a plot at Kiarutara market where he is constructing a semi-permanent business house. He is also paying school fees for his children and he has to be ready with a lot of money for one who is joining form one next year.

Jimmy says that owning the pump is the best thing that has ever happened to his life.

## Case study 2

### Josephine Mwari Owino

Josephine hails from Mucharage Village, Skendu Location, Kiminini Division of the Trans Nzoia District. She is both a farmer and a businesswoman. Her husband works and stays in Nairobi. Once in a while she goes to Nairobi to visit the husband. During one of those visits her husband told her about the Super-MoneyMaker pump which he had seen being demonstrated at one of dealer's shops. She got interested and asked the husband to take her there. At the dealer's shop the pump was demonstrated to her and she liked it at once. Back at home she had been doing a bit of bucket irrigation without much success due to the difficulties involved. She therefore did not hesitate to reorganise herself and change the plans of whatever else she had intended to buy and bought the pump there and then.

When she went home, her homestead became a beehive of activities with neighbours streaming into the compound to see the pump. During the first few days she never paid anybody to operate the pump since people would be more than willing to operate it for free. She had to lock it in the house when going out since she feared that people might break it.

The area under irrigation drastically went up to 1 acre. She started growing Kales, Cowpeas, and Napier grass for her two daily cows. She also got into the business of growing green maize. The pump allowed her to start growing two cycles of maize instead of one like everybody else in the area.

Her cows milk yield increased drastically due to the green fodder they were getting at a time when everything else looked dry.

Josephine started drifting from her normal business of buying maize for sale and concentrated more on irrigating her farm. Every day in the afternoon people would stream into her farm to buy either kales or cowpeas leaves, which are very popular in that area due to the local peoples eating habit (*Ugali* is their main food). She has been getting a minimum of Ksh. 200 every day from the sale of these whole her cows now earn her more than Ksh.1,000 more every month from the increased milk out put. She gets more money when she sells the green maize at the end of the season.

Josephine is so proud of the pump that she plans to buy a second one so as to have at least three acres of irrigated land. She has already constructed a raised tank where she pumps the water into and then fixes a hosepipe to get water into the farm.

Paying school fees and domestic expenses are no longer major hustle since the money is assured. She says, *"When you people come next time, I will be having two pumps. It is such a nice thing I cannot believe my eyes when I experience the power of the pump with all its simplicity. When I go t Kitale, I find somebody demonstrating the Super-MoneyMaker outside Mea Ltd. I stand there watching and listening to the demonstrator like I have never seen or heard about the pump before. When I get back home I have to pump some water just to see the pump work. Every time it feels like the pump is new again"*.

### **Case study 3**

#### **Mutuku Makau**

Mutuku Makau comes from Muvae village, Central Division of Machakos District. He is the area councillor. When he bought the pump, he had the idea that it would make it possible to get water from the nearby river to his house. He had been seeing it demonstrated at Pasha Ltd in Machakos and asked all the questions he needed to ask and was satisfied that the pump would be useful to him. He had carefully laid down the piping system before buying the pump. What he did not know is that the pump would change his two brothers, sister in law (Mbithe) and a friend lives. These people stated borrowing the pump for use in their farms for irrigation. They would get the pump in turns such that the pump is almost in constant use. The friend has two sons who he pays for operating and working in the farm so that they are able to support themselves. The sister in-law employs somebody else to assist in peddling the pump while she directs the water to the crop. Each of these people has been growing kales, tomatoes, cabbages and spinach. They have all improved their livelihood by increasing their income. Each of these people is able to take produce to the market twice a week something none of them was doing before. Mbithe is able to support herself with the money she gets from the sale of the crop. She is looking forward to owning her pump one day.

The friend has eight school going children and the only source of income is the farm.

The councillor gets to use the pump twice in week to pump water to his house for domestic use.

The pump has made the entire family turn to the farm for their survival something they had not done before although the river has always flown at the foot of their farm.

## **Case study 4**

### **Ann Nyambura**

Ann in her late thirties comes from Gakira Village of Kangema Division in Murang'a District. Her husband had a nice job and their lives were quite fine without working on the farm too much. Life was easy until mid 98 when they got rude awakening when the husband was suspended from the job and they found themselves with no source of income. What they had is a family farm where their father had already allocated them a piece of land. It was their only hope for survival. They started doing bucket irrigation growing some spinach and cabbages but they could not do much. They turned to fallow irrigation. This also did not go far since they could only get water to the lower parts of the farm.

One day, as they were watching the television, they saw the Super-*MoneyMaker* pump. It was a manual pump just what they needed at that time. They were quick to know that they could get the pump in Murang'a town. Thuna Njoroge (husband) went to Murang'a and when the pump was demonstrated to him he liked more. He bought the pump and started irrigating at once. They planted a lot of cabbages immediately and spinach. When the crop was ready, it was too much for the local market and Ann had to hire a pick-up to take the cabbages to Nairobi. They fetched higher prices this way and the profits were even higher.

During the second season, Ann increased the area under irrigation and worked so hard that neighbours were wondering why she had to labour that hard. Currently she works in the farm the whole day and when the children come from school they would irrigate together. She has also encouraged her son who is in Standard seven to start his own small-irrigated area. When the son sells the crop, he gets money to pay for his tuition. Ann has now used all the irrigatable area in the farm. She has inter-cropped kales with coffee, which has not been doing very well. They have since extended their house and bought some household items. They are also able to pay the school for their four children easily. Ann says that the pump changed her life and made her realise the potential of their farm. Ann has become the envy of the village. Her farm stands out in the neighbourhood through the use of the manually operated pump.