

Agricultural development through small-scale fruit production in Nepal

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Executive summary:

Aythos, a U.S. based nonprofit working in Nepal, has been supporting rural Himalayan farming communities through agricultural interventions since 2009, with the goal of improving their access to economic opportunities. Despite the prevalence of agriculture all around Nepal, this small mountainous country still has a large annual trade deficit. This imbalance is caused in part by the demand for imported high-value fruits that is not met by local production (Kathmandu Post, 2014). Empowering farmers to grow and sell high value fruits has the potential to decrease malnutrition, increase incomes, and alleviate the migration pressure that families face each year, a pressure which usually results in male heads of households moving seasonally for better work and income generating opportunities.

Aythos has identified kiwifruit as one potential solution address these issues in Helambu, a small municipality seated in the Himalayan foothills just north of Kathmandu. Over the past several years Aythos has provided planting and pruning trainings while splitting the cost of sapling purchases with villagers. This work has seen mixed results, in part impacted by the large earthquake Nepal experienced in 2015, but also due to insufficient and poorly executed initial training in vineyard management. Farmers have demonstrated different levels of commitment to the kiwi vines after their initial establishment, resulting in many plants dying and most plants growing without proper management.

My project, supported through the Research and Innovation Fellowship through Agriculture (RIFA), worked with Aythos on several different fronts to address the difficulties these new kiwi farmers in Helambu are encountering. Training curriculum for harvesting, soil management, and pruning were designed to help provide the necessary corrective interventions to make unmaintained kiwi vineyards still reach optimal productivity. Not only were trainings

designed to address farmer's needs, but targeted instruction was also tailored to Aythos staff. In the past, local staff members have lacked basic agricultural and project management knowledge that would enable them to better facilitate trainings and assist farmers in understanding and applying horticultural concepts during Aythos' field visits to Helambu. A framework was adopted to monitor and evaluate the success of these various training efforts, designed as a tool to help Aythos continue to increase the quality of the services they provide to communities.

Key background information:

Nepal is a small, landlocked country of considerable geographic and cultural diversity. It has a population of 29 million and is one of the poorest countries in the world, with a GDP per capita of \$2,500. Lacking economic opportunities within the country, many Nepalis migrate to India and to the Middle East for work, sending remittances back to family. These remittances account for 29% of the annual GDP. Of the Nepalis remaining in the country, over 70% are dependent on agriculture for their livelihoods, which accounts for another third of the country's GDP (Central Intelligence Agency). Despite the country's dependence on agriculture, a large portion of Nepal's fresh fruits and vegetables are imported from neighboring India and elsewhere, rather than being grown locally, contributing around 50 million USD last year to Nepal's already significant trade deficit (Himalayan Times, 2016).

Geographically, Nepal has elevations ranging from 300 ft. above sea level to the summit of Mt. Everest, standing at 29,029 ft. The country is generally divided into three regions that are designated by altitude, forming longitudinal bands across the country. The Terai, or lowlands, lie in the Indo-Gangetic plain on the southern border. The foothills lie at mid elevations in the central region, and the Himalayan mountain region occupies the northern border with China. While the Terai region is subtropical and able to grow horticultural products such as mango,

banana, and papaya, the temperatures at higher elevations of the foothills allow the cultivation of nearly all temperate/deciduous crops (Pariyar, 2017).

Despite the variety of temperature regimes and the potential agricultural products that can potentially be grown in each elevation and sub climate, both shortage and excess of water can

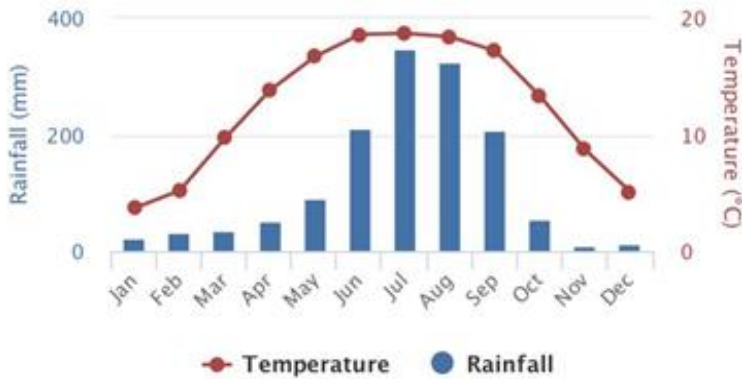


Figure 1. Average monthly temperature and precipitation in Nepal.

pose a significant challenge for farmers. Although Nepal has 4 distinct seasons, monsoonal precipitation causes this rainfall to be almost entirely during the summer months (World Bank).

This results in transportation problems, summer disease pressures, and water shortages outside of the monsoon season for those who cannot afford irrigation or water storage. Transporting water for irrigation can be especially difficult for farmers living and farming on terraces cut into steep slopes.

Most of the organization's stakeholders live within the Helambu Municipality of the Sindhupalchowk region, just northeast of Kathmandu. These villages are typically on mountainsides between the elevations of 6,000 and 7,500 ft. The proximity to the city makes Kathmandu the obvious market for high value agricultural goods, but reliable transportation can be difficult to obtain. In linear distance, it is less than 30 miles away from the capital city, but because the terrain is so mountainous and the infrastructure is so poor, it can take anywhere between 6 to 8 hours to reach Helambu via a vertiginous public bus ride from Kathmandu. During summer monsoon rains, the final 2 hours of the bus ride is often impassable, due to

flooding washing away parts of the dirt and gravel road. Every year by October or November, the residents have fixed the road for the remainder of the dry season, but until then, the final part of the journey must be completed on foot. This may be an additional 5 hour hike.

These transportation issues, coupled with summer disease pressures from the constant rain and humidity, has made cultivating many summer fruits prohibitively difficult. Farmers also lack the knowledge on how to effectively manage fruit trees, further complicating the problem. Instead of growing high-value horticultural crops, most villagers grow a limited number of staples such as potatoes, millet, and wheat, as well as a small selection of vegetables such as spinach and radish for household use. Although these are sometimes sold in neighboring towns,



Figure 2. Map of Nepal, highlighting Sindhupalchowk, where Helambu is a municipality (Rural Access Program).

the returns to inputs and labor are marginal at best, especially when compared with the returns to labor when migrating and taking construction jobs in urban areas throughout South Asia.

| Table 1: Opportunities and threats to smallholder success in Helambu | | |
|--|--|--|
| Situation in Helambu | Opportunities | Threats |
| Nepal receives abundant rainfall during the summer monsoonal rains | -Crops receive ample water during most of the growing season | -Irrigation necessary during spring blooms -Rural transportation greatly impeded throughout monsoon -High moisture level leads to increased fungal and bacterial pressure throughout summer |
| Helambu is approximately 80 km by road away from Kathmandu | -Helambu farmers have access to the county's largest market to sell their produce | -Despite close proximity, mountainous terrain and poor infrastructure makes transportation take an entire day -The most affordable option is public transport, but poor road quality and fast driving can easily cause fruit bruising in transit -No cold chain exists to reduce spoilage. If cold storage were to be utilized, it would only be after fruit arrives in Kathmandu |
| Much of Helambu is organic certified | -Products appeal to niche markets and can be sold at a higher price | -Farmers are at risk to disease outbreaks with limited knowledge/tools to limit disease spread -Adequate plant nutrition must be met through compost or plant/animal manures |
| Nurseries exist to supply fruit saplings to growers | -Aythos doesn't need to train farmers on grafting and propagation or handle these operations themselves | -Nurseries have limited access to superior germplasm and new varieties -Farmers/Aythos has little knowledge about the genetic traits of the selected saplings. I.E. initially farmers were told they were receiving the Hayward variety of kiwi, only to find out this year when their vines began producing that they were growing Allison, a less marketable alternative to Hayward |
| Male heads of household and elder sons often migrate to Kathmandu, India, or even the Middle East to seek better paying work | -Remissions help sustain those who remain in rural villages and often pay for increased standards of living/nicer houses etc | -Many of those who have received training on orchard management and fruit production have migrated for part of the year, leaving no one in the household with training to manage the plants |
| Helambu resides in the buffer zone of Langtang National Park | -Revenues from trekking tourism provide income for those with guesthouses and a small volume but high value market for fresh produce | -Animals within the buffer zone are protected by the park service, causing crop losses to deer, wild boar, and Himalayan ferrets that often come onto village plots during the night |

Due to its geographic location, Helambu farmers have both unique market opportunities and challenging barriers to success. In years past, apple cultivation around Helambu was widespread, and the fruit was known in Kathmandu to be especially sweet when compared with other local apples for sale. This relative fame not only contributed to a profitable apple sector, it also allowed creative entrepreneurs to capitalize on this by creating several value-added apple products. Unfortunately, much of the apple production in Helambu was wiped out by a disease

that swept through orchards, most likely fire blight. While farmers may have difficulty accessing pesticides to control disease outbreaks, the bigger hurdle is the lack of understanding about specific pests, how to manage outbreaks, and difficulty in obtaining information.

Many conventional methods of controlling disease outbreaks are no longer an option for many farmers in Helambu, as many of the villages have committed to organic production. For several decades now, highly publicized incidents of organophosphate poisoning from pesticide residues have served to shift the public and farmers alike towards organic farming (Shahi, 2014). In Nepal, organic certification is carried out by the government, but rather than certifying individuals, the government works with entire villages to educate them on organic farming practices and help them obtain organic certification. This increases the selling price of their produce, but it also reduces the options farmers have available when a pest outbreak occurs. Most industrial fertilizers and pesticides that can be found in the United States for organic fruit and vegetable production are unavailable to farmers in Nepal, leaving dedicated organic growers making labor intensive, but reputedly effective pesticide concoctions with ingredients such as buffalo urine and local herbs, as promoted local organic farms and by the International Center for Integrated Mountain Development (ICIMOD).

Along with the challenge of organic fruit production in Nepal comes the challenge of working with an unfamiliar crop. Kiwi is a relatively new fruit to Nepal, with even the most experienced growers in the country having less than ten years of experience (ICIMOD, 2012). The consumption and cultivation of kiwi has certainly grown, but annual totals certainly hold potential for future growth, as the plant can potentially be grown at elevations spanning much of the hill region. As a perennial crop requiring a trellis system, a kiwi vineyard is much more capital intensive than typical staples farmers grow each year, but managing the vines requires

less labor each season than for an alternative crop, such as maize, and for a significantly healthier and more valuable output. In the city, consumer prices for staples such as potatoes may only be around \$0.50 a kilo, while kiwis can go for as much as \$8 a kilo, nearly a dollar per kiwi. For comparison, a dollar could purchase the average Nepali all-you-can-eat meal of *dahl baht*, a rice and lentil mainstay dish that is often served with potato curry and a small vegetable side. Depending on quality and the farmers access to premium markets, farm gate prices can range between \$1.50-\$3.00 a kilo, which, assuming an average yield of 50 kg per vine, could mean \$75-\$150 in revenue for a family from just one kiwi vine—a substantial boon to household income.

Other crops have been investigated as potential market opportunities, but none seem as suitable as kiwi for the circumstances in Helambu. While kiwi is harvested in November and December, summer harvests of stone fruits and earlier bearing varieties of pome fruits would need to be brought to market when farmers do not have direct road access to their villages, due to monsoon rains damaging the roads each year. Harvests would need to be carried by foot several miles out to the nearest functioning road before being loaded onto transportation to Kathmandu. Another benefit of kiwis is the long shelf the long storage potential. Because kiwi is a climacteric fruit, when harvested at maturity it typically will take several weeks to reach peak ripeness, but can be stored for 4 to 6 months under the right conditions. This physiological trait gives farmers increased flexibility in choosing when to sell or consume their kiwis, rather than risking their spoilage (Beutel, 1990).

Partner organization: Aythos

To understand the scope of my project more fully, it is important to take a more in-depth look at Aythos and how it functions as an organization. As stated before, Aythos was founded 8 years ago and has been working Nepal ever since. It has a board of trustees with members mostly from the United States and it is managed by its founder, Beau Miller, from Washington DC. Beau oversees a team of Nepali nationals that run the daily operation of Aythos around Kathmandu and Sindhupalchok. In their 8 years of serving the region, their goals have shifted from initially working to address educational needs through local schools to working with farmers to increase economic opportunities in rural villages. Because of this goal, three years ago Aythos began working with farmers to plant kiwi vines, in the hope that tapping into this market could add a local and viable option for farmers to improve their family's well-being.

Aythos, while based in Kathmandu, does its work primarily in Helambu in the Sindhupalchok region of Nepal. At the time of my work, there were three full-time Nepali employees stationed in Kathmandu that sustained the daily operations of the nonprofit—Dorje, Shanti, and Muna. All three were in their early twenties. Dorje and Shanti are in the process of getting their bachelor's degrees from local colleges, while Muna is professionally trained as a midwife. Dorje and Muna are Hyolmo, the ethnic group that dominates in Helambu, while the Shanti is ethnically Nepali, from the Terai region. Their local connections and knowledge of the culture and village dynamics certainly are an important asset for Aythos. Soon after arriving in Kathmandu, though, it quickly became clear to me that there were many dysfunctional aspects of the organization. These include:

- Lack of training in project management skills
- Poor communication dynamics and work sharing between employees leading to tension and resentment
- Limited knowledge of agriculture

- Lack of direction and oversight from leadership in D.C.

It was apparent that the management in the U.S. hoped that the staff would be self-starters and take initiative to learn new skills to tackle problems as they arose, but the local team itself lacked the necessary training and workplace culture to effectively meet these expectations. A weekly Skype call didn't seem to be sufficient to guide the staff in effectively managing their time and opportunities to work towards a greater impact. Receiving volunteers and letting their ideas and energy drive the day-to-day agenda appeared to be the norm, and without careful consideration of my influence, I realized that I too would likely contribute to this problem. I had to be careful to engage the team and the ongoing projects in a way that empowered and enabled each of them to take greater responsibility and leadership as well as work more cohesively on future projects. While oftentimes this was frustrating for me, I knew it would be much better for the staff members and the farming families of Helambu if I could forgo the need to feel productive, getting things done efficiently myself, instead of working to facilitate Aythos staff in taking leadership over their own projects. A key component in understanding my role as a part of this process was the initial field visit we made to 5 villages in Helambu.

Village visits and needs assessments

Not long after arriving in Kathmandu (KTM) in early September 2016, I went along with the other RIFA fellow and the local staff on our first field visit to Aythos' partner villages. The stated purpose of our visit was to "know our product" so that we could be able to properly market it. At this stage, Aythos was aware that the fall of 2016 would be the first potential year where any noteworthy harvest of kiwis might take place, as this was the third growing season for the vines in several partner villages. Two staff members, Shanti Regmi and Muna Tamang, led the trip to visit with farmers, discuss the status of their kiwi vines, and make estimates of the

likely kiwi yields given the current crop load. Although Aythos has not ever directly marketed any agricultural products, the hope of the director was that Aythos could help facilitate farmers in finding market linkages that would give them good financial returns from their fruit harvests.

Given their lack of education and background in agriculture, neither Shanti nor Muna had a good framework by which to evaluate the potential yields and the health of the respective vines. The farmers had little idea either. For many of these farmers, their only instruction on kiwi production was nearly 3 years prior, and it was almost entirely done via lecture accompanied by some multimedia. No trees or vines were available for trainees to practice effective trellising and pruning. Shanti and Muna were not present at these initial trainings, as they had both been with Aythos for under a year. Within the year since Aythos hired them, there had been kiwi trainings for new plantings in other villages, but these were organized and outsourced to experienced instructors. Aythos staff, though, had been present during these teaching sessions, but had prioritized working with some of the villagers to prepare tea and meals for the trainees over receiving instruction about kiwi planting and management. With no experienced personnel on the team, they didn't know anything was wrong with the kiwi vine management or why the harvestable yield was so low until it was explained to them.

Recognizing a "Train the Trainer" opportunity, the remainder of these field visit interviews were utilized as chances for farmers as well as Shanti and Muna, who were translating, to learn fundamentals about proper trellising and pruning for kiwis. While a few farmers had sizeable crop sets, a consistent pattern of uncertainty and neglect was present across all 5 villages towards kiwi vine management. Many farmers were eager to learn, but none knew that proper pruning would help make future management easier, reduce crop load, and increase fruit size. A few had lost interest in their vines and did not seem motivated to learn more. None

demonstrated a proper understanding of how to properly manage their plants to optimize fruit production.

Upon our return to KTM, we immediately prioritized holding several trainings for the farmers, considering both what farmers wanted to learn and what we assessed would be necessary as corrective interventions to help put their vineyards on the right track.

Agricultural extension and capacity building trainings

During my three months in Nepal, we planned three trainings and conducted two. The third happened just a few weeks after my December departure. The topics explored in the three farmer trainings were 1) kiwi harvesting and postharvest handling, 2) soil texture/health and composting, and 3) winter pruning for kiwi vines. For both the harvest training and the pruning training, the timing was coordinated to align as well as possible with the ideal time in the crop cycle, enabling farmers to immediately put their training into practice. This training methodology contrasted greatly to the initial training the farmers received at planting, which, as stated before, involved intensive classroom sessions about the entire lifecycle of the plants. In our trainings, each lesson involved hands on components for the farmers, and in the weeks following their training, they themselves would be able to apply what they learned on their own farms.

Additionally, the other RIFA fellow and I utilized time in Kathmandu to work directly with Aythos staff to design training modules to meet their needs for professional development.

Harvest Training

While the Helambu villages lacked the volume and quality to consider this year's harvest as competitive with kiwi imports in high end grocery stores of KTM, a harvest training was deemed necessary since this—year three—was the first year of a harvestable crop in the village of Ghangyul. Perhaps more so than other fruits, harvest training for kiwi is important as it is

especially difficult to know when kiwis have reached optimal maturity for harvest. Additionally, storing the fruit after harvest involves several unique challenges to these growers who have never dealt with high value horticultural products. Training farmers on these techniques now will allow this knowledge to be applied in future years when maturing vines and improved management will hopefully increase yield and quality, at which point the fruit will be in sufficient quantity and quality to be considered for higher value markets.

When harvesting kiwis at the ideal time, the fruit tastes sour and astringent. There is no visual external sign to indicate maturity, like changes in base color. Picking too early would reduce the sugar content potential of the fruit at peak ripeness, while harvesting too late would reduce the shelf life of the fruit. After harvest, starch hydrolysis converts starches to sugars, continuing until all starch has been broken down and the fruit is ripe for consumption. When kiwifruit reach the 12-18% soluble solids range, they are ready to be eaten (Strik and Cahn, 1998). In our market research throughout Kathmandu, a common complaint of fruit vendors and wholesalers about Nepali kiwi was that it is too sour compared to imported kiwi, which can likely be attributed to poorly timed harvests, not to biological inferiority of locally grown kiwifruit.

Since on commercial farms, a spectrometer is usually used to gauge harvest maturity, appropriate alternatives needed to be taught to Helambu farmers. Due to each family maybe having an average of only 6 vines, a spectrometer would be an inappropriate and cost prohibitive option. Table 2 shows what methods were taught at the harvest training, based on research and interviews with local growers.

| Table 2. Techniques for judging kiwifruit maturity at harvest | |
|---|---|
| Commercial practice | Nepal smallholder solutions |
| <ul style="list-style-type: none"> Sample kiwifruit juice with spectrometer; for Hayward, harvest at 6.5° brix | <ul style="list-style-type: none"> Around late November/early December, periodically harvest several and keep in a paper bag for several days; if it ripens well, it is ready for harvest Take sample fruit and cut open; all seeds inside the fruit will have changed from white to black Observe vineyards for signs of pests consuming fruit; rats (we promised not to tell the county health inspector) will climb vines to eat kiwi when they are mature Rub the kiwifruit with your fingers; if the fuzz falls off easily, the fruit is ready to be harvested |

For a more effective training, it was decided that the primary trainer position needed to be outsourced to an experienced local trainer/farmer. While the other RIFA fellow and myself could have potentially led the training, it was clear that we would not have been as credible as a local farmer, and all the material would have to be painstakingly translated throughout the training. Aythos staff certainly couldn't have been the trainers; even if they knew the material by heart, their age and lack of education/experience farming would greatly diminish the willingness of farmers to alter their practices based on the training. To standardize what had previously been entirely up to the hired trainer so that we could monitor the success of the training, we built a curriculum for the trainer to follow. It includes the major objectives and learning outcomes, as well as a schedule of engaging activities for the instructor to use to help teach the lessons. A slightly truncated version of this curriculum is included in Appendix A.

Since there was no standardized M&E procedure from previous trainings, we worked with Aythos to design post training questionnaires for participants, the trainer, and the staff. We also developed an interview/observation sheet to use on our next trip to Helambu to monitor the application of the training information several weeks after farmers harvested their kiwis. As this M&E process was developed in tandem with Aythos staff members, hopefully it will set a

precedent that will improve the evaluation and execution of trainings in the future. These evaluation forms can be found in Appendix B.

Soil Health/Compost Training

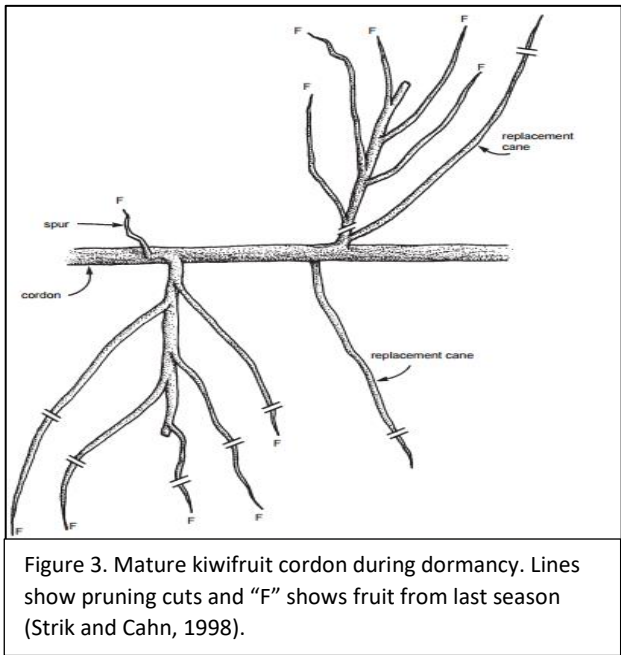
As mentioned above, Helambu villages have committed to and even take pride in their commitment to organic production. Although plants did not show obvious signs of nutrient deficiencies, rudimentary soil testing showed that the soil was slightly acidic and deficient in NPK. Since farmers had requested soil tests to understand their own soil better, we decided to accommodate them with soil tests and expand the training to include a broader emphasis on soil, including soil texture, soil testing, and composting.

Over the course of 2 days in the village of Nakote, farmers worked together as a community to make a compost pile using local materials, while also receiving interactive instruction on soils. Each farmer received hands on experience testing soil texture and using the soil test kit to measure pH, Nitrogen, Phosphorus, and Potassium levels. The deficiencies shown in the soil test served to reinforce the importance of the bulk of the training, demonstrating to farmers the importance of compost as an organic fertilizer.

Winter pruning training

Chief among the farmer's needs was to bring their plants back to a manageable state before it was too late. For the older plants, farmers had failed to “maintain a well-formed permanent framework for the vine,” one of the primary goals of pruning and training kiwi (Strik and Cahn, 1998). The canopies were chaotic and a veritable rat's nest of interwoven vines. It was evident that this would make balancing annual fruit production and vegetative growth increasingly difficult to manage as the vines matured. Based on conversations with farmers and

the state of their plants, those who had 1 or 2-year-old vines also did not know how to prune their plants to create and maintain the optimal plant structure for long term productivity.



Before leaving Nepal, objectives and outcomes were developed for the pruning training curriculum, leaving the activity design and scheduling up to Aythos, which the staff carried out finalizing and executing in early January, working with Binod Puri, the same trainer for the compost training, to carry out one day training events in 4 different Helambu villages. The precedent that was set by the harvest training of returning to the villages

several weeks after the training to monitor its effectiveness was followed by Aythos staff on their own initiative, which is an exciting example of our investments in capacity building among Aythos staff paying off.

Aythos capacity building trainings

To increase Aythos’ effectiveness moving forward, the staff agreed that they needed to be better equipped to develop and manage future projects. To address this need, I worked along with the other RIFA fellow to develop professional development trainings for the Kathmandu office. These training topics were chosen along with Dorje, Shanti, and Muna, and were meant to address the underlying issues mentioned above and are shown in Table 3.

| Table 3. Professional development for Aythos staff | |
|--|----------------------------------|
| Key barriers to effectiveness | Associated training/intervention |

| | |
|---|--|
| <ul style="list-style-type: none"> -Lack of training in project management -Poor communication dynamics and work sharing between employees leading to tension and resentment -Limited knowledge of agriculture -Lack of direction and oversight from leadership in D.C. | <ul style="list-style-type: none"> -Project work scheduling, Gantt charts, holding effective meetings -One-on-one meetings with staff leading to problem solving sessions where we brainstormed changes to teamwork protocol & workplace communication -Fundamentals of soil science training -Basic tree physiology and fruit production training -Cross cultural workplace/virtual teams training |
|---|--|

Many of these trainings will hopefully continue to benefit Dorje, Shanti, and Muna in carrying out Aythos' projects well in the future, but some tangible benefits have already been realized. In response to individual conversations and group discussions about roles in the organization, the team decided in November that they should approach Beau during a with a request to redefine their roles and duties, making their tasks and the authority structure of the office clearer. They also have obtained approval from the Aythos board to be more intentional about pursuing future training opportunities in agriculture and in project management, some of which may be online while others may be trainings held in and around Kathmandu. Already feeling more confident in their own understanding of plant and soil needs during my time there, I noticed the three of them stepping up more consistently to answer questions and explain concepts to farmers, without needing prompting or explanation themselves. This even led to Shanti teaching a portion of both the harvest training and the compost training. When transitioning from the harvest training to the compost training, the staff themselves suggested the creation of a work plan and a Gantt chart to aid in project execution. After we taught and conducted effective meetings as a model, staff led meetings became more efficient and usually ended in concrete actions steps to keep momentum moving forward. It was extremely gratifying to see these changes taking place naturally, with Dorje, Shanti, and Muna taking ownership of the transformation of their own organization.

Recommendations moving forward

Having explained at length the diverse array of tasks my project worked on in Nepal, I would like to conclude with a list of key recommendations for Aythos that I hope will ultimately increase the wellbeing of the rural farm families of Helambu:

1. If Aythos continues to assist farmers in establishing their own fruit production, it should avoid multi day training events at planting time, where farmers are inundated with information that they can't apply for months or years. Rather, Aythos should have trainings year round at key points in the crop year to equip farmers with the skills they need in a context where they can practice under the supervision of an instructor and then immediately apply the management techniques to their own farm. These should include 1) planting, 2) trellis construction, 3) annual winter pruning, 4) fruit thinning 5) summer pruning, 6) harvesting/post-harvest handling.
2. Aythos should always hire local trainers who are experienced farmers, and ideally ones who are connected to the market for crop being addressed by the training. This will increase the credibility of the training and help build momentum for better management practices and better market opportunities. Whenever possible, peers from nearby villages who are exemplary in some way should be recognized and given the chance to share their successes and plans, so that farmers can build local connections that will help in solve future business and agricultural problems.
3. Aythos staff should design the curriculum, monitor its execution during trainings, and evaluate the successfulness of the trainings afterward rather than giving hired trainers total autonomy and zero accountability. Trainers should be able to adapt the curriculum, but only through dialogue with staff. This requires that staff members continue to receive

training in agriculture, so that they can understand and design lessons for trainings that are necessary in the future.

4. Volunteers and fellows should only be brought on by Aythos when there is a clear role for them and sufficient work for them to do. This work needs to be something that Aythos staff truly need expert assistance on, not simply an opportunity to get additional “help.” Improper use of volunteers has hindered the development of leadership and initiative among staff.

Conclusion

Despite the complexity of training farmers to cultivate kiwi and the difficulties they will have in marketing their crops, I still would argue that Aythos made a wise decision in promoting this fruit to farmers in Helambu. The nutritional benefit to families as well as the potential for high financial returns in the future makes it worth any associated risks. Most of the kiwis harvested this year were too low of a grade to be sold, although we do know of one entrepreneurial farmer from Nakote, Anil, who created his own packaging and labels, transported over 100 kg of kiwi to Kathmandu, and sold direct to consumer via Facebook friends. He is an exemplary model that hopefully other farmers will soon partner with or emulate.

Unfortunately, the way in which Aythos has approached this project has hindered its success. If the benefits of the recent harvest, composting, and pruning trainings are to last, continued support will need to be offered at through future training events and through Aythos staff. Other villages that are in different stages of their kiwi vine’s growth will soon require the same trainings that were executed this year, giving Aythos the opportunity to continue to improve these already successful trainings. Succeeding at this, however, will require additional professional development for Aythos staff, so that on their frequent visits to Helambu, they can

be more competent in the techniques of managing kiwi vines, and so they can encourage farmers to apply their training, re-teaching techniques/principles wherever necessary. Progress has already been made on this front with Aythos staff making clear gains in confidence, knowledge, and project management skills over the course of three months of mentoring by RIFA fellows.

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Appendix A



Harvest Training – 2016

Gangyul, Nepal

Compiled by Kaitlyn and Jonathan Yates

M.Sc. Students and 2016 RIFA Fellows

UC Davis

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Kiwi Harvesting Training

Methodology

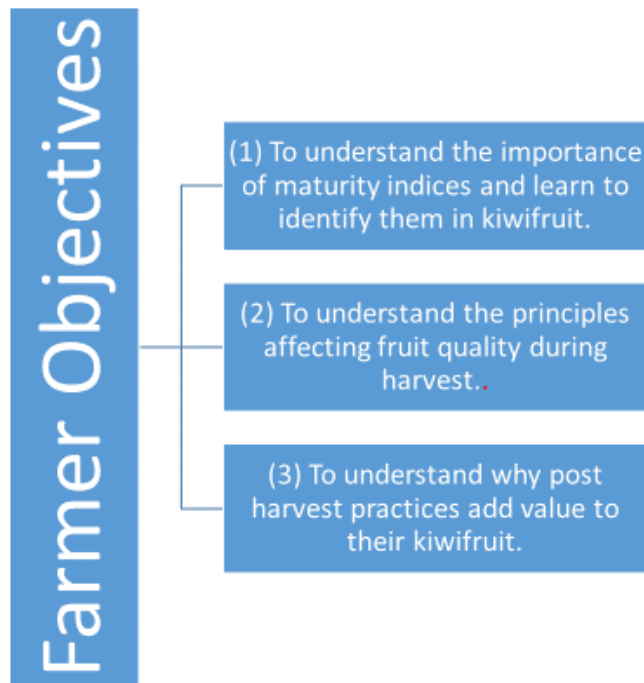
The methods used for this training are designed to allow participants to investigate and learn principles and skills that will benefit the harvesting and post harvesting practices, thereby increasing the returns they can get from kiwis.

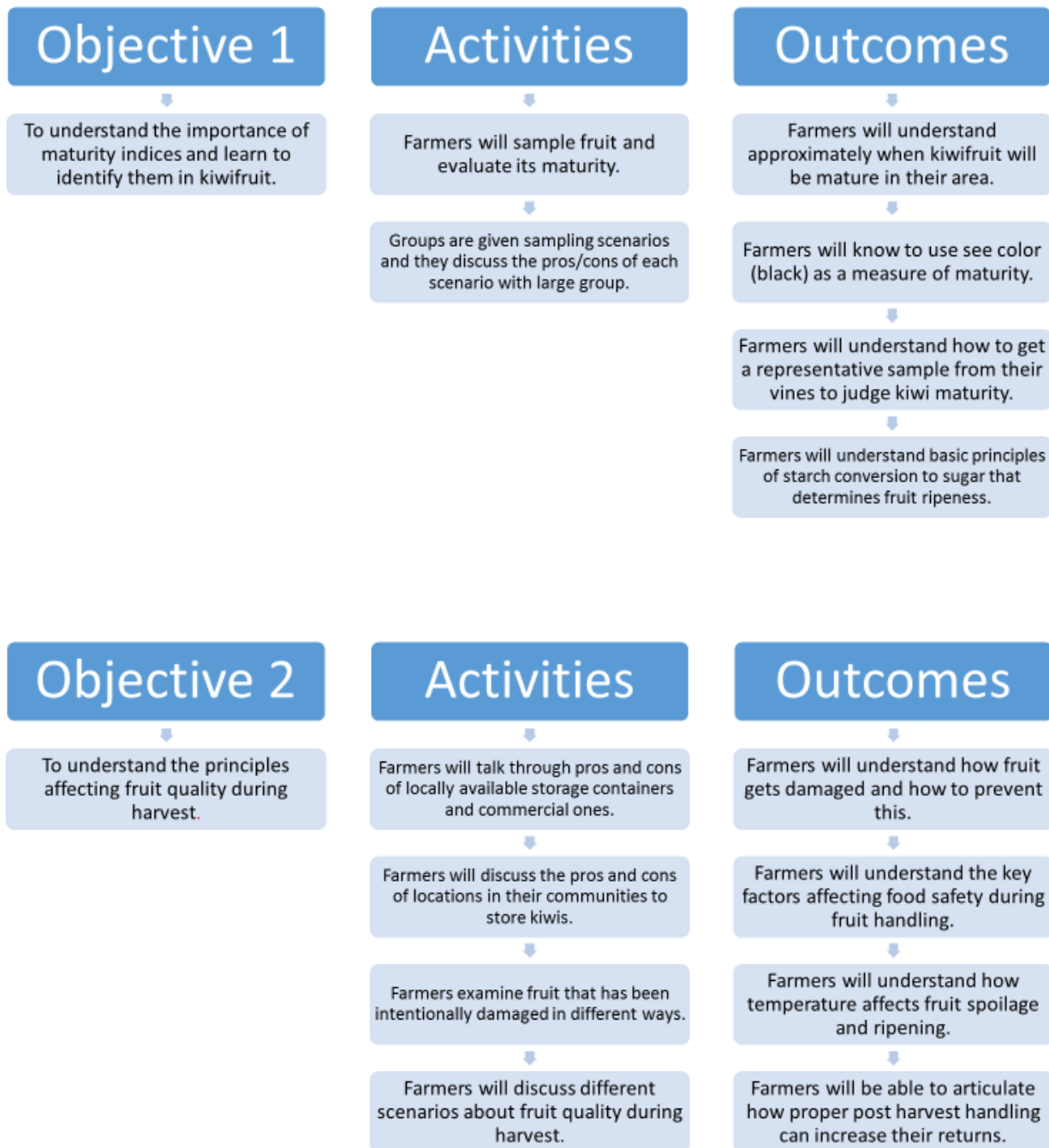
The trainings are participatory, interactive, and activities based to ensure the maximum retention of knowledge and lead to the most likely adoption of skills. Proven adult education methods (FAO) will be used to ensure a better learning environment.

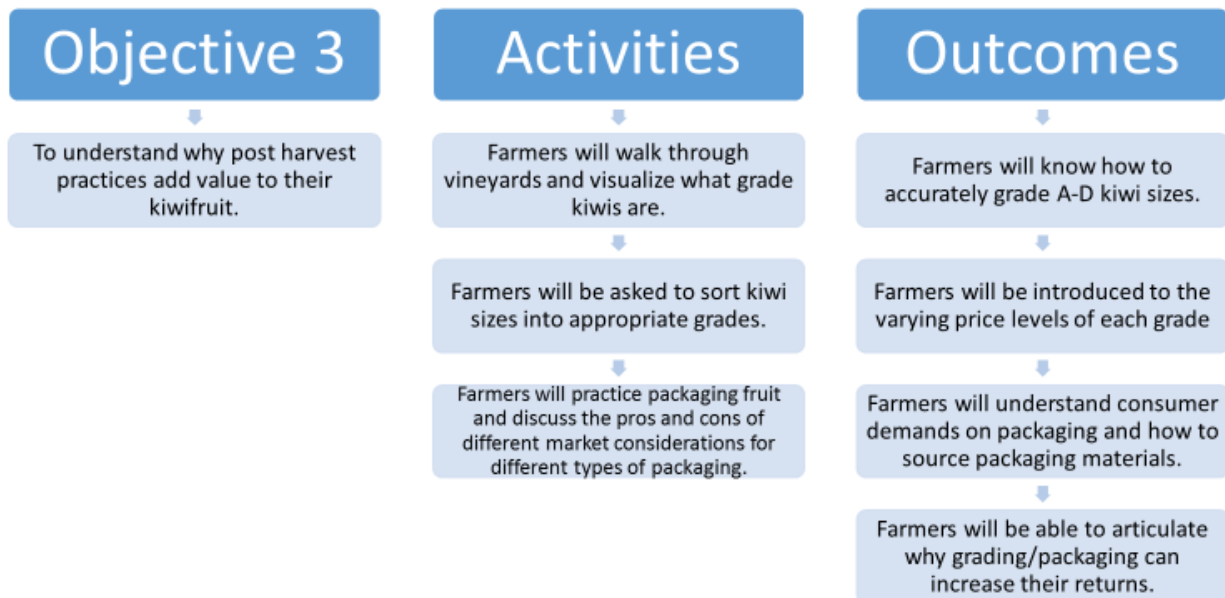


The trainings focus on three primary objectives: knowledge, skills, and attitude changes. The training will be set up as an environment where small group discussions and large group forums will facilitate debate, collaboration, and the use of knowledge within the community to solve problems related to harvest and post-harvest handling.

Learning Objectives







Values of Training

- Farmers are the local experts
- The best classroom is the field
- The trainer is the facilitator (not the expert)
- Team building build local collaboration
- Self-reliance (knowledge and resources are all locally available)

Important Cultural Norms and Rules To Follow

Norms: Set by specific community leaders and Aythos staff ahead of time.

Rules:

- Participate (listen, talk, ask questions, do activities)
- Share your experiences (good and bad)
- Stay for the entire training
- Have fun
- Respect each other when speaking

Grouping and Deciding Expectations

Grouping: Divide group into equal, smaller size groups. Give time for groups to decide on team name/cheer.

Expectations: Ask each stakeholder to articulate their expectations.

- What do participants expect to learn from the training?
- What do facilitators expect from the training?
- What do trainers expect from the training?

Adult Learning Methods to be Utilized: (NFE to be used)

- a. Sharing
 - I. Knowledge is shared in an open discussion format amongst small groups of farmers. This is best used when you want everyone to share and participate. Sharing is also a way to obtain feedback in informal/semi-informal interview settings. While participant share the trainer should help them stay focused by providing a question or topic of discussion.
- b. Case study
 - I. A problem or scenario is presented to the participants who must work together to figure out the cause or solution. Case studies are a great way to encourage teamwork as well as to allow farmers to work through situations they have/will encounter in their practice. Trainers should be aware that in some cases there may be multiple “right solutions” and should encourage participants to think critically.
- c. Problem solving exercises
 - I. Participants must work through a problem requiring physical movement, materials and group discussion. This method is highly participatory and experiential. In problem solving exercises the trainer must have a specific objective in mind. (i.e. grading kiwifruit correctly)
- d. Panel Discussion
 - I. Allow farmers to ask questions to the trainer or others with more experience. This can be used as a way to allow participants to lead the discussion and to obtain answers to their own questions. It is also a useful tool for sharing knowledge in a more formal setting.
- e. Brainstorming
 - I. Participants are encouraged to share all of their ideas without bias or judgement. This helps the trainer understand the participants’ existing knowledge (whether well informed or misinformed) and serves as an icebreaker into a given topic.
- f. Large group discussion
 - I. Often times used after a small group discussion to share relevant information obtained by each smaller group. This allows the larger group to benefit from the combined knowledge of the entire class after participants have shared in a less intimidating format.



Kiwi Harvest/Post Harvest Training Day Schedule

Duration: 7 hours (9:30 am – 4:30 pm)

Materials needed:

- 1 kilo of kiwis grade A-D
- 1 scale
- 4 small boxes for grading
- 5 storage container options (1 cardboard flat, 1 plastic bin, 1 basket, 1 tarp)
- Label examples
- 3 dried kiwi bags
- 3 chocolate covered dried kiwi bags
- 2 kiwi jam jars
- White board (1mx1m at a minimum) or chart paper
- 1 set of markers

9:30 am-10:00 am Farmers arrive and find a seat.

10:00 am - 10:30 am Introduction, grouping, and deciding expectations (share team names at this time)

10:30 am - 11:00 am Farmers brainstorm in small groups about what indices they use to harvest kiwifruit while sampling kiwifruit, followed by a larger group discussion

11:00 am - 11:40 am Each group is given a sampling scenario and asked to discuss the pros and cons of their scenario and present their scenario to the larger group. The farmers are then asked to vote on the strategy that they think is best. Discussions should happen in the field.

11:40 am – 12:00 pm Short didactic session explaining starch to sugar conversion using a graph.

12:00 pm - 1:00 pm LUNCH BREAK and official sign in, encourage farmers to talk about their farming experiences.

1:00 pm – 1:15 pm Brief review of knowledge learned during morning session, award lucky draw tickets to those that answer questions.

1:15 pm – 1:30 pm Small group discussion on *What is post-harvest handling?* And *Why is it important?* Ask each group to share one new thing about why it is important.

1:30 pm – 2:00 pm Give each group a different storage container and ask them to come up with a list of pros and cons for each container. Rotate the containers every 5-7 minutes depending on # of containers. (Plastic, cardboard, basket, bag, tarp).

2:00 pm - 2:30 pm Group discussion on the effects of temperature on fruit storage facilitated by trainer. Ask each farmer to identify one location in their home/community that they can store fruit that is safe from heat and pests. (Field trip to one home if possible).

2:30pm - 2:45pm Farmers will be shown fruit that is damaged in different ways and asked to identify if the damage was from rough handling, temperature, or disease/pests.

2:45 pm - 3:00 pm Tea Break

3:00 pm–4:00 pm Divide group into two equal halves. One have will learn how to grade kiwi by size while one group learns about market considerations for packaging kiwi.

4:00 pm-4:30 pm Summary of resources, evaluation, announce pruning class, lucky draw of value added kiwi products

Detailed Harvest Curriculum

Introduction, grouping, and deciding expectations

Objective: Begin to establish spirit of camaraderie between participants, so that everyone is ready to share, participate, and learn

Time: 10:00-10:30

Activities:

1. Facilitator introduces him/herself (especially their credentials as a farmer/teacher) and the training for the day
2. Split into groups and:
 - a. Introduce everyone in the group (along with sharing something silly, like your favorite TV show)
 - b. Groups decide a team name
 - c. Groups make a list of their expectations for this training to share with the whole class
3. Facilitator engages all groups in large group discussion about everyone's expectations, also introduces the facilitator's expectations to the group, if no one mentions them:
 - Participate (listen, talk, ask questions, do activities)
 - Share your experiences (good and bad)
 - Stay for the entire training
 - Have fun
 - Respect each other when speaking

Key questions (for facilitators): Why are you here today? What do you hope to get out of today? What kind of group atmosphere do you think is best for learning?

Discussing about harvest indices

Objective: Help participants understand what indicates kiwi maturity and ripeness, but through a classroom format which values participant knowledge

Time: 10:30-11:00

Activities:

1. Facilitator transitions the topic into kiwi harvesting by asking groups to come up with a list of things they think are important for deciding when to harvest kiwis
 - a. Facilitator and assistants circulate the room and guide discussion of the small groups
 - b. Lists can be written on paperboards
2. Small groups share with the larger group what they came up with
 - a. Facilitator asks questions of the groups as they present, highlighting important points that groups got or assisting in areas they missed

Key questions (for facilitators):

- What's the difference between a mature kiwi and a ripe kiwi? (facilitator guides answers to explain that ripeness means it is ready to eat, and maturity indicates that the fruit is ready for harvest, and that it will continue to ripen after picking. Immature fruit will not ripen after harvest so ***don't pick too early!*** Facilitator makes sure people understand that a major complaint about Nepali kiwis from vendors in Kathmandu is that Nepali kiwis are too sour compared with imports. This is because Nepali farmers pick too early—there is no reason their fruit can't taste just as delicious)
- How do you know when a kiwi is mature and ready to harvest? What methods have you used in the past? (rats become interested in the kiwis, black seeds tip, typical harvest time is last week of Nov-first week of Dec, etc).
- How do you think big commercial kiwi farmers know when to harvest their fruit? (after groups answer this question, facilitator explains penetrometer, refractometer, and harvesting method for commercial farmers, as well as ways for farmers to get by without this 10,000rs. tool)

Harvesting scenarios/case-studies

Objective: Get farmers to think through several relevant examples and apply what they've learned

Time: 11:00-11:40

Activities:

1. Facilitator transitions the group to case studies, introducing the task of evaluating pros and cons of each study, which each group will share with the larger group
 - a. Facilitator is assisted by other Aythos instructors, who each take one group to introduce the case study to and ask guiding questions

Scenarios:

- The farmer thinks the kiwis are looking good and it's getting to be the right time of year, so he harvests all his fruit at one time.

Pros: Harvesting at one time makes the work more efficient and allows the farmer to grade and sell his/her kiwis all at once to a broker/HEACOP.

Cons: Without checking if the fruit is mature (black seeds, rats are going after it, picking one and ripening it with a banana etc), this farmer may have harvested all their fruit too early, and the fruit will not ripen or taste as good.
- Farmer picks all the biggest fruit first to eat/sell, and then waits a few more weeks to pick the rest.

Pros: If the farmer doesn't have a way to sell their fruit all at one time, storing the fruit on the tree may be a good idea (it can last longer on the vine)

Cons: It may take more time/work. Farmer didn't use a system to confirm the fruit ripeness. If the big ones are mature/ripe, the little ones probably are too. If there is a frost, the fruit left on the tree will be ruined
- Farmer randomly samples a kiwi from many different vines in his/her vineyard, checking seeds for blackness.

Pros: Good way to see if all the plants are ready for harvest

Cons: Without ripening a fruit on their own, the farmer still might be harvesting too early to have the sweetest fruit.
- Farmer uses the late November-early December time window to know when to harvest

Pros: good way to know roughly when to harvest

Cons: if the weather this year has been different than usual, the optimal maturity may come earlier or later than the typical harvest window

Key questions (for facilitators): What are some of the strengths/weaknesses of this approach to harvesting? Would you do it this way?

Starch to sugar conversion in fruit and the role of ethylene

Objective: Farmers understand what causes the underlying process of fruit ripening and know of ways they can influence the speed of their kiwi fruit becoming ripe

Time: 11:40-12:00

Activities:

1. Facilitator transitions the group out of small group discussion and large group sharing to a new topic: how fruit becomes sweet
2. Questions are asked that fuel a discussion/lecture on how fruits convert starches to sugars after they are picked (for fruits like apples, bananas, kiwis. A fruit like a strawberry will generally not ripen if you pick it too early)
 - a. A visual representation in the form of a graph is used to show how starch content gets lower over time, while sugar content goes up

Key questions (for facilitators):

- Why do kiwis taste so bad when they are picked?
- What is happening in a kiwi (or apple/banana) as it becomes sweet?
- Do you know what influences this transformation? (temperature-things keep longer when they are kept cold, ethylene-this plant hormone speeds up ripening and apples + bananas make a lot of it)

Morning review

Objective: review reinforces learned material and gives opportunity for extra clarification of difficult topics

Time: 1:00-1:15

Activities:

1. Facilitator transitions the group out of lunch time/discussion into a review time
 - a. Questions are asked & correct answers are rewarded with extra lucky draw tickets
 - b. The facilitator will add to or clarify any confusing answers or difficult questions, reinforcing the morning learning
 - c. Participants are asked if they have any questions about the morning's material

Questions:

- How does a refractometer help farmers know when to harvest?
- When is the typical kiwi harvest time for Nepal?
- Without a refractometer, what methods can you use to know when to harvest your kiwis?
- What does the plant hormone ethylene do in the ripening process for kiwi?
- What method can you use to speed up the ripening of your kiwi fruit?

Post-harvest handling discussion

Objective: farmers will understand post-harvest factors that can increase or decrease the shelf-life and value of their fruit

Time: 1:15 -1:30

Activities:

1. Facilitator transitions the group out review time and into a post-harvest handling discussion
 - a. Small groups are asked to discuss: *What is post-harvest handling?* And *Why is it important?*
 - b. Small groups share with the larger group about what they've learned, facilitated by questions from the instructor

Questions:

- Why does it matter how you handle your fruit after you harvest it?
- What methods can you use to take good care of your fruit after harvesting?
- How long can your fruit last if you take good care of it?
- Why could it be worth your effort to take these extra measures post-harvest? (quality fruit, less losses, better \$, buyers will trust you and want to come back)
- Discussion should touch on: the role of keeping fruit cold after harvest, food safety for the people who eat the fruit, hazards for fruit quality (it can desiccate if the air is too dry-cover the boxes, it can get bruised and rot-be gentle with it, rats and other pests can get to it-so store it in a safe place from these)
- People should understand that kiwi can be stored for a long time after harvesting (4 months is probably feasible for them), as long as it is handled properly.

Storage container activity

Objective: farmers will analyze different storage containers, learning to identify the pros and cons of each as a packaging material or transportation tool

Time: 1:30-2:00

Activities:

2. Facilitator transitions the group to storage containers, explaining that there are pros and cons of the many options farmers have available to themselves
 - a. Each small group is given a different container, which they will analyze the pros/cons of before passing it along to the next group
 - b. Small groups share with the larger group about what they've learned, facilitated by questions from the instructor (less formal, as all groups got the containers)
 - i. Questions are concerning 1 container at a time
 - ii. Facilitator guides discussion, ensuring that it touches on cost, durability, ease of storage etc, for each container

Questions:

- What is a strength/weakness of this particular container?
- Would you use this storage container?
- How do you pick between storage containers?

Temperature effects

Objective: farmers will understand how temperature affects post-harvest losses

Time: 2:00-2:30

Activities:

1. Facilitator has small groups discuss: how does temperature affect fruit after harvesting?
2. Groups share with the larger group
3. Facilitator asks groups to discuss amongst themselves which places in their community are available for fruit storage

Questions:

- What does heat do to fruit?
- What does cold do to fruit? What if it freezes?
- Which storage spaces would be ideal? What are the pros and cons of current storage spaces?

Post-harvest losses activity

Objective: farmers will see examples of different types of post-harvest losses, understand what causes them, and understand how to avoid them

Time: 2:30-2:45

Activities:

1. Facilitator shows the large group examples of different types of fruit damage (actual fruit, and pictures), asking the group what caused the different damage
 - a. Causes include: rough handling, freezing damage, sunburn, high humidity, low humidity, pest damage
2. Participants brainstorm ideas for how to avoid these various types of damage

Questions:

- What caused this damage? Would you buy this fruit?
- How do you avoid having this happen to your fruit?
- What other concerns (besides taste and appearance) might you have with this fruit? (food safety!)
- Participants should understand that having damaged/rotting fruit with the rest of their fruit will cause the good fruit to spoil much faster. Remove any damaged fruit as soon as possible

Grading activity and marketing discussion

Objective: farmers will learn how and why to grade their kiwis, while also learning what steps add value to kiwis, demonstrating why farm-gate prices are below retail/consumer prices

Time: 3:00-4:00 (half hour for half the class on each activity before swapping)

Activities:

1. Two facilitators divide the class into two halves, doing each activity for 30 minutes

- a. **Activity 1: Kiwi grading**

- i. Facilitator asks group what they know about grading and why grade fruit
- ii. ABCD grades and their potential prices
- iii. Volunteers take a box of kiwi and grade them accordingly

Necessary materials: a scale, 4 boxes, 1 kilo of each grade of kiwifruit

- b. **Activity 2: Marketing discussion**

- i. Facilitator guides discussion of the costs are of selling farm produce.

Midway through, they are given the handout of different marketing costs

1. Transportation costs
2. Packaging costs (materials and labor)
3. Post harvest losses
4. The cost of running a store (rent, mortgage, electricity, paying employees)

Questions:

- **Activity 1:**
 - Why does grading add value to your kiwis?
 - Who currently grades their produce? What other crops have you done grading for?
 - Which grade of kiwi would you prefer? What grade do you think you'll harvest the most of this year?
- **Activity 2:**
 - Why might it be fair for a farmer to sell their fruit for 200-300rs. a kg. and Bhat Bateni to sell it for 700 rs.?
 - Would you prefer to take these steps yourself to get a higher value for your fruit, or would you rather sell your fruit to someone else who will take these steps?

Appendix B



Training Evaluation Forms

Trainer Self-Evaluation

| | |
|---------------|-----------------------|
| Trainer Name: | Training Date(s): |
| Training: | Number in Attendance: |

| Please rate your experience and yourself: | Uncertain | Below expectations | Met expectations | Exceeded expectations |
|---|------------------|---------------------------|-------------------------|------------------------------|
| I was pleased with the training | | | | |
| I emphasized the farmer as the expert | | | | |
| I followed the curriculum | | | | |
| I taught on all learning outcomes | | | | |
| My time management | | | | |
| I facilitated effective activities | | | | |
| I felt prepared | | | | |
| The communication from Aythos in preparation for the training | | | | |
| I made adjustments to the delivery based on participants' needs | | | | |
| I transitioned well between content | | | | |

What went well about the training?

- 1.
- 2.

What could be improved about the training?

- 1.
- 2.

Did you cover all the material? If not, what did you miss and why?

Is there anything Aythos could do to better support you during a training?

Would you be interested in working with Aythos again in the future?

Trainer Evaluation

| | |
|---------------|-----------------------|
| Trainer Name: | Training Date(s): |
| Training: | Number in Attendance: |

| Please rate your experience and the trainer: | Uncertain | Below expectations | Met expectations | Exceeded expectations |
|---|-----------|--------------------|------------------|-----------------------|
| I was pleased with the trainer | | | | |
| The trainer emphasized the farmer as the expert | | | | |
| The trainer followed the curriculum | | | | |
| The trainer taught on all the learning outcomes | | | | |
| The trainers' time management | | | | |
| The trainer facilitated effective activities | | | | |
| The trainer seemed prepared | | | | |
| The communication from the trainer before the training | | | | |
| The trainer made adjustments based on participants' needs | | | | |
| The trainer transitioned well between content | | | | |

What did the trainer do well?

- 1.
- 2.

What could be improved about the trainer?

- 1.
- 2.

Did the trainer cover all the material? If not, what did they miss and why?

Is there anything Aythos could do to better support a trainer?

Would you be interested in working with this trainer again in the future?

Training Evaluation

| | |
|-----------|-----------------------|
| Name: | Training Date(s): |
| Training: | Number in Attendance: |

| Please rate the training | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|-------------------|----------|---------|-------|----------------|
| I was pleased with the training | | | | | |
| The learning objectives were clearly defined | | | | | |
| The time allotted for the training was sufficient | | | | | |
| The “classroom” space were adequate and comfortable | | | | | |
| Adequate tea and snacks were provided | | | | | |
| The curriculum was organized and easy to follow | | | | | |
| The curriculum was a helpful tool that I would use again | | | | | |
| Small group discussion allowed more people to share their opinions | | | | | |
| The activities were fun and effective | | | | | |
| I felt like a valuable part of the team during the planning process | | | | | |
| I felt like I was able to contribute to the success of the training | | | | | |
| My opinions were respected throughout the training planning and execution | | | | | |
| I feel more equipped to plan a training on my own | | | | | |
| I feel more equipped to advise farmers on the training topic | | | | | |

What went well about the training execution?

- 1.
- 2.

What could be improved about the training execution?

- 1.
- 2.

What went well about the training planning/preparation?

- 1.
- 2.

What could be improved about the training planning/preparation?

- 1.
- 2.

Is there anything that could be done to make me feel more supported in my job for the next training?

List at least one management skill you learned and if you think you will apply it in your job (if you did not learn anything you can leave this blank):