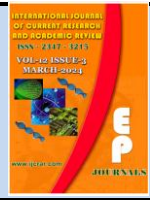




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Scaling Up Water Lifting Devices for Micro-Irrigation System in Western Oromia, Ethiopia

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Abstract

Water lifting devices enable the lifting of water from a lower level to a higher one. Water lifting technologies free the farmers from the limitations of inadequate rain during dry seasons, thus raising their capacity to grow crops up to two or three planting annually. The method lifting water to the field for irrigation in the country and in Oromia too are mostly traditional. The water is transported to the field with the help of bucket; water points and area to be irrigated are far apart; the ground and/or river water is at deeper position to convey to area to be irrigated. Therefore, this activity was aimed at scaling up of over flow pump and Rope & washer pumps for micro irrigation. The study was conducted in Four Zones of Western Oromia Namely West Wollega (Nadjo woreda), East Wollega (JimmaArjo), H/G/Wollega (JardaggaJarte) and West Shoa (TokkeKutaye). Training was organized and delivered for farmers, DAs and SMS in the selected woreda. Totally 10 rope and washer pump and ten (10) over flow pump were distributed. 60 farmers were participated on training of operation and handling of over flow treadle pump and rope and washer pump. Data was collected by; focus group discussions and interview. The collected data was analyzed from feedback/field report and Focus group discussion. The study recommends that Training should be given for extension staffs who work directly with irrigation farmers on Treadle pump operation, maintenance, assembling a pump to highlight technical aspects, the importance of proper installation procedures and maintenance of each component. Woreda Irrigation Development Authority should facilitate field demonstrations with farmers for further scale up Sources of technology should be as close as possible to the farmers. So the respective Woreda Irrigation Development Authority should facilitate for farmers who need these technologies by providing these pumps from the sources.

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Keywords

Scale up, water lifting Devices, over flow treadle pump, Rope and washer pump, micro irrigation.

Introduction

Water is essential for the growth of agricultural crops. In many regions, however, there is insufficient rainfall available to produce a crop with decent yields, and irrigation systems are needed to provide the crop's need for water. Also, provision of drinking water is

fundamental for both human beings and livestock, but its transport from the water source to final destination is often required. Water sources can either be under ground water reservoirs, open natural water bodies (rivers and lakes), or artificial water bodies (canals). The use of water lifting devices is crucial to transport water from water source to the field or to the consumer. Water lifting

devices can be divided into two groups: (i) devices that are run by muscle power of humans or domestic animals and (ii) devices mechanically lift irrigation water. Devices which are run by muscle power are often very time-consuming in real terms, due to their low productivity (Varma *et al.*, 2020; Janaka, 2019). Mechanized lift irrigation techniques, while more efficient, need to be adapted to the local conditions and to the different demand needs.

To establish and implement water lifting devices, local people need to be trained on how to use these technologies in water efficient way, as well as how to maintain these technologies in the long run. Local hydro geological, economic and social conditions, as well as national strategies, e.g., the strategy to standardize the equipment, must be considered in selecting the technology which best fits local conditions. In the end, it is the individual farmer or the benefitting association who should make the final choice.

Water lifting technologies free the farmers from the limitations of inadequate rain during dry seasons, thus raising their capacity to grow crops up to two or three planting annually. Thus, additional income possibilities for the subsistence economy of the households are provided. In addition, Water efficient technologies such as pumps can bring an improvement to the situation of women by increasing household food security and nutritional variety, as well as decreasing the amount of labor required to obtain water. Most pumps can easily be operated by women.

When comparing the advantages and disadvantages of various water lifting devices, it is important to focus on technical feasibility and sustainability in the context of the respective target region and target group. It is estimated that more than 90% of the food supply in Ethiopia comes from low productivity rain-fed small-holder agriculture (Teweldebrihan *et al.*, 2021; Zewdie *et al.*, 2020).

Hence, rainfall or access to irrigation water is the most determinant 245 Agricultural Extension Research Proceeding factor affecting the food self-sufficiency at household level and national food supply. Not only limited access to water has impeded the productivity of farming system but also lack of appropriate means of utilizing the available water more productively. Appropriate methods of water lifting and distribution are the most important aspects that determine the efficiency and success of an irrigation system (Mekonen Ayana *et*

al., 2006). Also, in terms of cost, the water diversion, conveyance and distribution systems are the most expensive parts of modern irrigation network. The distribution of modern irrigation development in Ethiopia is mainly concentrated along the plane of perennial rivers. Neither the poor smallholders have the capacity to install the expensive modern irrigation system nor can the already implemented and planned large, medium and small-scale irrigation schemes benefit the majority of the poor. From the perspectives of poor farmers alternative methods such as low-cost smallholder irrigation technologies are vital and attractive.

Experiences from other developing countries show that coupling of low-cost irrigation technologies with water conservation and harvesting technologies allows better control and management of limited water resources and results in much higher returns to farmers (Mekonen Ayana *et al.*, 2006). Small-scale, low-cost irrigation systems that can be easily afforded and managed by poor farmers contribute significantly to the endeavors of ensuring food self-sufficiency at household level.

Over the past decade, a small but significant revolution has been taking place in small-scale irrigation in the developing world with the introduction of the treadle pump. This simple, human-powered device can be manufactured and maintained at low cost in rural workshops in developing countries. The costs of buying, running and maintaining engine-driven pumps for irrigation are prohibitive for most small farmers in the developing world.

The majorities rely on traditional human-powered water lifting devices but these too have their drawbacks. Many farmers had problems with the inconsistent weather; they were often battling with lack of rainfall and droughts in unproductive lands.

The irrigation pump allows them to have consistent water throughout the year, helping the crops and providing income that is more consistent for the families. The method lifting water to the field for irrigation in the country and in Oromia too is mostly traditional. The water is transported to the field with the help of bucket; water points and area to be irrigated are far apart; the ground and/or river water is at deeper position to convey to area to be irrigated.

Therefore, this activity was aimed at scaling up of Treadle Overflow Pump and Rope & Washer Pumps for small scale irrigation.

The main objective of this study includes improving farmers' knowledge and skill of water lifting devices. To develop local capacity for future scaling up of the technology. And also to strengthen stakeholders' linkage and collaboration.

Materials and Methods

Water lifting devices intended to be scaled up were both overflow treadle pump and Rope and washer pump. Raw materials such as round mild steel bar, PVC cylinder, T-pieces and elbows, nylon rope, hosepipe, old tyer and bucket were required to be used in the manufacturing of these lifters.

Four zones namely West Wollega, East Wollega, H/G/Wollega and West Shewa zones were selected randomly among the mandate area of Bako Agricultural Engineering Research Center.

From these zones four districts, from each district one PAs were selected purposively based on Irrigation potential. From each PA 15 farmers were selected purposively.

DA's, Irrigation experts, and administration bodies were made selection of progressive farmers for scaling up of the technologies. Data was collected by; focus group discussions and interview. The collected data was analyzed from feedback/field report and Focus group discussion

Results and Discussion

Farmer training and awareness creation

A total of 60 farmers participated on training of operation and handling of over flow treadle pump and rope and washer pump. It is estimated that over 200 farmers have now had exposure to over flow treadle pump technology and rope and washer pump through field visit scale up.

Stakeholder linkage

Training of trainers was given by Ethiopian Agricultural Transformation Agency for our three shop crafts men. And by those crafts men six Small Micro Enterprises were trained how to manufacture the devices for farmers' use. In such a way linkage was established between manufacturers, government bodies and users(farmers)

and the manufacturers have started manufacturing these two technologies up on request.

Benefits due to use treadle pump and rope and washer pumps

The benefits of using the treadle pump and rope and washer pump in farming practices

- Increased land area under irrigation;
- Reduced work time compared with bucket irrigation; full irrigation of fields, resulting in improved crop quality;
- Reduced labor demand
- Reduced workload
- Work time has been reduced compared to bucket irrigation;
- Irrigation used for seed multiplication; examples include coffee and tomatoes
- Women operate treadle pumps without any traditional or religious constraints and see this as an opportunity for empowerment.

Limitation of rope and washer pump

- The installation of the rope pump requires skilled personnel/ crafts men
- Traditional rope pumps have a lift of only about 10 m;
- Users need to exercise care when using the pump as it is susceptible to contamination;
- Most problems occur with the rope or washers getting stuck or slipping over the pulley wheel.

Limitation of over flow pump

- Farmers complained about difficulty in priming pumps. This consumes a great deal of their energy, so much that some of them give up the whole process.
- Durability problem

Conclusion and Recommendation

The costs of buying, running and maintaining engine-driven pumps for irrigation are prohibitive for most small farmers in the developing world. Owing to this, majorly of them rely on traditional human-powered water lifting devices but these too have their drawbacks. Over the past decade, a small but significant revolution has been taking place in small-scale irrigation in the developing world with the introduction of the treadle pump. This simple, human-powered device can be manufactured and

maintained at low cost in rural workshops in developing countries.

Recommendation

Training should be given for extension staff who work directly with irrigation farmers on Treadle pump operation, maintenance, Stripping and assembling a pump to highlight technical aspects and the importance of proper installation procedures and maintenance of each component Woreda Irrigation Development Authority should facilitate field demonstrations with farmers for further scale up.

Every 6 months to 1 year, the rope should be replaced. Every few years, the washers should be renewed. The maintenance needs of rope and washer pumps are simple, but frequent, and users need to ensure that they are carried out and that their pump is kept in good working condition.

Hygiene is more important than with many other types of pumps, particularly when the pump is used communally. In such cases, it is important that the users organize effective measures for ensuring good hygiene practice Sources of technology should be as close as possible to the farmers.

So the respective Woreda Irrigation Development Authority should facilitate for farmers who need these technologies by providing these pumps from the sources.

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