

Agriculture *for* Development



**Tropical
Agriculture
Association**

No. 21, Spring 2014

Challenges of the 21st Century

(11st Ralph Waldo Emerson Lecture)

Low-cost technologies for coffee growers in Ethiopia

The oil palm: panacea or peril?

Micro-scale water harvesting in Tanzania

Agroecology and development in Bangladesh

The spread of small pump sets and drip-irrigation in Nepal

Where will your next fish supper come from?



What's moving them? The spread of small pump sets and lay-flat pipes in Rupandehi, Nepal



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Summary

The article describes the introduction of small irrigation pump sets and lay-flat-pipe water distribution in part of the Terai zone in Nepal where the use of both technologies has expanded rapidly since 2005. The questions 'who are the beneficiaries?', 'what drives them?' and 'what constraints do they face?' are reviewed. It is concluded that more needs to be done to reduce the costs of the technology in order to improve access by smaller farmers, while at the same time continuing research into the actual effects of small-scale irrigation technology on farming practices, and raising awareness among officials and academics on its possible benefits.

Introduction

The use of groundwater has the potential to greatly increase agricultural productivity, yields and food security, especially in those areas where rivers only provide water seasonally. To access groundwater, investments need to be made. Even when groundwater is shallow, these investments often prove too high for smallholder farmers (Polak & Yoder, 2006). In the Terai region of Nepal, as in many other parts of Asia, smaller and cheaper pumps are becoming increasingly popular among smallholders (Shah *et al.*, 2006). These 4-5 hp pumps, often of Chinese origin, are fuelled by either diesel or kerosene (Figure 1). Their weight and size is one half or one third that of the traditional equivalent (Indian diesel pumps, designed in the 1940s). Prices (as reported by dealers and farmers in Rupandehi in April 2011) vary, but range from \$US150 (5 hp diesel, Chinese origin) to \$US300 (5 hp kerosene, Indian origin).



Figure 1. Lightweight Chinese pump-sets (foreground) are preferred to the traditional Indian designs which are heavier and more expensive.

Their low price and light weight are said to make them well-suited for smallholder farmers with highly fragmented land holdings, as are common in most developing countries (IWMI, 2002; Shah, 2007). This is all very well in theory, but the question remains: Who actually benefits from this 'pro-poor' technology and what are the constraints and drivers for adoption? To get more insight into the use and diffusion of small pump sets, a study was conducted in the Rupandehi district of Nepal in 2011. This paper reports on the most important results.

Methodology

During the course of 2½ months (February-April 2011), semi structured interviews were conducted with farmers (103), pump dealers (10), government officials (8) and NGO employees (3) in the Rupandehi district of Nepal. Visits were also paid to IDE Nepal, the Nepal Engineering College and National Agricultural Research Council in Kathmandu.

Use of small pump sets

In Rupandehi, small pumps were originally introduced in 2004 by a government-owned company importing Chinese products. Eight years later, a variety of small pumps are available at many different shops at many different prices. Small Indian pump sets are more expensive, but preferred by farmers who do not trust the Chinese quality. The image of the Chinese pump is that of 'use and throw'. Farmers expressed the idea that it is

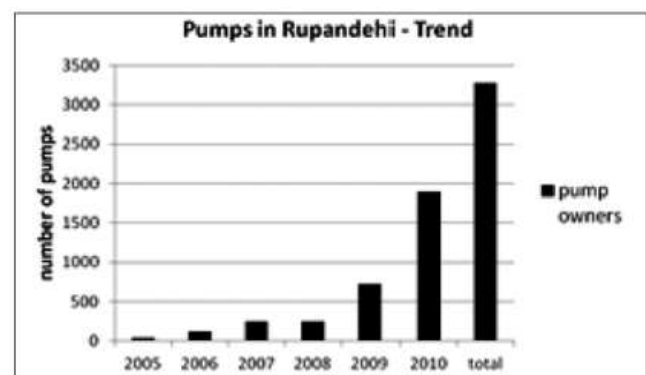


Figure 2. Indication of increase in pump numbers in Rupandehi. (Source: Based on reported yearly sales from dealers in Rupandehi and data on year of purchase obtained through farmer interviews - numbers are therefore only indicative)



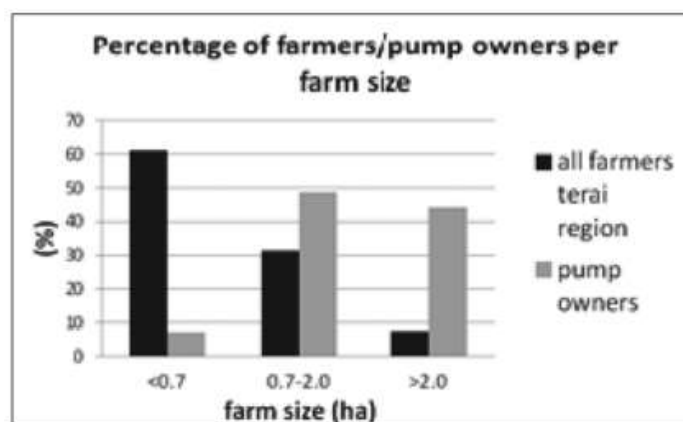
not worth-while to repair them, as it will take longer and cost more than buying a new one. However, in spite of these comments, sales have gone up fast, especially in the last few years (Figure 2).

In 2011 the pump sets were half the 2005 price, which will have contributed to the recent growth in purchases. Farmers who have bought a small pump set said they had done so to avoid the long waiting times and uncertainty of the larger groundwater and surface water irrigation schemes, which cover large parts of the district. They want timely irrigation and want to be independent of other farmers. A small pump is preferred to a big pump, because of the lower price and increased ease of transportation. Reasons given by farmers for not adopting a pump earlier were a lack of funds, perceived high risks of breakdown and reliable access to other, cheaper irrigation methods.

The small pump sets are mostly used in combination with a shallow tube well, but are also used to lift water from rivers, canals or ponds. Sometimes the small pumps are the only source of irrigation; at other times, they complement existing irrigation schemes. Pumps are more common in areas where existing irrigation facilities do not meet farmers' needs and where water can be accessed easily. In areas where the groundwater table is low (more than 25 m deep), a shallow tube well is too expensive for most farmers.

Characteristics of pump owners

The reasons for non-adoption of pumps are more critical for smaller farmers. In the surveyed group of pump owners, the smallest farmers (less than 0.7 ha) were under-represented



(Figure 3). Figure 3. Farm sizes in the group of interviewed pump owners. (Source: Based on the Agricultural Census 2001/2002 (CBS Nepal, 2006) and interview data)

The smallest farmers expressed problems in obtaining credit from banks, as land is often used as collateral for obtaining a loan. Governmental subsidies for pump sets and tube wells are only given to groups of farmers, which seems to contradict the idea that most farmers appreciate the pumps for the independence it gives them. The majority of pump-owners, especially those owning less than 1.5 ha, were not able to buy a pump from agricultural profits alone. They sometimes turned to credit or subsidies, but mostly received income from work outside the agricultural sector or from remittances. It was observed that there is a large rental market, in which farmers rent their pump sets to others for about \$US2.50/hour. This indicates that the smallest farmers are possibly also benefiting from the increase in access to pumps, but the exact impact of the rental market needs to be studied more extensively.

It would be reasonable to assume that investment in irrigation technology contributes to an intensification of agriculture. This line of thought could lead to the conclusion that pump owners

will convert to commercial (vegetable) farming. This idea is, for instance, promoted by Polak & Yoder (2006), who describe an agricultural revolution in which smallholder farmers produce more cash crops after gaining access to groundwater. In Rupandehi, no such thing was found during the field work. Of all interviewed pump owners, none was cultivating cash crops. All were growing cereals for sale and a range of other crops for home consumption, as they did before purchasing the pump. Having more secure and regular access to irrigation did raise the productivity of their farms, but this increase cannot be quantified with the results from this study.

Small pumps in combination with Lay Flat Pipes

With an increase in pump use, there has also been an increase in the use of flexible plastic pipes that can be attached to the pump and used to convey water to more distant locations. The pipe can be rolled up for storage and transport, and is therefore referred to as a lay-flat pipe (LFP). The LFP (Figure 4) improves application efficiency of irrigation water by at least 33 percent and decreases labour costs since it obviates the need to construct irrigation ditches (NAEF, 2009; Shrestha, 2010). Shrestha (2010) states that 60 m is the average length of LFP used by Terai farmers, but smallholders in Rupandehi reported using up to 240 m. Some 93 percent of the farmers who were asked about LFP were actually using the LFP for irrigation. This shows how widespread and important this technology has become for smallholder irrigation. At the same time it is interesting to note that the LFP was not promoted by either government bodies or NGOs.



Figure 4. Layflat pipe used with Chinese pump-set.

The LFP is locally produced in Rupandehi and is available in different diameters: a 4 inch diameter LFP costs about 25 Rs/m. The previously-sold Indian canvas-and-rubber pipes are up to ten times more expensive, though more durable. Several farmers indicated that they had to replace the LFP every year, but this seems to depend on use and storage conditions. Farmers report they like to use the LFP because it prevents them from disturbing their neighbours' fields and therefore



avoids conflict. They also appreciate that they do not have to dig the field canals. Surprisingly, saving water is hardly mentioned as a reason to use LFP. The use of the LFP in Rupandehi seems to have been increasing rapidly in recent years. The factory owner claims that his production for the Nepalese market has increased 15-fold between 2004 and 2011: from 10,000 kg to 150,000 kg per year.

Challenges

One of the challenges of the Chinese pumps is their maintenance and repair. It is difficult to obtain the correct spare parts, sometimes causing repair delays of several months. This, in combination with the common local belief that Chinese products are always of inferior quality, has created distrust among farmers. Another problem is the additional cost of creating a private shallow tube well, which increases greatly if the groundwater is deep. Most farmers are not able to go deeper than 25 m, after which it becomes too expensive. A future challenge, which is not yet experienced by farmers, will be the lack of fuel. With diesel and petrol becoming more scarce and expensive, the operation of the small pumps might become difficult. During the last month of the field work, April 2011, petrol stations were regularly closed and fuel shortages in Kathmandu were serious. An alternative, cleaner and cheaper energy source could be hydroelectricity, although there would be problems of load-shedding and electricity access in remote areas.

Increased groundwater use can also lead to the depletion of the resource. In 2011, no complaints were made by farmers about falling groundwater tables, nor did the local groundwater resources development board express any concerns. However, with such an unregulated growth of groundwater use, monitoring the effects would be advisable. In addition, arsenic in the groundwater has also been reported to be a major problem in some areas (Thakur *et al*, 2010).

Concluding remarks

It seems that the small pumps can greatly improve agricultural production for many, but yet fail to reach the smallest farmers. The promotion of a fair rental market for pumps might counter this, but at the moment there is no evidence for this. At first sight, it does not seem that farmers are intensifying their farming practices or switching to more valuable crops. However, more study should be done on the benefits and drawbacks of using small pumps. To increase the spread of small pump sets, it is important to alleviate the cash constraint small farmers are now facing. This can be done through subsidies, preferably individual subsidies, but also by improving access to credit. Another way is to look at cheaper ways to create shallow tube wells.

At the time of the study, hardly any attention was being given to the small pump sets or LFP at the higher policy levels or in the agricultural development community. The existence of small, light-weight, 5 hp diesel pump sets

was even denied by some teaching staff at the Nepal Engineering College in Kathmandu. However, since this study was undertaken, considerably more attention has been given to shallow tube well promotion in preparation for the new Nepal Agricultural Strategy (Cook *et al*, 2012). Further increasing knowledge about the potential of small pumps might be a first step in getting even more support for them.

References

- Cook J, Kalu Indra L, Adhikari DL, 2012. Irrigated agriculture vision, strategies and roadmap. Final draft. (Irrigated Agriculture and Water Resources Component). *Preparation of the Nepal Agricultural Development Strategy*. (ADB TA 7762NEP). Manila: Asian Development Bank.
- IWMI, 2002. Bringing pumps to people. *Water Policy Briefing, Issue 2*. NAEF, 2009. NAEF 2008-2009 Biennial Report. *National Agricultural and Environmental Forum*, Bhairahawa, Nepal.
- Polak P, Yoder B, 2006. Creating wealth from groundwater for dollar-a-day farmers: Where the silent revolution and the four revolutions to end rural poverty meet. *Hydrogeology Journal* **14**: 424-432.
- Shah T, 2007. Crop per drop of diesel? Energy squeeze on India's smallholder irrigation. *Economic and Political Weekly*.
- Shah T, Singh OP, Mukherji A, 2006. Some aspects of South Asia's groundwater irrigation economy: analyses from a survey in India, Pakistan, Nepal Terai and Bangladesh. *Hydrogeology Journal* **14**: 286-309.
- Shrestha S, 2010. Final report on study of efficacy of lay flat thin wall polythene tubing (LFTPT) in increasing water application efficiency of shallow tube well and small lift irrigation. *Nepalese Society of Agricultural Engineers*, Tripureswor, Kathmandu, Nepal.
- Thakur JK, Thakur RK, Ramanathan A, Kumar M, Singh SK, 2010. Arsenic contamination of groundwater in Nepal - an overview. *Water* **3**:1-20.