Food Preservation in Rural Tamil Nadu, India

Karthik Raman[1]
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In collaboration with
The Women's Organisation for Rural Literacy and Development Society

1Karthik Raman graduated with a Bachelor's degree in Economics from Case Western Reserve University. He served as a Coro Fellow in Public Affairs (US). As a 2007-2008 Indicorps Fellow, Karthik Raman volunteered with the Women's Organisation for Rural Literacy and Development Society (WORLD Society) in the remote villages of the Naickaneri Hills in Vellore District of Tamil Nadu.

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Abstract

In the Naickaneri Hills in Vellore District of Tamil Nadu, India, the local community is specifically challenged with obstacles that limit their ability to consume vegetables on a daily basis. This is significant to their health because, according to the National Institute of Nutrition's publication "Nutritive Value of Indian Foods", fruits and vegetables provide several necessary vitamins and minerals. According to the UN's Food and Agriculture Organization food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. This case study highlights the implementation of a technology that enables the rural and urban poor to preserve produce in order to increase food security.

The described technology is widely referred to as the Pot-in-Pot or Zeer. The need for the intervention, experiences, and lessons learned from implementation are systematically elaborated and included. Depending on local situations in other communities, the presented technological solution and its implementation could provide useful insights to tackle issues of lower consumption of various types of produce.

1.0 Introduction

This case study highlights the implementation of a technology that enables the rural and urban poor to preserve produce for longer periods of time. Widely referred to as the pot-in-pot or zeer, it came to be known as the small fridge or rural fridge in the local community.

As a 2007-2008 Indicorps Fellow, I volunteered with the Women's Organisation for Rural Literacy and Development Society (WORLD Society) in the remote villages of the Naickaneri Hills in Vellore District of Tamil Nadu. WORLD Society is a non-governmental organisation (NGO) that focuses on the development issues relatedto local women. I spent my time with them working on nutrition interventions.

The Naickaneri Hills are located eighteen kilometers east of the small town of Ambur in Vellore District of Tamil Nadu state in India where villagers procure vegetables for consumption. Villagers tend to go to Ambur once a week. Since vegetables usually stay fresh for only two to three days, people often eat vegetables for two to three days a week only.

With the pot-in-pot, the villagers were able to keep their fruits and vegetables fresh for upwards of a week. Assuming people went to Ambur at least once a week, they should be able to restock their produce and consume vegetables daily, thus boosting their intake of essential micronutrients.

In this paper, a description of experiences with implementation of pot-in-pot technology and lessons learned from implementation are presented. The ideal audiences include, but are not limited to, practitioners of health interventions in rural and urban settings throughout the world. Depending on local situations in rural and urban communities throughout the world, health practitioners may find this intervention to be a useful solution to address issues of lower consumption of various types of produce. Unless otherwise noted, all information gathered in this endeavor came from informal conversations with the villagers themselves.

1.1 Community

Approximately 5,000 Adivasis or tribal villagers occupy the twelve village hamlets in Naickaneri Hills area. Men and women both engage in agricultural work and the collection and sales of firewood. The firewood is sold in Ambur. Part of the agricultural produce is consumed at the villagers' homes; part is sold in Ambur. Some individuals and families have begun to migrate to Karnataka and Kerala to engage in construction and agricultural labor work for extra income. The village has gone through some development in the past ten years. For instance, a bus now runs between Naickaneri and Ambur four times a day. This bus ride takes about fifty minutes each way.

1.2 Historic Diet

Traditionally, people here ate a balanced diet of whole grains, pulses, vegetables, and dairy products. People used to grow corn and a variety of millets including finger millet (or ragi), foxtail millet, pearl millet, and sawmai (sawmai is another millet which does not have an equivalent English name) in abundance and saved them in large gunny sacks in their homes. The finger millet was consumed in porridge form as culley; the corn and other millets in semi-liquid form as a dish called "cool"; and the sawmai prepared similarly to rice. Villagers consumed vegetables, most of which were grown on their

farm, in stew form as columbu and pulses, which were either procured in Ambur or grown on the farmland. Dairy was consumed as yogurt; each household owned about two to three cows.

1.3 Changes to Historic Diet

In the recent past, dietary patterns began to shift. Once the government-run public distribution system opened in the community, people started to buy lots of white rice, as it is cheap (5 rupees per kg), and consumed that instead of the traditional foods which contained a variety of grains. Eating a variety of grains is important as each type of grain provides different vitamins, minerals, amino acids, and fatty acids in different proportions. Some people continued to eat culley, cool, and sawmai, but not nearly as much and not nearly as frequently. Now, much of the farmed vegetables along with fruits are sold in Ambur instead of being consumed within the community. A bus service began to Ambur about seven years ago making selling produce much easier than before.

In the past, every family had about two to three cows, which allowed them to consume curd on an almost daily basis. The Forest Office then began to fine anyone who allowed their cows to graze in the forest. The Forest Office was attempting to balance the needs of the population at large with those of the local community. They are a government agency charged with preserving the forest, which is the traditional realm of the local tribes. The local cows proved to be a nuisance and deleterious to the attempts to grow new plants. Thus, the Forest Office chose to control the cows by outlawing their presence in the forest. To compensate the villagers for this and other actions, the Forest Office built a nearby boarding school, began to employ local villagers, began to offer loans for self help group members, and held occasional health camps. All these initiatives were designed to minimize the harmful impact of the Forest Office on the lives of the villagers. However, the new laws concerning livestock discouraged many villagers from keeping their cows, bulls, and buffaloes. They ultimately let their animals go and never went back to find them. Some have been able to keep their animals, but end up circumventing the laws by bribing the Forest Officers. Some villagers also say that at about the same time, many cows and bulls fell ill and died en masse.

Precipitation in the Naickaneri Hills has steadily decreased for the past decades or so. The lower rainfall is a factor that impacts other local nutrition issues. A reduced water availability means lower milk production from bovine population to feed their young and therefore, reduced consumption of milk by the population. As a result of lower rainfall, people grow smaller quantities of cereals and vegetables that affect their consumption of vegetables further.

1.4 Current Diet

To assess the community's current nutrition situation, I became an active participant in community activities. I ate at the villagers' homes; I conducted interviews of village life and health; and I learned how to cook from the villagers and prepared my own meals for about a month, early in the process.

This informal interaction allowed me to experience the local diet firsthand. I was able to identify the typical diet, as there was only moderate variation from one home to the next. Based on this purely qualitative data, I came upon the following observations:

1. While exact meal times vary from home to home, meals were generally scheduled around 9 AM, 12 PM, and 7 PM with tea consumed at 7 AM and 4 PM.

2. As stated above, meals largely consist of white rice and columbu. The white rice, as mentioned above, is by large obtained from the public distribution system. The rice is washed well, so while I cannot be certain, it is unlikely that much bran remains on the rice. Occasionally, traditional Naickaneri dishes, such as culley are eaten. Columbu is a traditional South Indian gravy in which lentils and tomatoes are boiled. Other boiled vegetables can also be added to the gravy. The columbu and the rice or culley are eaten together. In the Naickaneri Hills, the columbu will oftentimes not contain vegetables. When it does, the most common vegetables consumed are eggplant, potatoes, and drumstick.

3. There are some limitations to the above observations. It is difficult to assess whether community members fed me better than they fed themselves. Also, as much as I tried to interact with a large, diverse group of people, I may have eaten more frequently with households from above the average income range. This is because I did not actively select houses to eat at; I ate meals with the families who invited me to join them.

1.5 Structured Assessment

In May 2007, The Food and Nutrition Technical Assistance (FANTA)[2] Project's Household Daily Diversity Score (HDDS) was used to determine various households' access to a diverse diet.

Access to a diverse diet is often an indicator of access to micronutrients. Of twelve villages, three of the most remote were surveyed. Of a total of approximately 700 households, 103 are located in these three villages. Of these, 71 were present and responded to the questions asked. We surveyed their previous day's food intake and categorized it into twelve groups. Each home then received one point for each category filled. The twenty-four hour recall method was used to reduce the possibility of error in remembering what was eaten in the household. The advantages of the twenty-four hour recall method are explained in the **FANTA document above.**

The HDDS only looks at categories, not at quantities of food consumed, as it is not a diagnostic to determine specific deficiencies in diet, but rather a tool to help us best determine a household's ability to access and consume foods from various categories. There are no absolute high, low, or mediocre scores in the HDDS methodology; it is a tool to determine where a household stands and what realistic targets should be for improvement. We implemented the HDDS in the middle of May when food and income are likely to be at a low point, as it is right before the monsoon season begins. The final score for the three villages on a scale of 1-12 was 3.25 (a raw score of 231 for 71 households surveyed). This is lower than what I had expected based on my experience in the community. This perhaps indicates the bias in my perceptions, as the community members may have been feeding me better than they feed themselves. This result may also indicate that I tended to eat with relatively wealthy families in the community.

The major reason for a lower than expected score was that fewer families than anticipated had eaten vegetables the previous day. Fifty two of the 71 families had not consumed any vegetables besides the few tomatoes required to make parrupu columbu (lentil stew). Another result was that many of those 52 families casually mentioned that they cannot make the trip to Ambur more than once a week to buy

2. The Food and Nutrition Technical Assistance (FANTA)
(http://www.fantaproject.org/downloads/pdfs/HDDS_v2_Sep06.pdf)

vegetables, especially during the dry months of December through July. **As can be seen below**, this casual feedback was the impetus to try an intervention aimed at food preservation. The implementation and results of the HDDS are not meant to be scientific experiments. The intended (and in my eyes, achieved) outcome was to gain a greater understanding of the local situation and be able to express new findings through this framework.

1.6 Importance of Fruit and Vegetable Consumption

According to the National Institute of Nutrition's publication Nutritive Value of Indian Foods, fruits and vegetables provide several necessary vitamins and minerals. Specifically, green, leafy vegetables contain calcium, iron, beta-carotene, vitamin C, riboflavin, and folic acid. These aid with growth and maintenance of good health. Other vegetables provide necessary minerals, vitamin C, and bulk to the diet. Fruits contain beta carotene and vitamin C.

2.0 Summary of Introduction

As times have changed, the traditional Naickaneri diet has steadily deteriorated for various reasons. When asked, many villagers felt they were healthier before the drastic changes in dietary pattern. Many fruits and vegetables are sold by the villagers in the town of Ambur. Ambur is also where most vegetables are acquired during the dry season. As many cannot make this trip more than once a week, they are left with no choice but to go without the vital nutrients in fruits and vegetables for four or five days per week for as many as eight months of the year. Next part of the paperexplores the possible and ultimately, the ideal solution for this local community.

3.0 Solutions

There are three potential solutions for the food preservation issue facing those of the Naickaneri Hills: electric refrigeration, zero energy cool chambers, and the Pot-in-Pot.

3.1 Electric refrigerators

Electric refrigerators (fridges) are cooling appliances, comprising a thermally insulated compartment and a mechanism to transfer heat from it to the external environment, which cools the contents to a temperature below ambient. The advantages of the fridge are:

1. It does not need to be maintained.

2. It can preserve not only fruits and vegetables, but also dairy, juices, and medications.

The drawbacks are:

1. It requires electricity.

2. It is relatively expensive.

3. Space is required in the home for it.

In the Naickaneri community, a fridge is not an ideal solution, as people would not be able to make the upfront investment in one. Also, many homes would not have the space or even the access to electricity. Interruptions in access to electricity that last longer than a day occur on a monthly basis, which also makes this solution impractical for the local population.

3.2 Zero energy cool chambers

A zero energy cool chamber[3] is a double brick walled structure used to preserve fruits and vegetables. The gap between the two brick walls is filled with river or lake sand. The sand is saturated with water. Water must be poured over the sand to ensure that it remains moist. As the water evaporates, it removes the heat from within the chamber through the process of evaporative cooling.

The advantages of the cool chamber are:

1. It is relatively inexpensive.

2. It can be made from locally available materials.

3. Its size can be fitted to the household need.

4. It can be easily made and maintained.

The drawbacks are:

1. Space is required outside the home for it. Many homes are built close together and this space immediately outside the home would be difficult to find.

2. Even at the smallest size, it is probably too large for one family's needs.

3. Needs to be watered daily.

4. Depending on the size, it may require a great deal of water. Although the community has reliable access to water, the quantities needed would require additional trips to local wells which could be seen as an undue burden.

While the cool chamber is far more suitable to the community than a fridge would be, many families do not have the space near their home, where meals are prepared, to construct such an object. Also, the size is too large for one family. Therefore, this option was kept as a backup in case the Pot-in-Pot did not prove to be successful.

3.3 Pot-in-Pot Coolers

3. Zero Energy Cool Chamber (http://www.kvk.pravara.com/horti/zeccsuccess.htm)

Similar to the cool chamber, the pot-in-pot[4,5] relies on evaporative cooling to keep fruits and vegetables fresh for longer periods of time. Instead of a double brick walled structure though, two earthenware pots are used; one needs to be able to fit within the other. Again, the gap between the two is filled with river or lake bed sand and must remain moist.

The advantages of the pot-in-pot are:

1. It is relatively inexpensive.

2. It can be made from locally available materials.

3. It can easily fit within a home.

4. It can be easily made and maintained.

5. It requires less water than the cool chambers.

The drawbacks are:

1. Needs to be watered daily.

2. If it needs to be transported, it can easily break.

3. Potters may not have large pots readily available, and specially designed pots may be required.

The pot-in-pot has clear advantages over the other two options: this not only fits the villagers' budgets and lifestyles, but can also fit into their homes.

4.0 Implementation

4.1 Pilot technology

The pot-in-pot was piloted at the home of a local NGO staff member. All told, the two pots along with a small lid cost 50 rupees. The head of WORLD Society donated 1 kg of tomatoes for the trial run. I informed the family how to water the sand to preserve the internal temperature of the device. I then checked on it everyday for approximately two weeks.

There were initial difficulties in determining how much water to use in the pot-in-pot. The first two days, the family was not using enough water. Both days, I asked them to use more water. The sand was still dry to the touch and I was worried that the vegetables would spoil at their usual rate. Starting the third day, the family started pouring too much water in the sand. The inner pot then began to absorb some of the water. As a result, the water then lay at the bottom of the inner pot, creating the possibility

4. Pot-in-pot tutorial (http://other90.cooperhewitt.org/Design/pot-in-pot-coole)

5. Pot-in-pot history (http://www.bbc.co.uk/dna/h2g2/A2116766)

that the tomatoes would spoil. I then suggested that the family use a moderate amount of water. This produced no change in the excess water used by day four, so I added a plastic bag to separate the tomatoes from the excess water. It was difficult to determine the exact amount of the water needed for keeping the pot running at the optimum level because humidity, temperature and other climatic conditions affecting the evaporation rate of water keep on changing on a daily basis. In the end, we were not able to determine the exact amount of water needed on a daily basis; instead we relied on the plastic bags to ensure the produce did not spoil from too much water.

The tomatoes lasted and came out unharmed for a total of seven days from being placed in the pot. The family and I then consumed the tomatoes in columbu form. I continued to eat regularly with the family. I would look at the pot just to see the contents and their condition. For at least another week, the family only used the device for storing tomatoes. I was tempted multiple times to talk to the family about all the possible uses for it, but I wanted to wait and see them adopt it as their own.

After a week, the family started to use it to store many vegetables—even carrots, which are not commonly consumed in this community. It was exciting to see the local community adopt and take ownership of this new technology. The end of the pilot came, ironically, during the monsoon festival when so many vegetables were procured by the family that they could not store them in the pot. After the festival, I repeatedly asked why they had stopped, but the only response I received was that it was the daughter's responsibility. The daughter, however, did not give me a straight answer when asked about the pot-in-pot. It has since remained unused.

4.2 Pilot - Lessons Learned

1. The family discontinued using a technology that they were originally excited to use and that benefited their daily lives. My analysis is that they stopped because they did not have to invest in the price or construction of the device. In the future, we need to find the appropriate balance between requiring the families to invest in new ideas, but at the same time we should be realistic about their economic situation and at what level the financial barriers would prohibit them from investing.

2. During the pilot, we did not determine the appropriate amount of water to use. Although using the plastic bags worked, the appropriate amount of water should be determined to enable further attempts at scaling.

3. It was difficult to imagine that the small size of the pot-in-pot would be able to store enough vegetables for one family for an entire week.

4.3 Scaling

The next step involved obtaining more pot-in-pots of larger sizes. I worked with a potter as he experimented with various sizes for both the inner and outer pots. After a month of various attempts, he hit upon a design that could hold approximately twice as much produce as the original pot-in-pot that was used in our pilot. During this time some failed pots were built, including some which leaked. Leaking pots would not be useful as the water would escape and the produce would not remain as cold. Once we had addressed these various issues, we were ready to expand the reach of the pot-in-pot.

We did need to figure out the ideal pricing structure. After the initial trial, it was known that we had to

charge a price for the pot-in-pot so that we could ensure people would continue to use it. Unfortunately, the larger pots and lid cost a total of Rs. 75 ($1.5). Many homes were interested in purchasing the device, but were hesitant about investing that sum of money. It was decided that the NGO would supply Rs. 50 per home and the local community members would pay Rs. 25 for a complete pot-in-pot set. There were many villagers who were easily willing to pay this price.

The weather was a problem. The last step in preparing earthenware is to boil it. Many potters only perform this activity once a week. Also, the day for boiling pots has to be on a day when there was no rain for at least three days before the boiling day. As we started to focus on this at the end of the monsoon, there was a significant delay in the pots being prepared.

Transportation became another issue. As Naickaneri only has a population of 5,000, there is no potter within the community. The closest potter we found who was willing to work on this experiment lived about two hours away; it required changing two buses to travel there. There was considerable difficulty in organizing the local community in going there, so the NGO and I eventually decided to go to the potter ourselves to acquire the pot-in-pots. Due to our interest in scaling quickly, we even covered the cost of transportation which was approximately Rs. 50. Transporting the pots via buses required the potter to package them tightly and for one person to hold two pot-in-pots, so that we could prevent them from breaking on the bus ride. After much waiting and coordination, we were able to transport fifteen pot-in-pots to the Naickaneri community.

In summary,fourteen pots were successfully set up and maintained and one more was purchased but was not set up before I left. Fourteen were successfully set up and were running for the final week of my fellowship. These pots required the same level of follow-up with families as we did with the first family. This time, however, people were only instructed on how to install their pot-in-pots, so they were more invested and could later instruct other families on how to set them up. The same issue of knowing how much water to use manifested later in the use of the pots. After several days of experimentation, we determined that a half glass of water twice a day was approximately adequate for the size of the pots we were using. As all the pots came out to be slightly different in size, we learned that the water requirements for pots also varies with the thickness of the walls of the pots other than factors described before.

4.4 Scaling - Lessons Learned

1. People are willing to pay for goods they value, assuming they can afford to do so.

2. Pots need to be boiled. This cannot happen if it rains three days within the boiling. Thus, the monsoon is not the ideal time to implement this technology.

3. Transportation logistics can reduce the number of pot-in-pots that can be moved from one rural location to another. These difficulties could be overcomed, but the number of pot-in-pots transported is limited to the number of people available to move them.

4. Pots need to be checked for leak.

5. Most of the families need maintenance assistance for the pots, especially, in first few months of

installation.

5.0 Sustainability

The key players at the NGO and the potter have met and interacted with each other, increasing the likelihood of sustainability. NGO staff members have also adopted the technology themselves, so other community members can see the value of the product. The feedback from those who currently use the device has been positive, which should also generate further interest within the community. The pot-in-pot is a reliable, useful technology, so further awareness campaigns should not be necessary per se.

Beyond this particular village, the pot-in-pot should be scaled up by other parties. The potter we have worked with has an interest in marketing the product, as he benefits from its sales. He works in a village known for pottery, so as people visit him for sundry pottery needs, he has the incentive to inform them about this new product line.

5.1 Challenges to Sustainability

1. The 50 rupees subsidy we introduced early on may in the end dissuade people from investing in the product if the subsidy disappears.

2. Thus far, no one has had to travel to the neighboring village to secure their own pot-in-pot. The transportation time and cost may discourage people from traveling such distances.

3. There is no urgency in the community to invest in the new technology.

6.0 Lessons for Other Practitioners

1. The rural poor are willing to invest in new technologies for their own benefit; though, it is difficult to determine when and where a subsidy should be offered. In this case, most of the product's price and all the associated transportation costs were not born by the beneficiaries. In hindsight, I wish we had never included the subsidy, as some villagers have commented on how it was unnecessary.

2. I was never able to create a sense of urgency to purchase the pot-in-pots. I have no advice on how to do this, but it would help for the product to gain a critical mass in a given community.

3. It is best to think several months ahead when implementing this in a new locale. Several steps are required:

a. A potter needs to be found.

b. The potter needs to experiment with making the pot-in-pot.

c. Interest needs to be generated amongst the intended population.

d. The pots need to be prepared, boiled, and transported.

e. There should be a demonstration of how to set up the pot-in-pot.

f. Significant follow up needs to occur with each home.

4. For the above to occur in an uninterrupted manner, it is best to wait until the monsoon has finished before the production process begins. Initial contacts could be made near the end of the monsoon.

7.0 Concluding Remarks

As stated in the introduction, the pot-in-pot is a viable, locally appropriate technology for addressing nutrition issues throughout the world. This statement needs to be taken with some caution, however. This technology only saw a slow adoption by the community because it was adapted to the community's needs and available resources. Similarly, anyone attempting this in another location must have a comprehensive, grassroots understanding of the local community and how the pot-in-pot would best serve the needs of the community and adopt the pot design and implementation according to the needs.