Testing and Scaling up of Sustainable Agriculture Kits

STORY OF CHANGE

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Photo: Roshan Pudasaini

KEY MESSAGES

- Terrace farming is practiced in 70% of Nepal's farm land and is an important source of livelihood for almost all rural households.
- Yet, most of terrace farming is still done using traditional practices that have high labour requirement. With the continuing trend of labour migration from rural Nepal, it is increasingly difficult to sustain terrace farming. As dwindling male farm labour, female drudgery is becoming a serious challenge in farming.
- In this context, solutions need to be not only technically efficient but also low cost, portable and affordable. The SAKS project created a menu of 47 innovations and tested them with target communities. Of these, 27 innovations were rated as useful and adopted by farmers.

Context

Terrace farming is the quintessential farming system in Nepal covering 70% of the country's farmland. Modern mechanization has not made inroads in terrace farming due to narrow and small plot sizes on a difficult terrain. In the recent decades, migration of males out of the villages in search of employment have reduced available farm labour and increased workload on females. Frequent droughts, unpredictable rainfall, landslides and soil erosion have been exacerbated by climate change. Terrace farming has become synonymous with drudgery inducing farming.

Despite these difficulties terrace farming remains important in Nepal. It is either the primary or secondary source of income for nearly all rural households in the mid and high hill environments. Alternative employment opportunities remain few and far between and little change is likely in the foreseeable future. Hence, addressing the challenges in the terrace farming system is of paramount importance.

Challenges of Terrace Farming

Harsh geography has slowed the development of transportation infrastructure limited the reach of extension services. Fragmentation of land in inheritance has decreased household landholding every generation. Finally, low purchasing power and illiteracy in the villages have limited their ability to actively seek out and invest in innovations

to improve farming. In this context, the main challenges of terrace farming systems (adapted from Chapagain and Raizada 2017) are:

1. Limited surface area: Despite occupying a large area of the country, much of it is not utilized directly for growing crops. For instance, 20-50% of the underutilized surface is vertical in the form of terrace wall or risers. Likewise, 10-20% of area constitute terrace edges where major hill crops like maize requiring expansive root system yield poorly. Production practices that utilize these underutilized spaces and surfaces can provide new production opportunities.

2. Narrow plots: The steep terrains in the mid and high hills only allow for narrow fields in most cases. Hence mechanization such as tillers, tractors and combine harvesters suitable in the plains are unsuitable here and use of traditional handheld and animal drawn tools is still prevalent. Light weight, portable and easy to operate tools and machinery are needed to achieve mechanization in this system.

3. Female drudgery: In the past two decades, migration of labour, especially young males, out of villages to urban areas and abroad in search of employment has become commonplace in Nepal. On the one hand, remittance has emerged as a major source of income for Nepali households and contributed to 29% of the GDP in 2014. On the other hand, the burden of farming has been compounded on females in the villages on top of their other traditional roles. Tools that specifically reduce female drudgery will bring a major positive change in terrace farming.

4. Soil erosion: Terracing is an expensive practice to control soil erosion with huge labour requirements. With limited farm labour, terrace abandonment and deterioration have become common. Furthermore, commercial fertilizers are hard to transport to these sites and are rarely used. Most farmers, rely on farm yard manure, but due to poor manure and urine management, much of the nutrients are lost. Hence, practices are needed to maintain soil fertility in this fragile production system.

5. Low productivity: Due to high labour requirements, limited access to inputs (e.g., improved seeds suited for terrace farming systems) and improved technology, the productivity and hence income earned from terrace farming remain low. There is a need for interventions that enhance resource use efficiency and productivity.

Testing Sustainable Agriculture Kits

The conventional manner of innovation development and deployment have not been able to address the old and new needs of terrace farmers. The SAK Nepal project took a new approach to address their needs. Instead of trying to guess the innovations that may work, we as implementers introduced and tested a few dozen innovations in hopes that at least some will be useful to the farmers. The process of testing dozens of innovations also allows farmers to get diverse perspectives and approaches to solving their problems, which will be useful for them to innovate themselves.

The SAK Nepal project is funded by the International Development Research Centre (IDRC) and Global Affairs Canada and implemented by the University of Guelph and LI-BIRD in Jogimara VDC of Dhading and Majthana VDC of Kaski. Using surveys, focus group discussions and prior knowledge of field staff in these sites, the key challenges as well as the tools and practices that could potentially address these challenges were identified. In total, a set of 25 practices and 21 tools (or products) were identified as part of the SAK menu to address the challenges of terrace farming in the project sites.

After testing these innovations female and male farmers and the staff rated them as good (score of 1), better (score of 3) or excellent (score of 9) across six criteria of i) relative advantage, ii) compatible, iii) simple, iv) amenable to trial by farmers, v) visible effectiveness, and vi) affordable.

Farmers in Majhthana engaged in participatory ranking exercise.
Photo: Roshan Pudasaini, LI-BIRD

Table 1. Innovations -- practices and tools (or products) - comprising the SAK menu to address the challenges in terraces farming system.

Challenges	Innovations Tested	Potential for Scaling UP
Female drudgery	15 products	**8 products:** 1. Hand held corn sheller 2. Farm rake 3. Fork weeder 4. Electric millet thresher 5. Hand gloves 6. Super grain bag 7. Grain mill 8. Fruit picker
Limited surface area	7 practices	**3 practices:** 1. Yam on sack 2. Pumpkin and chyote on terrace wall 3. Legumes on terrace edge
Mechanization in narrow plots	4 products	**1 product:** 1. Mini tiller
Low productivity	15 practices, 2 products	**7 practices:** 1. Maize-cowpea intercropping 2. Millet-Soyabean intercropping 3. Mustard-Pea intercropping 4. Ginger-Maize-Soyabean intercropping 5. Lentil/Pea in dry winter 6. Vegetable in plastic house integrated with water harvesting and drip irrigation 7. Hybrid maize seed production **1 product** 1. Composite vegetable seed kit
Soil erosion	3 practices	**1 practice:** 1. Improving cattle shed and farm yard manure

It is quite instructive to see the differences in ratings given by farmers (based on gender and site) and staff (Figure 1). Handheld corn sheller received excellent ratings in all criteria from farmers and staff alike, while table top corn sheller received poor scores from all raters. Farm rake and fork weeder were rated as excellent by farmers in Jogimara while fruit picker was rated excellent by farmers in Majthana. The farmers were more positive than staff in rating quite a few innovations including composite vegetable kits, electric corn sheller, silpaulin and super grain bag.

Of these, 11 practices and 10 products that were found to be relatively more useful by farmers have been sorted out to be considered for scaling up (Table 1). This testing from a large menu provides the farmers confidence to adopt. The demand from farmers shows a market opportunity for the private enterprises to procure and supply the products and thus provide efficient access to the tools. Likewise, the evidence of practices being adopted helps convince government's local development systems to support them through their programmes.

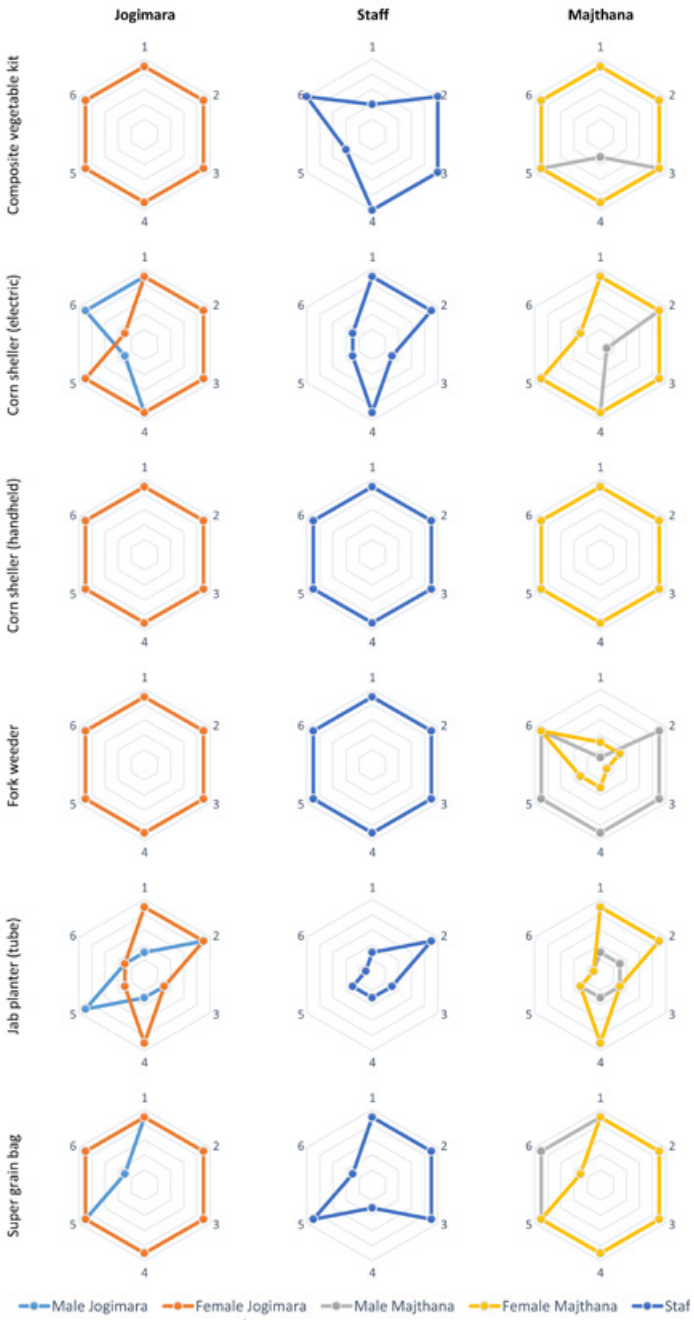

Figure 1. Rating of innovations in the SAK menu based on six criteria: 1) relative advantage, 2) visible effectiveness, 3) amenable to trial, 4) simple, 5) compatible, 6) affordable. Only six items are shown for illustration.

Features of Successful Innovations

Successful practices gave visible benefits that were obvious to the users as well as the neighbours. They were also perceived to have reduced the amount of labour and resources required. For instance, the practice of intercropping ginger or legumes with the main crop maize was popular because farmers could obtain multiple crops from the same amount of land. When unpredictable hailstorm damaged maize, high value ginger helped farmers spread their risks and maintain economic return.

On the other hand, practices that did not have direct and visible impact or were too complicated to manage were rated poorly. For instance, individual farmers found it difficult to produce biochar in enough quantity to be worth the effort. Furthermore, the benefits of application of biochar in terms of improved soil quality accrue over a long time and hence were not immediately visible to farmers. Hence, technologies like biochar may be suitable when better infrastructure for production and delivery as well as farmers understanding of the science behind biochar improve.

Farmers gave high ratings to tools that reduced drudgery, had multiple uses and were affordable. The handheld corn sheller at NPR 200 (CAD 2.5) per piece was the biggest success. Farmers like its portability, allowing them to do corn shelling anywhere, simplicity in operation and low cost. On average, the corn sheller saved each farmer 36 hours of labour in a season. On the other hand, the table top corn sheller was not preferred because it needs to be attached to a table, cannot shell the cobs completely and is more expensive at NPR 600 (CAD 7.5).

Local perception of what can and cannot be agricultural tools also affected the adoption of tools. For instance, knee pads, brace belt and magnifying glass were seen as athletic gear, medical equipment and a toy respectively. Farmers did not take these seriously for farming and hence they were not adopted despite appearing functional and affordable to the project team. Likewise, different weeders and seeding tools were not deemed to be compatible with their systems of operation.

Conclusion

Culture, customs, beliefs and compatibility with existing practices can determine whether an innovation gets adopted or not. Therefore it is not enough to simply evaluate the effectiveness of an innovation in research setting. Deliberately testing for adoption in target context is also needed. This kind of adoption testing is a valuable and complementary form of research that local NGOs can perform. It helps bridge the gap between formal research for innovation development conducted by the national agricultural research systems and universities and the ultimate adoption by farmers.

By testing for adoption rather than effectiveness, we were able to generate confidence among government development programs to invest in highly rated practices such as cultivation of yam in sacks and for private sector actors to market highly rated products such as handheld corn sheller. A major limitation with development projects is that a mechanism for long term supply of the innovations is not put into place. Introduction to compatible products creates a demand for the affordable products that fit the farmers' needs. This reduces the risk for private sector enterprises to enter the fray. NGOs partnering with existing private sector actors who have good knowledge of existing distribution networks of snack foods, utensils/hardware items and farmer cooperatives looks especially promising in terms of delivering products affordably over the long run.

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