DRIP IRRIGATE KECHLA, INDIA

IMPACT ASSESSMENT

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Executive Summary

Kopernik introduced drip irrigation to 55 households in Kechla, India. Kechla and the surrounding communities are located in rural Orissa (an eastern state of India) in the KBK (Kalahandi-Bolangir-Koraput) triangle known to be one of the poorest areas in India. We partnered with AuroMira Service Society (AMSS), a Delhi-based NGO to deliver the Driptech micro-chip irrigation system. Drip irrigation targets water specifically to crop roots, minimizing the use of limited water supplies and maximizing crop yields. Its benefits are particularly meaningful for farmers in Orissa state who have historically irrigated dry season crops by hand and juggle multiple jobs to sustain a basic living.

Kopernik Fellow, Annie O'Brien joined AMSS to conduct a rapid impact assessment. They interviewed 37 out of the 55 households that purchased the Driptech system, and performed baseline and follow-up surveys. The baseline survey was conducted between October 2011 and February 2012 (at time of installation) and the follow-up survey was conducted between April 2012 and May 2012 (after the farmers had harvested their drip irrigation crops).

This assessment was not a controlled experiment, the project did not require families to produce certain crops over time using the same amount of land and therefore comparison of yield and income was difficult.

Despite these data constraints, it was observed that the biggest impact was the **savings of between US$20 to US$59, with an average sum of US$40**. This is a significant amount when the average income per household is US$340 per annum.

The owners reported that they:

- **were highly satisfied with the ease of installation and maintenance;** and
- **perceived the overall usefulness of the technology as moderate to high.**

Valuable lessons learnt were:

- **timing**, the project required farmers to commit a significant amount of time to the implementation, i.e. registration, purchase, installation, which took place during the wet season harvest, which is a very busy time for a farmer;
- **data collection**, baseline units of measurement need to be comparable to those used in the follow-up;
- **logistics**, baseline data collection should be done at the start of the dry season a year before the project is launched to ensure accurate measurement of the impact.

Project Background

Project Objective

Worldwide water usage is currently one of the key global environmental concerns. The current levels of consumption are unsustainable especially when it comes to food security. Available water per person in developing countries is 20% of what it was fifty years ago. In these same places, agriculture accounts for 81% of total freshwater usage of which a major part is used for flood irrigation. In addition to inefficient use of water, flood irrigation leads to lower yields for many crops and is very labor intensive. Many small-plot farmers cannot grow crops throughout the year due to insufficient rainfall and are unable to afford existing irrigation systems which are either too expensive, too complicated to use, or of too poor quality. These factors weaken small-plot farmers' ability to improve their own livelihoods.[1]

The Driptech micro-drip irrigation system was distributed in the Kechla community in Eastern India to assist small-plot farmers in the area. This assessment was designed to test the following hypotheses:

- Use of the drip irrigation system will result in:
    - Increased crop yield;

[1] DripTech Website: Our Mission: <http://www.driptech.com/aboutus.html>

  - Increased income and/or increased savings due to more subsistence crops;
- The Driptech system will reduce the amount of water used; and
- The Driptech system will be easy to install and maintain.

Installation of the Driptech system

Snapshot of Location

Kechla and the surrounding communities are located in rural Orissa (an eastern state in India) in the KBK (Kalahandi-Bolangir-Koraput) triangle known to be the one of the poorest areas in India. The main form of travel between villages is by foot, while the district hub of Koraput is usually accessed by boat. The people in this area belong to the lowest castes of Scheduled Tribe, Scheduled Caste, Other Backwards Caste and General Caste of the Indian caste system.

Many communities were displaced about 25 years ago when the government flooded the area for a hydroelectric dam. These communities remain disconnected from the national power grid. Though signs were installed in 2009 throughout the area that claim

the region is electrified, power lines have only been planted in the last few months. Water access is provided in each village through hand pumps or wells. Substance abuse, particularly alcoholism, is present among the communities. The annual income is approximately US$340 and is earned through farming, fishing, wood-cutting, and menial labour for the construction of minor roads and a school.

Local Partner: AuroMira Service Society

To implement this project, Kopernik partners with AuroMira Service Society (AMSS), a Delhi-based NGO. AMSS has been active in Kechla since 2004 with the opening of a boarding school for 88 children from hamlets within Kechla village. AMSS is the only NGO with an active presence in the area year-round.

AuroMiro Service Society (AMSS) provides general health facilities to communities living within a 3-4 km radius. They provide healthcare through visiting physicians making the rounds in the area a few times a year. AMSS also provides the only functional school in the area**.**

Project Implementation

The Technology

The technology Kopernik and AMSS delivered to Kechla was the Driptech micro-drip irrigation system. Driptech is a social enterprise based in the US that produces affordable, user-friendly drip irrigation systems, marketed specifically to small plot farmers in developing countries. Drip irrigation targets water specifically to crop roots, minimizing the use of limited water supplies and maximizing crop yields. Its benefits are particularly meaningful for farmers in Orissa state who have historically irrigated dry season crops by hand and juggle multiple jobs to sustain a living.

Customers with their Driptech system collection tank

Driptech systems are configured in the field and come in a range of sizes with respective pricing. The price ranges from US$20 to US$250, and the weight from 5kg to 50kg.

The farmer benefits through:

- A yield increase of 20-90%;
- A quality increase of yield;
- Labor savings of up to 80%.

The key advantages of the Driptech system versus traditional drip irrigation systems are:

- It is 50-80% cheaper;
- There is a visible uniformity of water application;

- It works well with low pressure water sources, including gravity fed water from a tank; and
- It is easy to install and maintain.

Customer making adjustments to the drip system

Distribution, Pricing and Payment

AMSS, along with a Driptech employee, conducted outreach to explain drip irrigation technology and launched two pilot plots with the Driptech system in high profile areas in April 2011. AMSS launched Driptech sales in September 2011, with systems sold through to January 2012. System installations and training on use and maintenance were conducted from October 2011 to February 2012.

Customer installing the Driptech system

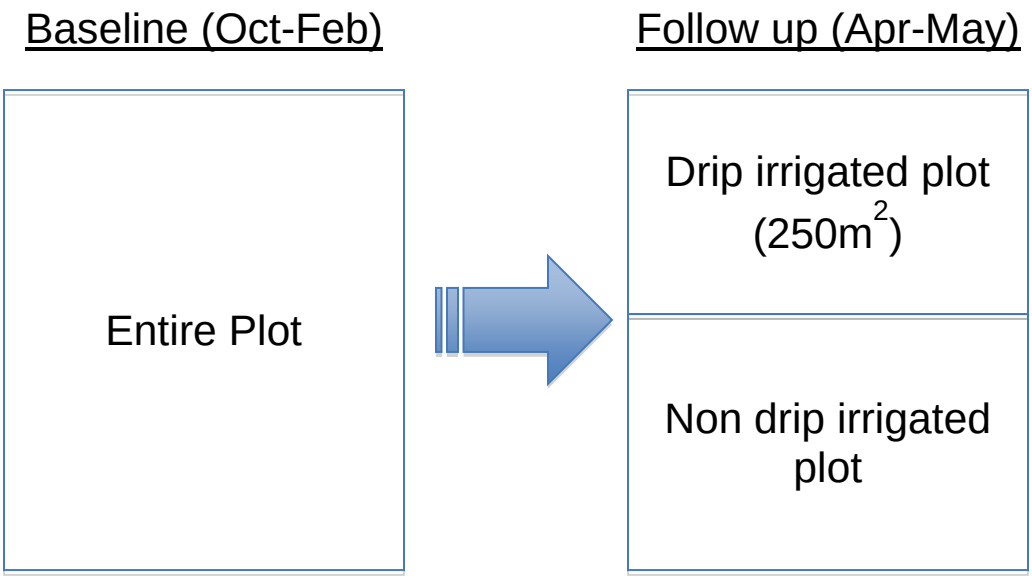
Impact Assessment

Process & Methodology

Among the 55 households that purchased the Driptech systems, 37 households were interviewed for baseline and follow-up surveys. The baseline survey was conducted between October 2011 and February 2012 (at the time of installation) and the follow-up survey was conducted between April 2012 and May 2012 (after the farmers had harvested their drip irrigation crops).

This assessment was not a controlled experiment as the project did not require families to produce certain crops over time using the same amount of land. Even if such a requirement was introduced, seasonality would have been a confounding factor. The factors which affected the data include:

- All 37 households' baseline plots differed in size, with an average of 3,244 m^2 and a range of 250 m^2 - 20,234 m^2 ;
- Households decided which crops to produce (22 crops overall[2]) and grew one or a combination of them using different plot sizes for each;
- Many households produced different crops between baseline (post monsoon) and follow up (dry season);
- Families sold and/or consumed the cultivated crops, depending on market rates and amount of production.



There were therefore severe limitations in comparing changes in yield and income.

The systems were sold at a subsidized rate of INR 1,000 (US$20.80). Farmers had expressed interest in participating during the initial pilot and information phase in April, but finalizing the participants proved more challenging than anticipated.
Part of the difficulty stemmed from the fact that October is a major festival season

[2] 22 agricultural products include: potato, onion, cauliflower, tomato, cabbage, radish, garlic, ginger, chili, eggplant, bitter gourd, saru, cucumbers, lady fingers, moccha, ground nut, beans, green chili, pumpkin, corn, long beans, and watermelon.

across India. While the festivals posed a challenge to coordinating the registrations with many customers being absent, they also impacted the resources (time and money) people were willing to commit to the project.

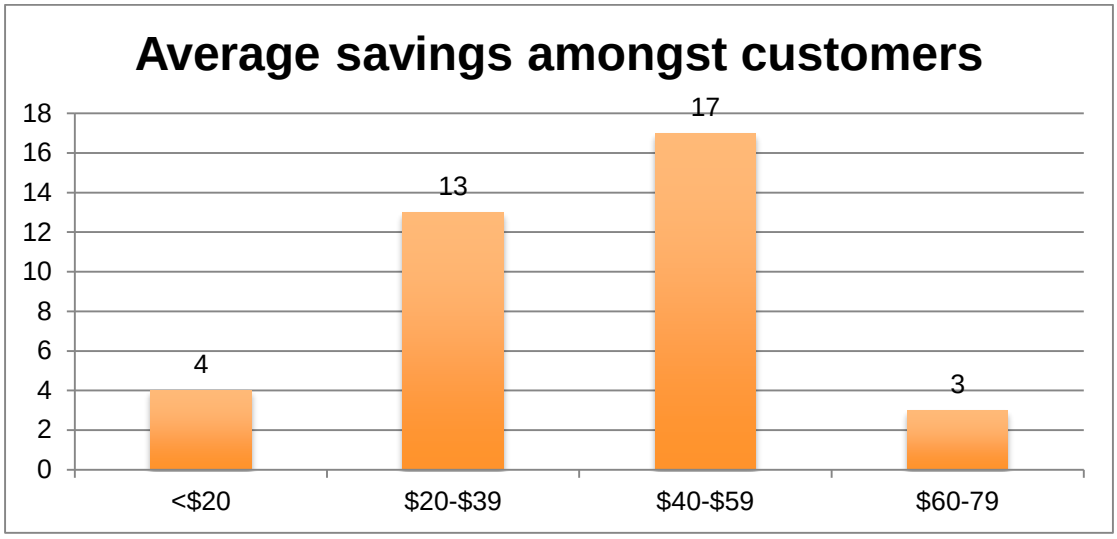
Another factor affecting the slow registration was the start of the monsoon crop harvest. Harvest season greatly limited the farmers' time available to go through the system installation and made the fields unsuitable for installing the drip irrigation system. In addition, some farmers said they would not have the capital to participate until after the harvest was sold. For these reasons, many farmers asked the fellow to return after the process was complete.

A number of farmers that had initially expressed a lot of interest in purchasing the systems changed their mind since the introduction of subsidized fishing nets and boats by the government to provide the communities with additional income sources. This redirected the farmers' attention to other income generating activities and also made it harder to track down potential customers.

Results of Impact Assessment

Hypothesis 1: Increased crop yield, income, and savings due to more subsistence crops

Most households were able to save between US$20 and US$59, with an average sum of US$40. This is a significant amount of savings given that the average income per household is US$340 per annum. The data was inconclusive in terms of increased crop yields due to incomparable data being collected.



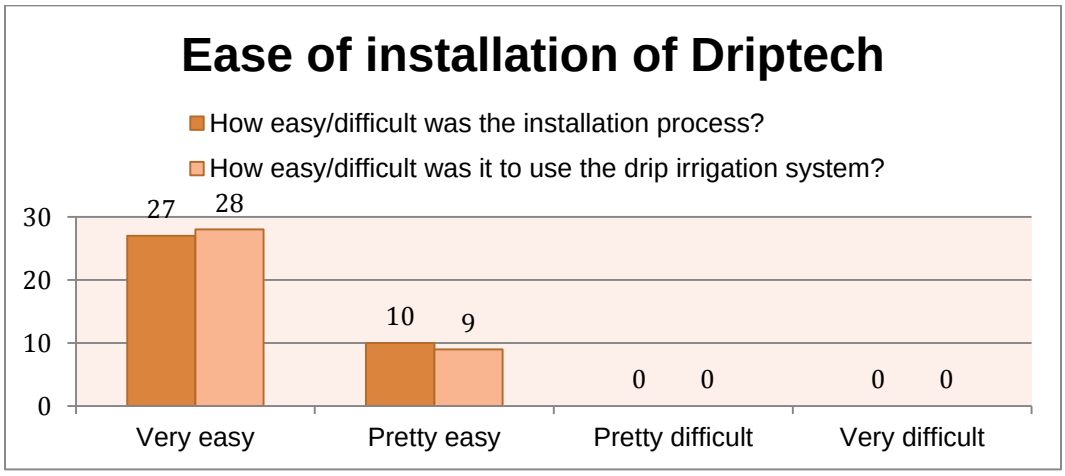
Hypothesis 2: Reduction of water used to irrigate crops

At baseline, only 4 out of 37 households were able to quantify the amount of water used to irrigate their respective plots. The sampled families used approximately 650 liters on average for the 250m^2 drip irrigated plot. At follow up, 26 households used 500 liters (one full water tank) which does show a reduction in water usage if compared. The remaining 11 households however required 1,000 liters (two full water tanks) to irrigate the drip-irrigated 250 square meter plot for each use. The absence of comparative baseline data means that this hypothesis could not be effectively proven and future projects will require respondents to track water usage more successfully.

A customer in his field

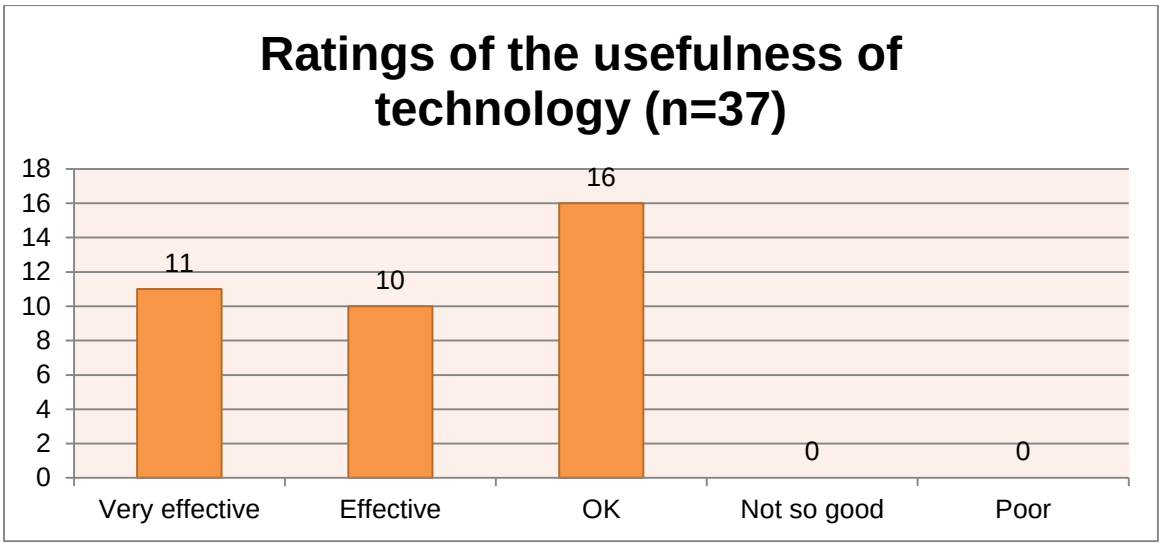
Hypothesis 3: Easy installation and maintenance of drip irrigation system

The Driptech system owners expressed high satisfaction with regard to the ease of installation and maintenance. Perception of overall usefulness of the technology was moderate to high.



Results from survey questions regarding ease of use

	Yes	No
Have you had any trouble with the system?	0	37
Is there anything you don't like about the product?	0	37
Do you have any suggestions on how to improve the system?[3]	1	36



Conclusions

Despite the data complications, the qualitative analysis in the form of conversations with Driptech system owners does demonstrate that the products positively impacted these households.

Samra Jani in Hingeiput said that he was "waiting for natural water sources to dry up," and was relieved to have a system to help his limited water sources go further. The

[3] A call was made to improve the system and ease the burden of filling the tanks with water.

inability of farmers to stretch their water source is a reality that is all too familiar for someone else in his village, Padu, who bought a system after he lost his entire cabbage crop last year during the dry season.

For Driptech owners like Arjun Jani in Hingeiput and Budhu Gunta in Narjiput, purchasing the product meant they finally had a way to use precious water sources more efficiently, after years of being frustrated by the amount of water wasted during dry season farming.

The availability and affordability of a Driptech system provided a greatly needed additional source of income for farmers like Nakul in Girlaguda or Kanda Guntha in Narjiput. Both farmers made the decision to harvest in the dry season for the first time because of the potential of this product.

Since this was Kopernik's first drip irrigation project, the team learned valuable lessons from working in the agricultural sector. Firstly, the project required farmers to commit some time to the implementation, i.e. registration, purchasing, installing, etc., during the wet season harvest, which is a very busy time for a farmer.

Secondly, in light of the limitations realized in the data collection, it is crucial to ensure baseline units of measurement that are comparable to those used in the follow-up. It might also prove beneficial to provide future customers with some time ahead of the baseline survey to track and quantify their water usage as it is a difficult statistic to derive on the spot.

Lastly, if timing/logistics allowed, it would be extremely valuable to conduct the assessment baseline just before the start of the dry season a year before the project is to launch to ensure accurate reporting. This would also address the issue of quantifying water and allow for discussion on crop continuity.

Happy customers with their Driptech tank

Annex

Kopernik in Action Blog 1

Introduction

For my Kopernik fellowship, I am based in Orissa, India working on two different projects. Initially, I am living in Kechla, a rural village in south central Orissa**.** I am working with Auro-Mira Service Society (AMSS), a Delhi-based NGO, to implement a Driptech irrigation project. In addition to assisting with the implementation, I will be conducting a baseline assessment as the first stage in the rapid impact assessment of the project. This blog post will provide an introduction to our partners, the project and the area in which we're working.

AMSS has been active in Kechla since 2004 with the opening of a boarding school for 88 children from hamlets within Kechla village; it is the only NGO with an active presence in the area year-round. I am working with Pranjal who has been with AMSS since 1998 and has been working in Kechla since 2004 and Sudam who has been with AMSS in Kechla since 2005.

Driptech is a social enterprise that produces affordable, user-friendly drip irrigation systems that are marketed specifically to small plot farmers in developing countries. Drip irrigation targets water specifically to crop roots, minimizing the use of limited water supplies and maximizing crop yields. For additional details on the project and how the system works, please click here to visit the Driptech website or here to visit the project's information page on Kopernik's website.

Over the next 4 weeks, we will be installing a total of 66 Driptech irrigation systems for farmers on 250 square meter plots to improve the harvest in the dry season (October – early/mid June) when rainfall is scarce. Two additional drip irrigation systems were

installed in March as part of a pilot demonstration. We will be working with farmers in Kechla and its neighboring villages.

I am returning to India after a year's hiatus to do a postgraduate degree in London. Before London, I lived in Delhi for 2.5 years working with an international NGO. I had the privilege to travel fairly extensively around the country, but none of my destinations, involved 13.5 hours of consecutive travel on a plane, two busses, an auto rickshaw and a boat—the quickest route from Delhi to Kechla. Having been here just over a week, Kechla's locale has more than proven itself as worth the effort it takes to get here. Kechla and its surrounding villages are scattered through undulating hills that offer so many shades of green that are only possible after a monsoon season, even a poor one. It is as rural an environment as I've ever seen; as I was cautioned before I arrived, "the nearest tea stall is 11km away." Having commuted in Delhi traffic, I appreciate that the only traffic jams are from water buffalo, cows, goats or sheep crossing the dirt roads.

But in all seriousness, because the residents of the villages belong to the lowest castes—Scheduled Tribe, Scheduled Caste, Other Backward Castes and General Castes—the area is deeply impoverished as these castes have historically been the most socially marginalized. Annual income is approximately US$340 which the villagers earn by juggling a variety of jobs including farming, fishing, wood-cutting, and day laboring (working on minor roads through government contracts and construction for an AMSS school). Koraput, the closest major town and market, is 80 km away by road or 45 minute boat road across the reservoir, followed by an 11km walk or auto rickshaw ride. While some farmers are able to sell locally to AMSS, the majority have to go to great efforts to sell their produce/goods.

The area bares the mark of much of rural India with minimal to no infrastructure. Though signs were installed 2009 throughout the area that claim the region is electrified, power lines have only been planted in the last few months. Water access is provided in each village through hand pumps or wells. AMSS provides general health facilities availed by

villagers living within a 3-4 km radius, though visiting physicians make the rounds in the area a few times a year. AMSS also provides the only functional school in the area**.**
I am looking forward to learning more about this area over the next four weeks and understand how this project will affect the beneficiaries. My next 2-3 posts will likely be in quick succession in an attempt to keep up with the whirlwind of work since we've had Sarah, our Driptech liaison and technical advisor extraordinaire, here to train the AMSS team and me on installing the systems. Back to work!

Kopernik in Action Blog 2

It's all about timing

When I arrived in Kechla, the first task was to finalize the list of 66 farmers who would be part of the project by paying a subsidized rate of INR 1,000 (US$20.80) farmers had expressed interest in participating during the initial pilot and information phase in April, but finalizing the participants proved more challenging than anticipated. After a week of visiting a few villages a day, sometimes each village twice a day, Sudam and I had only 29 registered farmers.

Part of the difficulty stemmed from the fact that October is a major festival season across India. Which festivals are observed varies from village to village. As there is generally no advanced external notice given, we only learned of the festival upon arrival. If we were turned away from villages because of celebrations, the villagers asked us to return at another date and time of their choosing. While the festivals posed a challenge to coordinating the registrations, they also impacted the resources (time and money) people were willing to commit to the project.

Another factor affecting the slow registration is because it is the start of the monsoon crop harvest. Harvesting itself is obviously quite time intensive while fields on the verge

of harvesting also make installing the drip irrigation system very difficult. In addition, some farmers said they would not have the capital to participate until after the harvest was sold. For these reasons, many farmers asked us to return after the process was complete.

In addition, some farmers who had expressed a lot of interest in purchasing systems have declined because the government recently provided subsidized fishing nets and boats for the local water sources (villagers pay INR 1,000 (US$20.80) up front and another INR 1,000 (US$20.80) after they net a minimum amount of fish). While this development is challenging, it highlights a critical point. For the majority of farmers, farming is only one source of income. Farmers, and all villagers, juggle as many different jobs as they can handle if they are able to find work. Nakul, from Girlaguda village, takes day labor contracts with the government in Koraput and acts as a night guard for a local ashram in addition to running his 400 square meter farm. Because of this reality, Sudam and I did our best to be available at each village at different points throughout the day to catch people between jobs, but it was tricky.

In light of these timing constraints, we have modified the program rollout slightly. We will do a phased rollout, initially focusing on installing the 29 systems purchased. AMSS is confident this will buy enough time for interested farmers to register. This also lets us use the installation process as free advertising and we expect that it will generate additional interest in each village. We are also making sales pitches in additional villages in the area who were not included initially because of the overwhelming response.

AMSS asked each participant from the two closest villages, Girlaguda and Narjiput, to collect some of the materials for his own system. And that means…we're almost ready for training!

Kopernik in Action Blog 3

Drip Irrigation 101

Last week, AMSS hosted Sarah, our Driptech technical advisor, for four days to train us on system installation. We started our training in Girlaguda, the village at the end of the road from Kechla. Sarah and AMSS had spent a lot of time in this village in April during the demonstration phase so the farmers were excited to have them back. While quite a few farmers in Girlaguda declined to participate after purchasing subsidized fishing nets and boats from the government, we had 3 excited farmers ready to go.

Rogenath's farm was our first classroom, so to speak, and I don't think there is a more idyllic backdrop for a sunset installation. It's a bit on the outskirts of the village, overlooking the reservoir**.** Nakul and Jogenath, who each purchased systems, and Jogenath's brother, Narsingh, joined for the inaugural installation as well.

Since Sudam and Pranjal (AMSS) had a brief introduction to drip irrigation during the pilot in April, I was worried about keeping up. But I was pleasantly surprised by how simple it was to assemble the system. I learned the art of evaluating how the land slopes to respond to the critical question: where should the submain pipe (the main pipe through which water is channeled) be positioned? (Answer: *always* along the greater slope). My vocabulary expanded to include FTAs, tank nipples, ball valves, take offs, grommets and drip laterals**.** I understand how hot it is inside a 500 liter water tank and the importance of applying M-seal carefully, yet efficiently, onto the tank nipple to escape the heat as quickly as possible.

It took us about three hours to install Rogenath's system, a process which included many questions, even more clarifications, Sudam's patient translations and some quiz rounds on proper system maintenance.

We continued to hone our installation skills on Nakul's and Jogenath's farms the following day, with Rogenath's support as well. Though many hands certainly make light work, by supporting their neighbors' installations, Rogenath, Jogenath and Nakul have become Girlaguda's in-house Driptech experts. While Driptech systems are very user-friendly and require minimal maintenance, in the event a system owner does have a question or an issue, he has access to a knowledgeable team to troubleshoot it. Such support is critical as the number of system owners continues to grow. Nakul's farm is along the main road into the village and in the process of installing his system, two additional farmers stopped to watch and bought systems of their own (our free advertising plan = success!).

Drip irrigation is celebrated for its efficient delivery of water to crop root zones. Yet its benefits are particularly meaningful for farmers like Nakul who have historically irrigated dry season crops by hand. Such a process is very time consuming, especially for someone who juggles multiple jobs, as Nakul does. Nakul will still have to fill his 500 liter tank, positioned one meter off the ground, with water by hand since he does not have a water pump – a considerable effort, to say the least. But drip irrigation maximizes Nakul's efforts and investment by delivering the water directly to his plants, one drip lateral at a time.

Kopernik in Action Blog 4

Lesson Learned

After successfully completing Sarah's drip irrigation training course, team AMSS and I headed to Narjiput to do 14 Driptech system installations. With a total of 57 households in the village, that means almost 25% of Narjiput homes now have a Driptech owner in them. Most of the fields on which we worked were in close proximity to each other and boarded the village directly. Because of the layout of the land, one could see at least 8

black water tanks dotting the landscape, adding a new dimension to the village skyline (unfortunately, my camera isn't powerful enough to capture the view).

The installations went smoothly and seamlessly, largely because every farmer worked on more than one installation. This is a trend we will continue to encourage based on the benefits discussed in my previous blog post. Though it is still relatively early in the project, Narjiput marks a critical turning point: we learned that the farmers were planning on using the systems in a way different than how we had assumed.

The most critical point of the installation process is identifying the greatest slope in the land. Aligning the submain along that slope ensures that the water flows uniformly through the submain to each drip lateral connected to it. Conducting the slope assessment is the first step of the installation and a process AMSS and I did ourselves. While we confirmed with the system owner if our assessment was correct, we did not clarify *w*hy *w*e needed that information or why it was important. Rather, once **v**erified, we shifted the PVC pipes to that slope to start assembling the submain.

We assumed that once installed, the system would remain in its original place. We did not consider that farmers might need to shift systems based on available water supplies or for crop rotation – which is exactly what they need to do.

Upon learning this, we quickly realized that we need to amend our approach to the installations to make sure each farmer understand how his system must be laid out in addition to understanding how it is assembled. Moving forward, we will incorporate such a discussion with the farmers at the start of each installation. We will organize meetings to address this component with farmers in Narjiput and Girlaguda as their installations are complete.

Driptech is also developing a slope diagram to illustrate the concept for all system owners should they need to reference it. AMSS is currently testing the efficacy of the

diagram with Driptech farmers in Girlaguda and Narjiput. I am glad we learned of the farmer's intended use for their systems so early in the project. I am lucky to be working with a team that moves so quickly to address both the immediate and long-term needs of the system owners.

Kopernik in Action Blog 5

Back in the (drip irrigation) saddle again

Welcome back to Kechla! After a month's hiatus, the AMSS team and I have hit the ground running in Kechla for the second phase of the drip irrigation project. We got off to a great start last week with 21 registrations. Adding that to the 30 registrations we secured in October, we are only 15 registrations away from our project total of 66. The most recent registrations largely come from two new villages, Hariyamunda and Khemiri, with the remaining registrations from villages in which we have already worked.

While we are continuing to make progress on the installations, we have also started conducting the baseline surveys with all registrants. The survey is aimed at understanding each farmer's experience with dry season farming, his apprehensions about using/maintaining the system, and his motivations for purchasing. I was particularly interested in learning about the last point in an attempt to understand each farmer's connection with the technology.

Many of the farmers surveyed thus far indicated that they decided to purchase a system to make it easier to harvest in the dry season when water sources are scarce – one of the system's main selling points. That's what drove Padu, a farmer in Hingeiput, to purchase—last year, he lost his entire cabbage crop in the dry season because of lack of water.

But there was another common motivating factor that I found surprising: quite a few farmers based their decision to purchase a Driptech system because someone else in their village already bought one.

At first I had trouble understanding this justification. Though farmers are paying a subsidized rate of INR 1,000 (US$20.80), that amount can be up to a tenth of their yearly reported income. How could such an expense be justified merely because a friend also made it? In assuming that farmers would be driven to purchase purely based on the Driptech system's celebrated benefits, I failed to recognize what this purchase fundamentally is: a risk.

The level of perceived risk varies among registrants, with some being more risk averse than others. Some farmers' expectations for and belief in the product may easily outweigh the risk of the financial investment, while others may not be *completely* sold on the idea, though still intrigued.

We must be cognizant of this risk factor in our work so that we make it as calculated a risk as possible for our registrants, building their confidence in their investment. We need to ensure that farmers clearly understand the benefits of the system and inputs required to achieve them. Farmers must know how to maximize system efficacy with proper maintenance. Thanks to our extensive training, those elements have been the focal point of this project.

Farmers will start to use their systems as soon as their fields have recovered from the monsoon harvest (between end December 2011 – early February 2012). They will then only have to wait about 3 more months for their first drip harvest. At harvest time, they will see how their drip irrigation systems make their dry season harvesting efforts go further in the form of increased crop yields. Hopefully, the fruits of their labor will be enough to prove that this investment was certainly worth the risk.