Rebuilding Nutritional Security of Golden 1000 Days Earthquake hit Families

Asta-Ja Research and Development Center (Asta-Ja RDC)
Kathmandu, Nepal
Email: astajardcnepal2014@gmail.com

Background
Asta-Ja Research and Development Center (Asta-Ja RDC) and the United Nations Children’s Fund (UNICEF) have entered into an agreement for the implementation of a project entitled “Rebuilding Nutritional Security of Golden 1000 Days Earthquake hit Families” on February 1, 2017. UNICEF is involved in improving early childhood health in Nepal and elsewhere (http://unicef.org.np/campaigns/golden-1000-days). Thus, UNICEF has funded Asta Ja RDC NPR 5,408,150 to implement an interdisciplinary Dry Chain project in a village in Kavre district.

The overall objective of this project is to contribute to the reduction of malnutrition among 2015 Gorkha Earthquake affected children and mothers by using simple and scientific food storage Dry Chain technology. The specific objectives are:

1) To minimize food and nutrition losses through preventive measures to control molds, insects and rodents.

2) To raise awareness about the nutrition sensitive Dry Chain technology by training local communities.

Dr. Peetambar Dahal, Retired Seed Scientist from University of California, Davis, USA, and Asta-Ja RDC Volunteer, has led a team of scientists and staff from Asta-Ja RDC, Dr. Jwala Bajracharya, Dr. Bishnu Chapagain, Mr. Pushpa Lal Moktan, Mr. Hari Bhusal, and other Asta-Ja RDC volunteers.

In order to implement this project, a number of stakeholder meetings were held in Kathmandu including Child Health Division in the Department of Health Services, Ministry of Health (MOH) and UNICEF Chief Mr. Stanley Chitekwe. We consulted other stakeholders including NAFSEEDs, Dahal Trading, MOAD, MOH, Nepal Reconstruction Authority and Zest Laboratory and Dept. of Food Technology and Quality Control. We also partnered with Jeff Davids who works on SmartPhones4Water in Kathmandu and uses Open Data Kit (ODK) to enable citizen scientists to collect hydrologic information through Android phones.

Pre-survey of the candidate village
A pre-survey of the candidate village was undertaken on Feb 27, 2017 as the consultation meetings at district headquarter Dhulikhel was delayed due to national agitation by staffs within the health sector. The survey team, consisting of Crop Development Officer (CDO) Tharka GC in District Agriculture Development Officer (DADO), Hari Bhusal and Peetambar Dahal from Asta-Ja RDC,
visited Ugrachandi Nala village. Poor quality of the maize was noticed in the open structure Suli (Figs. 1-3). Such poor quality of the food was convincing enough to the stakeholders to agree on implementing the program in this village.

Figure 1. Corn quality following 6 month open storage in local Suli structure at Chunataal, Ugrachandi Nala VDC on Feb 27, 2017.

Figure 2. Detailed view of individual corn from Fig. 1.
Figure 3. Corn quality following 6 month open storage in local Suli structure at Chunataal, Ugrachandi Nala VDC on Feb 27, 2017.

**District level stakeholders meeting**

At the district headquarter in Dhulikhel, we held group consultation with representatives from District Public Health Office, District Agriculture Development Office, Local Development Office, Veterinary Office, UNICEF affiliated staff and NGOs on March 2, 2017.

**District Public Health Office:** Suresh Paswan, Nutrition Officer; Janardan Neupane, Sagar Krishna Kayastha

**Local Development Office:** Sabita Sharma Adhikari

**DADO:** Durga Pandit, Tharka GC, Krishna Dhital

**Veterinary Office:** Raj Kumar Humagain

**UNICEF:** Ram Hari Acharya

**NTAG district coordinator:** Ravi Neupane.

**Asta Ja RDC:** Drs. Jwala Bajracharya, Jagat Devi Ranjit, Bishnu Chapagain, Peetambar Dahal and Mr. Hari Bhushal

**NAFseeds:** Rasmila Dongol.

Following suggestion of Local Development Office (LDO) representative, Dr. Bishnu Chapagain asked DADO to chair the interaction. After a brief introduction of the participants, Peetambar
Dahal presented the nutrition sensitive dry chain food technology. Although there were some concerns initially about choosing Ugrachandi Nala VDC, the quality of the food seen there convinced the stakeholders that we should try to improve the food situation. It became clear to everyone that preventing the food deterioration in the first place would be beneficial. Then, appreciative remarks were expressed by DADO, DPHO and veterinary officers. The veterinarian in particular was thankful for including his office in the interaction. Ram Hari Acharya, UNICEF, asked us to use the Female Child Health Volunteers (FCHV) network already identified by UNICEF. He further advised to share the nutrition message of UNICEF to our target households. These messages were: (i) Improve nutrition by using fresh produce through kitchen gardening (ii) Ask 1000 Golden Days families for wasting parameters (iii) Visit DPHO for nutritional supplements if needed.

1000 Golden Days Families

We had planned to help 1000 -1000 Golden Days families initially but targeting merely these households posed logistic problems in the program implementation. During the interaction at Dhulikhel on March 2, 2017 and at the health post in Ugra Chandi Nala VDC on March 6, 2017, it became clear that whole district would need to be covered if we target and support only 1000 Golden Days households. However, it was not possible with available resources of the current project. Additionally, the corn sheller was proposed to be shared between households. Clearly, the sharing activity demanded clustering of targeted households for maximizing the benefits. As a compromise, it was agreed that 1000 Golden days families should not be omitted within the target village. Our survey indicated that there are approximately 20 pregnant women and 110 children under 2 years in the target village.

Meeting FCHVs at the health post

We invited FCHVs from each ward of Ugrahnadi Nala VDC at the healthpost on March 6, 2017 and Peetambar explained the program concepts and asked their help to take the program to their wards (Fig. 5). However, FCHVs asked us to talk to the target households directly about the program and convince them. Seemingly simple, it was a tough proposition that would involve changing traditions. Thus, we had to convince the target households at each ward when we demonstrated proper use of the hermetic food storage bags and the corn shellers. To cover 1000 target households, we selected wards 4 (partial) and wards 5 through 9. We have asked the households to take the pictures of the grains before shelling. We will be monitoring the use of the hermetic bags and corn shellers at each household. Although we had not planned much support to these dedicated FCHVs, they were instrumental for delivering the nutrition enhancing storage materials.
Procuring hermetic bags and corn shellers

We procured triple layer hermetic /airtight food storage bags from NAFseeds as specified in the proposal. Based on the motto to help the children and mothers’ nutrition, we looked for ways to minimize the household labor that is mostly performed by the mothers. We identified corn sheller as one single item that could minimize women’s time in food preparation as well as help improve the food quality. Based on our interaction with households and further suggestions by CDO Mr. Tharka GC on Feb 27, 2017, we replaced the manual corn shellers by the electric ones (Fig. 5). This change was also supported and appreciated by the FCHVs whom we met at the health post (Fig. 4).
Distribution of nutrition enhancing hermetic bags and corn shellers

We used network of FCHVs at the health post to identify 1,000 households who produce rice and maize. FCHVs regularly provide other nutrition and health knowledge to pregnant women and children (Golden 1000 days families). We described the project objectives and usefulness of the hermetic bags and corn sheller to improve nutrition of the households. We discussed the pesticide-free control of insects which was the main grain storage problem faced by the households. We shared nutritional messages advised by UNICEF during the material distribution in each ward and will repeat these in monitoring visits.

We emphasized that the hermetic bags should be used to store food “**dried to suitability to milling or processing moisture content**”. If food cannot be dried to milling moisture content, it should **not be stored inside hermetic bags**. As this single interaction in a mass could not be very effective, we are making home visits to show proper use of the hermetic bags (see monitoring below). One electric corn sheller has been provided to groups of about 30-40 households so that maize cobs could be shelled and stored in hermetic bags avoiding open storage in raised structures. The corn sheller will be managed by **user groups** in each ward and they have devised strategy to replacing these units in case of breakdown. This enthusiasm shows the utility of these units in helping the mothers who mostly prepare the food for the children. We note that the corn stored in structures outside the home was of inferior quality such that it was being fed to the animals (Figs. 1-3). Besides, the hermetic storage would minimize women labor in postharvest food management freeing more time for mothers in the nutrition and education of the children. As a part of agreement with the households, they will store dry food for about eight months in hermetic and traditional bags and selected families will provide initial and final samples for nutrient, anti-nutrient and physical quality analysis. After such understanding in the mass meetings, we delivered nutrition enhancing supplies to the groups of target households that assembled at each ward (Figs. 6-11).

The table below shows the FCHVs and the quantity of bags and electric corn shellers distributed in their respective wards.

<table>
<thead>
<tr>
<th>FCHVs</th>
<th>Ward #</th>
<th>Household #</th>
<th>Bags</th>
<th>Bundles of 50</th>
<th>Corn shellers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambika Sanjel</td>
<td>4 (partial)</td>
<td>55</td>
<td>440</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Subhadra Bajgai</td>
<td>5</td>
<td>250</td>
<td>2000</td>
<td>40</td>
<td>6</td>
</tr>
<tr>
<td>Sita Sigdel</td>
<td>6</td>
<td>197</td>
<td>1182</td>
<td>22</td>
<td>5</td>
</tr>
<tr>
<td>Manju Dahal</td>
<td>7</td>
<td>212</td>
<td>1696</td>
<td>34</td>
<td>6</td>
</tr>
<tr>
<td>Parbati Bajgai</td>
<td>8</td>
<td>175</td>
<td>1400</td>
<td>28</td>
<td>5</td>
</tr>
<tr>
<td>Shanta Shrestha</td>
<td>9</td>
<td>160</td>
<td>1280</td>
<td>27</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1049</strong></td>
<td><strong>7998</strong></td>
<td><strong>160</strong></td>
<td><strong>29</strong></td>
<td></td>
</tr>
</tbody>
</table>
Figure 6. Hermetic bag and corn sheller distribution in ward #4, Ugra Chandi Nala. FCHV, Mrs. Ambika Sanjel

Figure 7. Hermetic bag and corn sheller distribution in ward #5, Ugra Chandi Nala. FCHV, Mrs. Shubhadra Bajgain
Figure 8. Hermetic bag and corn sheller distribution in ward #6, Ugra Chandi Nala. FCHV, Mrs. Sita Sigdel.

Figure 9. Hermetic bag and corn sheller distribution in ward #7, Ugra Chandi Nala. FCHV, Mrs. Manju Dahal. Deputy Mayor of Banepa Municipality Mrs. Rekha Dahal comes from this ward.
Figure 10. Hermetic bag and corn sheller distribution in ward #8, Ugra Chandi Nala. FCHV, Mrs. Prabati Bajgain

Figure 11. Hermetic bag and corn sheller distribution in ward #9, Ugra Chandi Nala. FCHV, Mrs. Shanta Shrestha
Monitoring and Evaluation

Asta Ja RDC members: Jwala Bajracharya, Hari Bhushal, Peetambar Dahal

FCHV: Mrs. Ambika Sanjel

As mentioned above, single time explanation about the use of hermetic bags and corn sheller would not be effective. Thus, monitoring the proper use of hermetic bags during the dry season was started in ward # 4 in Ugra Chandi Nala VDC on April 4, 2017. It was gracious of Mrs. Sanjel to walk with the team to individual households. We used ODK Data to register our visit. Notable household was a disabled member Mr. Raj Kumar Shrestha (27.66 °N, 85.50 °E, 1515.85 m) who had used the bags on March 31, 2017. After 3 days, the insects had come to the top of the bag due to suffocation at the lower portion of the bag (Fig. 1, Youtube video, left). In another household, moths were visibly flying inside the bags (Fig. 1, Youtube video, right).

Figure 12. Videos showing the initial grain quality at ward #4 (Bhandari gaun), Ugrachandi Nala on April 3, 2017. Left, https://youtu.be/L1LrsMcAN2E; Right, https://youtu.be/K5m7VrTYB-k
Figure 13. Monitoring the use of hermetic bags in ward #4 in Ugrachandi Nala VDC on April 3, 2017. First row, left: earthquake damaged house; right, demonstration of proper use of hermetic bag by Hari Bhusal; Second row, left: demonstration of proper use of
hermetic bag by Hari Bhusal; right, Hari using ODK Data and saving picture of the household; Third row, left: Mr. Raj Kumar Shrestha teaching his neighbor on the proper use of the hermetic bag; right, family with children; Fourth row, left: Ms. Shrestha wanted more bags to save corn and rice; right, Ms. Sanjel saving small quality of seed using the bag properly. Her daughter Sarina Sanjel in Dallas, USA asks her not to use pesticide in the vegetables.

The team members walked to individual households and demonstrated the use of hermetic bags to those who have not properly used it. Approximately 25 households could be monitored in one day (Figs. 12, 13). It was realized during this visit the need to collect the food samples in a shorter window to better estimate quality of control samples across households. We also saw that not all households had the food grains available to store in the bag as they had already sold the rice that was harvested during October-November. This was due to inability to protect rice from the storage insects. Similarly, most households had little corn available in ward #4 as it was nearing the planting time (Fig. 14, left). Those who had more grains appreciated the use of the hermetic bags. A female member wanted 20 more bags to store the food. Clearly, we saw that the bags could be used in the next harvest season and we could change the tradition of selling rice at lower prices at harvest. The households also shared that they would prefer to use their own harvest instead of purchasing the rice from the market that might not be pesticide-free. Clearly, we did not reach the households at the time of the rice and maize harvest season. Rather, it was spring season to transplant the tomato and chilies (Fig. 14, right).

Figure 14. Identification of mismatch between corn harvesting and initiation of climate smart dry chain (food packaging) at UgraChandi Nala VDC, Kavre. We delivered the nutrition saving tools on March 19 and 21, 2017 and started monitoring on April 3, 2017. Note that corn seed had been just panted (left) and vegetable seedlings were also getting ready for transplanting even in the open (right). The latter also indicates the arrival of warm spring season.

Overriding message: Never store wet grains inside hermetic bags
The users might be tempted to store grains at harvest in hermetic bags. We advise households to use hermetic bags to store grains at **processing or milling moisture content** only. A big test question will be for the corn that will need to be dried sooner to processing moisture content in mid hills in September. The time and energy used to make and store corn in open structures would need to be diverted to repeatedly dry the corn. Even corn shelling would require drying to about 18% MC from initial 25-30 % MC at harvest. Since molds begin to accumulate due to lack of drying within 3-4 days after harvest, rigorous monitoring and evaluation of quality would be needed in the next corn and rice harvest season. Drying during rainy season will be the subject matter of concerted approach of several agencies and outside the subject matter of the current project. We bring awareness only that artificial drying could be needed during the rainy season if food grains could not be dried to milling or processing moisture contents.

**Field monitoring of nutrition sensitive Dry Chain program by Mr. Babu Ram Acharya, UNICEF**

Mr. Babu Ram Acharya from UNICEF asked to see the ongoing activities at Ugrachandi Nala on April 4, 2017. Hari Bhusal showed the sampling and proper use of the bags to Baburam on April 5, 2017.

**Interaction with UNICEF Chief Stanley Chitekwe and Prof. Keith West, The Johns Hopkins Medical University (Program Director, USAID Nutrition Innovation Lab)**

Peetambar Dahal interacted with Chief of UNICEF in Nepal, Stanley Chitekwe and Prof. Keith West and Swetha Manohar of The Johns Hopkins Medical University (JHU) and shared the nutrition sensitive Dry Chain concept. The concept was appreciated by Prof. West who agreed to work further on research and interventions. JHU has been involved in Vitamin A supplementation program in Nepal that has reduced child mortality by about 30%.

**Interaction with Asst. UN Secretary General Gerda Verburg**

Due to implementation of ongoing nutrition enhancing programs at Ugra Chandi Nala through the village level health post, PD was invited by Mr. Suresh Paswan, Nutrition Officer in District Public Health Office, Kavre to a program at Dhulikhel that was attended by Asstt. UN Secretary General Gerda Verburg on April 7, 2017. This interaction was also attended by UNICEF Chief in Nepal Mr. Stanley Chitekwe, Dr. Sapkota, Chief of DPHO; NPC Members Prof. Geeta Bhakta Joshi, Savita Malla and Krishna Neupane; representatives from district Agri., Veterinary, Water and Sanitation Officer and Chief District Office. The objective of the meeting was to observe nutrition in emergency and recovery efforts in Kavre district. Ms. Verburg repeatedly brought up the issue of food and nutrition as she also heads Scaling Up Nutrition program of the UN. Thus, it was easy to introduce moisture based nutrition sensitive climate smart dry chain into the discussion. A bulk estimate of $50 million was requested to introduce drying and packaging system in Kavre district. Another important issue was related to the network of FCHVs. Dr. Sapkota asked Prof. Geeta Bhakta Joshi, NPC member, to include Rs 5000 per month to support FCHVs. Dr. Dahal
communicated with Prof. Joshi to increase this support to Rs. 30,000 per month to get maximum help from this unique network of FCHVs. As it was the time to allocate resources for the next fiscal year, it is hoped that the FCHVs would get some support from the government as well.

Sharing with Chaudhary group, retired NARC officers

Dr. Dahal had already shared the Dry Chain concept with Chaudhary Group (CG) in July 2016. Another effort was made to share the recent developments with Nirvan Chaudhary in CG at Entomology Division, Khumaltar where retired officers had also gathered. However, Amir Thapa from CG group communicated at the last moment and did not attend the interaction. The dry chain concept and the ongoing activities at Kavre that was appreciated by the group of retired officers (Dr. Madhusudan P Upadhyaya, Dr. Govinda Acharya, Mr Mahendra Thapa, Dr. Jagat D Ranjit, Mr. Krishna Khanal, Mr. Rishiram Upadhyaya, Mrs. Bhavan Shrestha, Dr. Jwala Bajracharya).

Sharing the Dry Chain concept with FAO, Nepal

Dr. Dahal interacted with Somsak Pipoppinyo, FAO Representative in Nepal and Bhutan, Dr. Binod Saha, Asstt. FAO Representative, Shrawan Adhikari, Program Officer in Kathmandu. PD pointed the important role played by FAO in food security in Nepal including manpower development. Nutrition sensitive moisture based food security concept presented by PD was appreciated by the group. PD opined to the need to use the drying resources in Kavre but this district is not in FAO’s target. To address the food security issues, FAO has been actively involved in improving food security in Nepal. The Zero Hunger Challenge (ZHC) has been envisioned which addresses nutrition and food quality. This program has identified postharvest loss as one of the pillars of ZHC and has proposed experiments to find the storage culprit. PD suggested the following scientific evidence on identification of the storage culprit.

“Moisture management strategy has been in place in pharmaceutical, processed food and seed industry and has minimized the loss of quality of dry products. Furthermore, an inverse relationship exists between nutrient loss and moisture content of stored dry foods. Moisture also becomes foremost concern to protect the dry grains for shelterless people during natural disasters. Massive annual grain losses taking place in Asia occur due to the lack of moisture management strategies. Toxigenic storage molds not only have immediate health effect including death, but also long term effects like liver cancer. If odor-proof hermetic/airtight storage is used to manage molds and insects, rodent attack is also minimized. Thus minimizing the molds and insects should be of foremost importance in global food and nutrition efforts. Nepal could be self sufficient in dry foods if the storage losses could be avoided.”

FAO group also highlighted different ongoing programs and they were interested in monitoring aspects of Asta-Ja RDC-UNICEF program. Scattered efforts would not be visible and it would be better to have concerted efforts of UNICEF, FAO and Nutrition Innovation Lab into sample districts. It was agreed that PD would provide the concept note for implementing the program into FAO activities too.
Laboratory assays

Our original plan was to use the laboratory services at Center for Molecular Diagnostics, Kathmandu and International Crop Research Institute for Semi-Arid Tropics (ICRISAT), Hyderabad, India. We had previously discussed with UNICEF to send the samples to India. We became aware that sending samples to India could be lengthy process between India and Nepal governments. After visiting several laboratories in Kathmandu, Jwala and Peetambar trusted the services at Zest Laboratory in Bhaktapur (http://www.labgo.in). There was need to update previous estimates and we omitted lysine assay. We have now asked Zest Laboratory to analyze both nutrient and anti-nutrients and test other physical parameters of the grains.

Peetambar Dahal and Hari Bhushal delivered 33 corn and rice food samples to Zest Lab for quality analysis on April 11, 2017. The data will be analyzed and presented during the awareness conference in August.

Team monitoring on May 19, 2017

Our plan has been to reach all households and show them proper use of the hermetic bags and ask them to store the dry foods (rice, maize) before the rainfall. The hill region in Nepal including Kavre is getting unusually high amount of rainfall this year. The monitoring team (Drs. Jwala Bajracharya, Bishnu Chapagai, Udhab Khadka, Madhav Adhikari, Hari Bhushal) visited ward 4, 7, 8 on May 19, 2017. The target village Ugrachandi Nala is close to Banepa and a bus shuttles between Kathmandu and ward #7. Thus, the households also grow high value vegetable crops. Our team found that the women were busy in potato harvest. Potato yields ranged from 1000 kg to 30,000 kg per household and it also needed storage space that would be next to dry grains in most cases.

Some women noted that when the grain gets bad, they would grind and sell for feed purpose. This view is similar to the pre-survey of the village on February 27, 2017 and the first monitoring on April 4, 2017. In the absence of awareness and monitoring the quality of food and feed, toxins from dry food products are indirectly passed into Cold Chain foods like meat and dairy products. This is a melting nutrition point for Cold and Dry Chains food products.

Some of the activities of team monitoring on May 19, 2017 are presented below (Figs. 15-22).
Figure 15. Corn getting to tasselling stage (left); team members visiting the households (right).

Figure 16. Households monitored on May 19, 2017.

Figure 17. Households in Ward # 4 visited on May 19, 2017.
Figure 18. More households were visited during monitoring on May 19, 2017.

Figure 19. Drying and packaging maize as observed on May 19, 2017.
Figure 20. Household member learning the packaging process (left) on May 19, 2017. Some households had not properly used the bags (right). Our goal was to share the knowledge of proper use of the hermetic bags by home visit and document the visit electronically.

Figure 21. Use of ODK data by Hari Bhushal (left) and other household member (right).
Figure 22. More households were visited during monitoring on May 19, 2017.

We will continue monitoring of the use of the hermetic bags. Special attempt will be made to collect samples during maize harvest after the rainfall with a hope to continue the project next year too. Such the samples at harvest would represent the innate nutritional quality of the food. We will discuss these issues during the national awareness conference on August 14, 2017.