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A Report On
OFAI and Sampdrup Jongkhar Initiative [SJI]
Organic Farming, PGS and Farmer Cooperative
Workshops

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By

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1 Definitions

- Panchgavya – A plant growth enhancing and pest repellent compound made from 5 elements from the cow viz. Dung, Urine, Milk, Buttermilk and Ghee (Clarified Butter)
- GNH – Gross National Happiness – the underlying *prana-mantra* proposed by the King of Bhutan as more important than GDP and a way of life in Bhutan.
- Citrus greening – Citrus Dieback or HLB disease is a wide serious disease which affects citrus trees.
- NTFP – Non Timber Forest Produce such as Chirata, wild herbs and berries etc.
- Sanjeevak – An easy to make plant potentate and pest repellent. Though not as superior as Panchgavya but a quick solution to use with crops.
- CPP – Cow Pat Pit is a biodynamic method of making effective manure with Cow Dung. CPP has multiple uses and is very effective in Organic Farming Applications.
- PGS – Participatory Guarantee System is a farmer friendly mechanism of peer certification of Organic Produce. It is an internationally applicable organic quality assurance system [like ISO 9000] implemented and controlled by the committed organic farmer-producers through active participation, along with the consumers, in the process based on verifiable trust.

2 Executive Summary:

The Samdrup Jongkhar Initiative [SJI] was launched in December, 2010, by the Prime Minister of Bhutan, Mr. Jigme Y. Thinley, in the presence of the District Governor and Ms. Kesang Tshomo, Coordinator of National Organic Program [NOP] of Bhutan. SJI is led by committee of various individual, but primarily lead by Ronald Tashi Coleman and his colleague Dasho Tashi Dorji. On 25 February, 2011, the PM met the SJI and OFAI members and reviewed the sustained activities of SJI. He complimented it for the unflagging enthusiasm in activities to promote GNH through organic agriculture and collective marketing. The PM's statement during the of the Five Year Plan at Somdrup Jongkhar town on 26 February, 2011, had specific references to organic agriculture.

The Organic Farming Association of India [OFAI] was invited by SJI to conduct a series of lecture-demonstrations and Q & A sessions from 18 to 27 February, 2011 to help promote Organic Agriculture, PGS and sensitize farmers on the benefits of running autonomous farmer cooperatives as a means to achieve the Bhutanese national goal of GNH. The approach was to enhance the utilization of the Ministry of Agriculture & Forests [MoAF] and NOP schemes through effective communication of available information and capacity building among the farmers through day-long workshops with emphasis on method demonstrations and trouble-shooting by Q & A sessions facilitated through local leadership. The demonstrations were conducted with the help of posters of MoAF/RNR Extension 'brochures'. These brochures contained valuable information of Organic farming techniques and were extensively used in the village workshops by the SJI/OFAI T.E.A.M (an abbreviation for 'Together Everyone Achieves More').

The farmers in most villages of Samdrup Jongkhar Dzongkhag were organic by tradition and only a few used any synthetic fertilizers like urea or sprayed any pesticides provided by the Bhutan Government agencies. Farmers knew many organic practices, including preparation of 'Panchagavya' used in some religious rituals in Bhutan as in neighbouring India. Dasho Tashi Dorji translated and provided the local context and humour to the lecture-demonstrations by OFAI faculty members and, towards the end of the ten day programme conducted some of the lecture-demonstrations independently in *Orang*, *Wooling* and *Dewathang* without any need of the OFAI T.E.A.M. members from India. Hence, a local expert had been enabled and empowered to sustain the process of conversion of 'natural farming' solely dependent on the goodness of Mother Nature to 'organic farming' where man assisted Nature to help boost productivity in harmony with natural processes. Mr. Ashok Kumar Pradhan, Extension Supervisor-1, with long experience in Khate Bhangtar/Somdrup and currently posted in Orang village also evinced keen interest in both, the preparations of organic formulations for enhancement of plant growth, reduction of disease infection and insect pest management in oranges and maize as well as the NOP of Bhutan.

Other RNR Extension may be given similar hands-on exposure to organic farming methods and visits to organic farms in India to be convinced that OA is better than the best of industrial agriculture, has sustained high production levels for all crops and at a fraction of the cost. The Low External Input Sustainable Agriculture [LEISA] 'organic' produce with credible local label such as 'PGS Organic' can actually be marketed at prices lower than those of industrial agriculture. The workshops culminated with a meeting with H.E. Prime Minister of Bhutan Mr. Jigme Thinley. A summary report of the meeting is attached as Annexure 7.1 below to this report. In addition various Organic Farming

techniques such as Panchgavya, CPP and Sanjeevak as discussed with the farmers are detailed in Annexure 7.2 below.

3 Introduction:

The Kingdom of Bhutan is nestled in the lap of the Himalaya Mountains or *Kailash Parvat* associated with the heavenly pair, Shiva-Parvati, the destroyers of evil. It has been ruled by the *Wangchuk* dynasty for a little over a century and has recently created history for two reasons: coronation of a young king after his father abdicated the throne and set in process to establish participatory governance through democratic elections. PGS, which finds mention in the MoAF publications and is in tune with Bhutan's guidelines for organic farming, can help take this democratization and empowering process to the villages in harmony with the principles of Ahimsa and GNH.

The geographical area of Bhutan is 38,394 sq. Km [ten times that of the Indian state of Goa, 3710 sq. Km.] and its population is about 7,00,000 persons [6,34,984 persons in May, 2005, or half the population of Goa]. A whopping 72% of the land is under forests; 10% under meadows, pastures, tseri shifting cultivation or barren; 10% under snows and glaciers while 8% is under agriculture and habitation. Of the 65,000 farming households, about 56% own 1 to 5 acres [0.4 to 2 hectares] of land

Samdrup Jongkhar Dzongkhag is the Eastern district that borders Assam. The elevations are from Mean Sea Level [MSL] at Darranga, Somdrup Jongkhar town and Khame Bhangtar/Somdrup to about 1000 metres above MSL at Dewathang town, Orong and Wooling villages.

The farmers in most villages of Samdrup Jongkhar Dzongkhag are organic by tradition and only a few used any synthetic fertilizers like urea or sprayed any pesticides provided by the Bhutan Government agencies. Farmers knew many organic practices.

The SJI workshops, led by Ronald Tashi Coleman and Dasho Tashi Dorji, have set its wheels in motion in December, 2010, with a flag off by the Prime Minister of Bhutan in the presence of the Coordinator of the NOP-Bhutan, Ms. Kesang Tshomo. The OFAI T.E.A.M. [Together Everyone Achieves More] of Ashish Gupta from Delhi, Vikram Singh Rawat from Himachal Pradesh and Miguel Braganza from Goa joined the SJI for ten days [18 to 27 February, 2011] to help in constructing Organic Agriculture, PGS and formation of farmers cooperatives as a means of collective marketing as the two-lane highway in the roadmap to reach the Bhutanese national destination of GNH through respect of all living creatures, big and small.

Tashi Ron Coleman has stated that the main objective of SJI is to make the people of Samdrup Jongkhar Dzongkhag, the Eastern-most District of Bhutan bordering Assam, self-sufficient in food at home and in every village while ensuring the health of all: soil, environment and every living creature through organic agriculture, value addition and collective marketing at local, district and national level through the farmer-led PGS.

The following sections contain details of the visit including the timeline briefs as well as a detailed overview of the workshops and experiences. A section follows this on conclusions, which contain the learning and recommendations resulting from this visit.

3.1 Volunteers from OFAI

A Three member team from OFAI was invited over by SJI to conduct workshops with assistance from SJI towards assisting farmers of the region in Organic Agriculture techniques, PGS certification mechanism and advantages of marketing through a village Cooperative model. The three members are -

- Miguel Braganza, Goa ,India
- Ashish Gupta, New Delhi, India.
- Vikram Rawat, Himachal Pradesh, India

3.2 Facilitator and Interpreters

Members of SJI assisted the volunteers in hosting the stay and workshops at various villages. The members also provided necessary translations, debriefing and assistance with the demonstrations held at various villages.

- Ronald ‘Tashi’ Coleman, Executive Director, SJI,
- Dasho Tashi Dorji, Chief Co-ordinator, SJI and former People’s representative to the Kings Court.
- Cheku, Co-ordinator, SJI.
- Dema, Co-ordinator, SJI.

Dasho Tashi Dorji accompanied the volunteers to all the villages where the workshops were conducted. His assistants Cheku and Dema managed the logistical arrangements. Tashi Coleman provided overall direction to the entire event.

Tashi Coleman arranged to bring banners from Thimpu RNR and Biodynamic Prep Kits of BD 501-507. These prep kits were used by OFAI team to demonstrate CPP at each village location where the meetings were held. In each demonstration the farmers inquired towards the availability of the Prep kits and they were promised that SJI will facilitate in acquiring this from RNR in Thimpu and making it available to them Free of Charge from Dewathang.

3.3 Beneficiaries

The interaction with various villagers took place in mainly 5 villages of the Samdrup Jongkhar Dzongkhag. The villages are –

- Khappe Samdrup [Lower Bangthar]
- Khamme Samdrup [Upper Bangtar]
- Orang
- Woolling

- Dewathang

The approximate number of farmers who participated in the workshops was -

Male: 260

Female: 280

In addition the volunteers and SJI members also held meetings with Vendors, vegetable sellers and general public and administration of Dewathang. In addition we met with His Excellency Prime Minister of Bhutan Mr. Jigme Thinley, his Minister of It is our belief that the impact of these discussions should lead to sensitization of Organic Agriculture, PGS and Cooperatives on a 10 fold basis. The total number of people who will now be in the know of SJI and associated work on Organic Farming, PGS and Farmer Cooperatives should be at least 3000.

4 Schedule of Events

The events timeline is described as the following subsections. However a specific overview of the entire visit follows in Section 5 below.

4.1 17 February 2011

Team members from OFAI arrive at Dewathang via Guwahati, Darranga and Samdrup Jongkhar. Cheku arranges a late meeting with the immigration office to facilitate the permits required for the visit to the Samdrup Dzongkhag.

4.2 18 February 2011

An inauguration meeting is held at the Jigme Namgyal Polytechnic [JPC]. The meeting starts a workshop series with farmers from the three Eastern Geogs [Lourie, etc]. The session was a semi-formal series of discussions with the farmers. A basic dialogue on introduction to Organic Agriculture and practices such as Panchagavya, Biodynamic Cow Pat Pit, collective marketing through farmer's cooperatives and PGS as a mechanism for certifying produce for the end consumers was held. This followed a Q & A session where farmers highlight their problems in marketing produce like Oranges, which are exported to Bangladesh and *Chirata* [Swertia chirata]. Specifically regarding Chirata, the farmers claim that though large quantities of Forest yield Chirata is sent to places as far as Delhi in India. They were unsure of its exact use at the destination as well as the fact that the middlemen do not allow them to receive complete financial benefits of the produce.

The after noon session was held with potential buyers of OA produce. The primary consumers of vegetable and milk in the geog are the JNP hostel, Army base camp, Army Hospital, *Chedra* [Buddhist Monastery of higher studies] and various vegetable vendors from Dewathang town. The discussion leads to the understanding of the following –

- All organizations travel across the border to India to purchase all food essentials. The main reason for this is lack of availability in the region, the price of any produce and the quality.

- None of the institutions consumes fresh milk despite of the presence of a functional Milk Cooperative at Dewathang. All institutions rely on powder milk made available from Indian markets.
- The institutions do not consume local farm cheese produced and instead manufactured cheese from India such as Amul or Britannia is used.
- All institutions have a relatively high demand for fresh vegetables e.g. cumulative demand for potatoes goes over 500kg. Whereas potatoes are not bought locally but across the border.
- All institutions agree that if local produce is made available on a regular basis, fresh and an affordable price they will choose to buy local.

4.3 19 February 2011

A meeting is held at the Dzongkhag [District] Administration office. The meeting is presided by the OFAI team, SJI members and resource people, District Extension Officer [DEO] and RNR Extension Agents of MoAF in SJ Dzongkhag, Hotel & Restaurant owners, wholesale/retail vegetable vendors. The purpose of the meeting is to assess awareness of 'organic' produce and possible marketing of produce by SJI-enabled organic farmers' collectives/PGS 'Local Groups' in SJ Dzongkhag/District.

4.4 20 February 2011

A workshop is held at the Kham Samdrup [Lower Bangtar] village which is at an elevation of 150MSL. The meeting included lectures/presentation, posters, live specimens, method demonstrations and Q & A session. A demonstration CPP pit was made by members of OFAI. Attending farmers were intent on learning more on how to make good quality compost from cow dung. It was observed that the village had a cultivation diversity of Rice, Areca, Banana and Pepper. Miguel noted that the road lining had *Glyricidia Sepium* fencing, *Calotropis gigantea*, *Eupatorium spp*, *Lantana camara* plants available. Farmers were familiar with preparation of *Panchagavya* and its cleansing properties and also used it for rituals. The day ended with a presentation of folk dance/ballad and *Bumchang* [maize brew] by village group.

4.5 21 February 2011

A debriefing review meeting was held and analysis of information obtained for planning the 'Way Forward' during the subsequent village level trainings. Discussions were held in learning of the workshop and meeting held in the past 2 days. OFAI members learnt about demographics of the region and cultural sensitivities, which must be kept in mind while making further presentations. OFAI members tuned the modus in which further training was to be held.

4.6 22 February 2011

A farmer's workshop was held at Khatte Samdrup [Upper Bangtar] which is at an elevation of 650 MSL. Lectures/presentation, posters, plant specimens, method demonstrations and Q & A sessions were held at the village. It was observed the crop diversity at this village was Maize, Areca, Banana and Pepper cultivation. Weeds such as *Eupatorium spp* are over-running the roadside all the way to the village and *Lantana camara* plants available. The farm on which the meeting was held had a wonderful mix of Multi-level cropping done. Coffee plants were also grown, but no processing knowledge existed with the villagers hence it was an unutilised crop. Farmers are familiar with *Panchagavya* preparation and its cleansing properties. CPP pit demonstration was held in which the farmers also participated and had keen questions to ask about making and obtaining the Prep kits.

4.7 23 February 2011

A training session was arranged at the Orong village. An RNR Extension Supervisor also attended and provided valuable inputs in the meeting. The village has a mix of Oranges and Maize is the major crops. Vegetables are grown for home consumption as well as marketed by a 22 members Farmers Vegetable Marketing Group. Hence the village had a functioning cooperative of farmers who collectively marketed milk and vegetables. The village or Orong could be a possible quick starter for a PGS groups and conjunct with Dewathang to form a larger cooperative to increase volume of produce for market. CPP demonstration was held at the village and farmers were advised on its various uses.

4.8 24 February 2011

A training session was held at the Wooling village. Here too, Oranges and Maize are the major crops and vegetables grown for home consumption. Farmers are familiar with use of maize straw and wooden pegs across the slope to prevent soil erosion and to gradually produce contour terraces. The farmers of this village seemed satisfied with their harvest of crops. In addition the villagers also made a living weaving belts, shawls and other silk and cotton patterns. Here too, CPP demonstration was completed with active participation from the farmers.

4.9 25 February 2011

Final training session was held near Dewathang town. The town has farmers who grow mainly oranges Maize. Vegetables are grown in kitchen gardens for home consumption. Farmers are familiar with use of composting and terracing across the slope to prevent soil erosion and to produce contour terraces. A clarification on the composting process demonstrated by the Navdanya team of Mr. Vinod Bhat and Mr. Darbaan Singh Negi was sought where the farmer described his experience in managing the pit compost. . One elderly farmer, Mr. Sherup, had actually tried the composting in three pits but had to harvest two pits early for the crop due to shortage of cow dung. One pit has been retained for full compost run of 180 days. While farmers agreed that vermicomposting was a labour saving device they all mentioned that worms were not available

4.10 25 February 2011

Interaction of SJI and OFAI members with the H.E Prime Minister of Bhutan, Mr. Jigme Y. Thinley, Finance Minister, Mr. Wangdi Norbu; Health Minister, Mr. Zonglay Drogba; Secretary for Agriculture, Mr. Sherup Dorji, and the Protocol Officer. Details of the meeting are in the Annexure 7.1 below.

4.11 26 February 2011

OFAI team visited the Orange plantation of Mr. Sonam Gyeltshen at Dewathang in Army restricted area. It was by far one of the best maintained Orange orchards in the area with traditional practices maintained. The plantation had 2000 trees at uniform 6 M x 6 M spacing in rows. Triennial pruning on the trees was done with sloping cut, which avoids water logging and related pest problems. Some observations made were that bench basins at base of the tree need to be made for soil, water and nutrient conservation. This was discussed with Mr. Gyaltsen.

4.12 27 February 2011

The OFAI team took a half day for a casual trek down to the river at the valley below Dewathang town with SPI Atlantic Statistical Researcher Ms. Linda Pannozzo, Appropriate Technology Consultant Luke and Zero-Waste Consultant Katherine Morales. Coincidentally it was observed that one large Orange grower en-route had adopted the basin making practice explained by the OFAI T.E.A.M. to growers in Dewathang on 18 February and reinforced on 25 February, 2011. It was really heartening to see such quick response.

4.13 28 February, 2011

OFAI team leaves for Samdrup Jongkhar town en route to Guwahati.

5 Specific Overview

This section contains observations and analysis made by the OFAI team during their visits to farms and meeting with various stakeholders in the SJI initiative. Though not in any particular order they reflect the myriad views which may help in understanding the challenges to be addressed by the people of Samdrup Jongkhar in adopting the practices of Organic farming and developing their own potential solutions towards establishing a self reliant and sustainable market with GNH at its heart.

5.1 Meeting with farmers from distant Geogs

On the 18 of February, 2011, SJI began a ten day programme of linking organic farmers to potential buyers, both institutional and individual, as well as for upgrading of farming and marketing skills through collective action. The core competence of the Resource persons was in cultivation of fruits and vegetables organically in high altitudes, collection and marketing of the organic fruits and vegetables as well as capacity building and networking of farmer groups. A meeting scheduled with the farmers from the three Geogs including Lourie Geog, resulted in a day-long sensitization and Q & A programme at the JNP, Dewathang. In the morning session farmers from the three far-flung Eastern-most Geogs of Samdrup district and some farmers from other Geogs were introduced to the

OFAI network of Organic Farmers' Organizations [OFOs] across India and the IFOAM definition of Organic Agriculture as '***a production system that sustains the health of soils, ecosystems and people, combining tradition, innovation and science, and promotes fair relationships and a good quality of life for all involved***' to development of assured markets using PGS and FairTrade.

The participating farmers were made conscious of the fact that their loyalty to the organic traditions has placed them at an advantage when the people who were seduced by the 'Green Revolution' technology of chemical-based farming and strayed away in the rest world were turning back to sustainable farming and organic produce. There was a need to adapt innovative uses of traditional formulations like '**Panchagavya**', '**Sanjivak**' and **CPP** that were now adapted for soil improvement and better plant growth. They are superior even to **Effective Microorganisms** or EM, which was laboratory produced and lacked the plant growth promoting substances that cow urine provided in the traditional formulations. There is a mention of some of them in '**A Guide to Organic Agriculture in Bhutan**', published in 2007 by NOP.

It was noted that a number of attendees were from far flung villages which required them to walk for almost 2 days before being accessible by road to Dewathang. This indicated the lack of infrastructure in the region the farmers have to endure. In addition the farmers indicated that from their region Chirata and Oranges were exported to India and Bangladesh; however they had no say in how these are sold to the end consumers. This indicated their desire to learn more about where there produce is used and how they can also learn about its potential benefits e.g. farmers were not clear how *Chirata*, which is shipped in large quantities to Delhi, is actually used.

However, the most commonly expressed problem was the absence of roads and transport to market the oranges produced in the Eastern three Geogs. In addition the marketing costs of the produce for individual farmers were greater than the sale value. There were neither collective marketing systems nor any value addition processes known to them. Local demand for fresh fruits was low.

Another problem faced by the farmers was that of damaged crops by wild animals such as pigs, elephants and deer. Wild animals, protected by law, browsed on and damaged crops in areas near forests, including 'slash-and-burn cultivation' or Tseri. Farmers of some region such as Khome Bhangtar had devised methods of using bamboo fences to protect their crops however measures were unsuccessful.

5.2 Panchgavya as Tradition with the Farmers

Panchgavya preparation was known to the people in Khome and Khome Bhangtar/Somdrup villages as well as Dewathang town in East Bhutan. However, its application to soil, plants and farm animals was an innovation that had not yet reached the people although there is RNR Extension brochure of the Dept. of Agriculture, MoAF, Thimphu, specifically on the agricultural applications of *Panchgavya*. They were also unaware of the validation of *Panchgavya* contents and applications done by scientists in the laboratories and fields of microbiology, biotechnology, crop physiology, agronomy, animal sciences and human medicine. The Resource Persons shared their experiences in India that would be useful in the local context of Samdrup Jongkhar district of Bhutan bordering Assam, India.

Milch cattle are available in every village of Samdrup Jongkhar Dzongkhag now and there is a tradition of making butter. Milk curdles naturally and so all the ingredients for these preparations/formulations are available in every village. So cow dung [**Wa Kee**], cow's urine [**Wa Chirang**], milk, curds and cow's milk butter, the five constituent ingredients of Panchagavya, are locally available. Sugarcane and bananas are locally cultivated and so sugarcane juice, jaggery [**Burum**] and ripe bananas are also available. In some villages like Khate Bangtar/Samdrup, coconuts are also grown and so coconut water is available as an additive to Panchagavya. Cow's urine also contained the plant growth promoting substances as well as insect repellent properties. The training workshops helped the farmer participants to recollect their experiences and recover from the recesses of their memory what their elders told them before the Green Revolution technology was introduced in Bhutan about 25 years ago.

While farms were observed to have proper cow sheds, there was no good arrangement to collect cow urine. It was suggested that hollow half-bamboo be fixed at slope perimeter as a easy channel for collecting urine in a bucket. This was taken well by farmers of various villages.

5.3 Citrus Greening problem at Orange Orchards

There is a widespread incidence of citrus HLB disease that results in poor fruit bearing, colour inversion during ripening, mottling of the younger leaves, yellowing of branches, slow decline and ultimately death of the plants. Trunk borer incidence can also be seen occurring randomly in almost all orange gardens. Most orange growers do not possess a sprayer and do not know the difference between an insecticide and a fungicide, though the RNR extension agents are reported to have conducted some demonstrations in 2009, insect pests and diseases management were not a priority of the farmers. It may, therefore, be better to directly focus on plant health management to prevent insect infestation and disease infections rather than to deal with curative measures after such incidence. Preparing basins at the base of plants, crescent trenches upslope of the trees for soil and water conservation, use of Panchagavya, Sanjivak and of CPP sprays and use of plant-based insect-repellent extracts may be ideal for Bhutan.

At least two farmers owned 2000 bearing orange trees scientifically planted in rows spaced at 6M x 6M and pruned triennially with oblique cuts with band saw. However, treatment of cut ends was non-existent and hence the prevalence to stem/bark borers as well as incidence of diseases. By the end of the ten day workshops one of the two large farmers in Dewathang had adopted the practice of preparing **basins** around the base of the orange trees on the 25 to 50 percent [22 to 45 degree gradient] hill-slopes for soil, moisture and nutrient conservation advocated by the OFAI T.E.A.M. The Agriculture Secretary, Mr. **Sherup Dorji**, shared the view of the OFAI T.E.A.M. that the Bhutanese oranges needed more attention. Citrus dieback, Greening [**Huanglongbing** or Tristeza] spread by Psyllid vector, bacterial canker and other diseases needed to be attended to. The National Plant Protection Centre [NPPC] of the Ministry of Agriculture & Forests [MoAF], Government of Bhutan [www.moaf.gov.bt and www.vercon.bt; nppc@druknet.bt] has recognized the importance of HLB and has mandated the RNR Extension agents to carry out annual post-harvest [March- April] and pre-harvest [September-October] surveys for **HLB** symptoms like blotchy, chlorotic leaf mottling and yellowing of branches and for presence of Psyllids. *Phytophthora* disease and bark/trunk borer incidence are also included in the survey due to a possible association of tree health and HLB infection.

5.4 Existing Markets for Oranges

The farmers in the extreme East and parts of Dewathang town [recently designated as 'A' Class town like Samdrup Jongkhar], Orong and Wooling villages grew oranges, most of which are exported to Bangladesh via Assam. The three grades of oranges as per size were **Killi**, **Milli** and **Tablet**. Killi [about 10cm in diameter] is the biggest size, obtained at the start of the season in November-December, while Tablet [about 5 cm in diameter] dominated the end of season crop in February. The fruits are currently sold by the truck-load and fetch an average price of Rs.0.80 per fruit with a range from Rs.2/ for 'Killi' orange to Rs.0.35 for 'tablet' orange. The traders in Samdrup Jongkhar town did the **sorting, grading and packaging of the oranges** in wooden crates for export. There was hardly any local consumption of the delicious, juicy and sweet 'Local' oranges. No **juices** or **concentrates** of orange are available, whereas synthetic flavoured RTD 'fruit' juices imported from Bangladesh are used extensively.

5.5 Weeds used for plant protection

The farmers are also familiar with plants that industrial agriculture terms as 'weeds' but organic agriculture treats as a 'misplaced resource' that can be tapped for preparation of insect repellants. These included *Lantana camara* [Aputro], *Parthenium cinerifolia* [Meringma], *Eupatorium sp* [Assamay] and Flame Nettle [Baizoo]¹. They were told how the leaves of these plants can be cut and soaked for ten days in diluted Panchagavya, Sanjivak or even cow's urine, filtered through cloth and the extract diluted ten times in water for spraying on plants as an insect repellent. The concept of the 'kill' that is integral to industrial agriculture, where the Latin word 'cedo's' that is the root of insecticide, herbicide, etc means 'to kill' as in homicide and suicide, is culturally unacceptable to the 'Ahimsa' practicing organic farmers and Buddhists alike.

The village level sensitizing programme was initiated in village Khamekham Bhangtar, which is at a low elevation and grows rice, maize and areca nut, with limited area under chillies and vegetables. There is natural water flow from seepage. There are large plants of *Glyricidia sepium* used as crop fence along the roadside where the mud road begins near the bridge. This tree can be multiplied by stem cuttings at the onset of monsoon and planted at every metre distance. The leaves are a wonderful nitrogen-rich green manure for rice [to be incorporated in the soil at first ploughing of the rice field] and the root nodules also fix nitrogen. The leaves repel rodents, specially field rats and mice. The powdered bark, mixed with rice flour or cooked rice, repels rats when they consume it.

The *Calatropis gigantia* plant can also be multiplied by cuttings. Finely chopped leaves and stems of Calatropis can be put in a sack or bamboo basket in the stream of water flowing into the paddy field and it will protect the crop from sucking insects and hoppers. Leaves of the American Smoke Weed, *Eupatorium spp*, and *Lantana camara* with pretty flower clusters can be decomposed in a 20 litre plastic bucket or mud pot with half litre Panchagavya or cow's urine and enough water to immerse the leaves [pressed down with a stone or brick] for ten days. The liquid can be filtered through cloth [old cotton sari, etc] and each one litre diluted to ten litres in water and sprayed as an effective insect repellent for most cereals and vegetable crops. The farmers were

¹ Names in parentheses are local names for the weeds

shown life samples of the plants collected in their village and the procedure of how to use on a laptop presentation as well through a Q & A programme.

5.6 Soil Conservation at Wooling

During summer, the farmers in Wooling village of Samdrup Jongkhar Dzongkhag laid the dry maize stalks across the slopes amidst the stubble, reinforcing it with wooden pegs or stakes where needed. The dry straw in summer was unsuitable for fodder, directly or as silage, and hence this soil conservation measure of cost free. Wooden stakes were easily available from the nearby Community Managed Forests [CMF] provided by law in Bhutan. Soil conservation led to gradual reduction of gradient of the field plots along the hill slope and led to moisture conservation for the crops as well as recharge of mountain streams during the post monsoon period. They were also familiar with composting and only the techniques needed to be upgraded using the wealth of innovations validated by agronomists, microbiologists and other crop scientists in India and elsewhere. One farmer in Orang village recalled that he father would advise him to plant rice where earthworm castings were visible. This is indicative of good soil organic matter content and clayey soils.

5.7 Non Timber Forest Produce

The important Non-Timber Forest Produce [NTFP] was Chirata [*Swertia chirata*] that is collected and sold without any value addition by the villagers in the far-flung Eastern Geogs like Louri in Samdrup Jonkhar Dzongkhag. The farmer-collectors raised the issue of low prices obtained by them through sales by individuals to traders. Chirata is a medicinal plant that is permitted to collect by some Geogs by the Bhutan Forest Department [MoAF]. Major profits in the Chirata business were made by middlemen. The collectors were not even aware for what the plant is used and by which pharmaceutical units. According to Dasho Tashi Dorji, Rubia [*Rubia cordifolia*] used in medicine and for colouring as well as Star-shaped Anise [*Illicium griffithii*] are other important NTFP.

There is no regulated market for NTFP in Bhutan. There are also no standards for eco-certification for preventing over-exploitation and sustaining the production of NTFP. Bhutan can benefit from the standards and procedures being developed for India and other Asian countries through 'PGS-Wild', Keystone Foundation [www.keystone-foundation.org] and Government of India appointed committee on NTFP development. There is also a need to develop local value addition enterprises, markets and marketing collectives to help farmers get fair returns as well as to enhance the production of fruits, vegetables and local chillies in the district.

5.8 Existing Cooperative Movements and Challenges to Self Sufficiency

The farmers of the most of the Geogs other than the remote ones had no problems in the sale of oranges as they had a better road network. Though undergoing road-widening over the last two years and uneven or potholed, they were still motor able. However, most did not have access to common marketing systems for vegetables.

Cooperative marketing initiated for fresh milk and cottage cheese did not find a ready market in Dewathang and hence sold most of its produce in Samdrup Jongkhar town. Most Bhutanese preferred powdered milk for their tea and processed cheese [mostly the Indian cooperative AMUL

brand] for their nation's favourite dish, Chilli-cheese [*Amed-achchi*]. The Indian traders in the border town were customers for the fresh milk. The JNP did not buy the fresh milk from the cooperative because of taste preferences and because the supply was available only at 10 A.M. by which time the students were in class. The JNP, the army and Chedra bought most of their vegetables from the *mandi* (local wholesale market) that has sprung up on the Indian side, across the porous international border check point from Darranga, Bhutan. Most of the traders, both Bhutanese and Indian, in Samdrup Jongkhar town and Dewathang also sourced their vegetables from this border market, well before the checkpoint on the Indian side.

Market surveys in the vegetable market on the Indian side of the border, Samdrup Jongkhar [2 km away] and Dewathang [18 km away] showed an addition of 20% at Samdrup Jongkhar and 30 to 50% at Dewathang on brinjals, radish, chillies, etc which are highly perishable and have about 20 to 25 % spoilage if not sold within the week. The margins are lower on ginger, potatoes, onions, etc which have a longer shelf life. The vendors in Dewathang sell vegetables to attract customers to buy groceries and other provisions. Some vendors tacitly acknowledge to the use of synthetic chemicals in sales of the produce e.g. bananas were artificially ripened with Carbide even in Dewathang town.

The vendors in Dewathang and traders in Samdrup Jongkhar were willing to sell fresh organic vegetables alongside the other vegetables. They also expressed their willingness to stack organic vegetables separately and even sell them with a reasonable premium if they were fresher than the regular vegetables. The customers would gladly pay more for better produce. Consumers already pay 30% more for local chillies over the chillies brought from Assam because of their superior quality. A beginning could be made in some of the kitchen gardens near Dewathang market. The possibility of covered cultivation of local chilli under poly-tunnels on bamboo frames during monsoons, with seedlings raised in kitchen gardens during late summer, needs to be explored. The price of chillies soars to Rs.80/- per kg and local chillies are non-existent in the market during monsoons.

6 The 'Way Forward'

There is a substantial demand for vegetables by institutions like the JNP, the Army mess and the vendors in Dewathang and Samdrup Jongkhar town supplying to the people residing or working in Samdrup District of East Bhutan. They are willing to source their vegetables locally if the prices are competitive, the quality is better and the supply of required quantities are assured on a bi-weekly basis at a single point. That is the challenge before the Samdrup Jongkhar Initiative. A series of interventions are inevitable to achieve this:

1. Focus should be built on select few commercial crops to first make the farming profitable. As per our observation thrust must be given to improve the orange cultivation as main crop of the area. Other two crops where expertise and consultancy required are Banana and Potatoes. Farmers can also start with intercrop of vegetables to supply to a cooperative for marketing.
2. SJI should work as a facilitator in providing literature, training and items such as Biodynamic prep-kits, worms for Vermicompost etc. It should also liaise with various stakeholders such as the Ministry of Agriculture at Thimpu and local Dzongkhags in promoting organic farming amongst the various villages in its outreach.
3. On Slope farming on the mountains requires contouring for soil conservation and water retention. This must be encouraged as a best practice amongst farmers. Each cooperative must have a 'Best Practices' manual containing local experiences and practices such as basin management, compost methods etc.
4. Start with creation of small cooperative groups at Dewathang which may leverage the existing cooperative infrastructure of the Milk coop to start marketing produce. This will provide a gradual scale of expansion without having to reinvent and reinvest in new schemes for marketing. This can also be a model case for SJI as a logical next step to forming and running organic cooperatives.
5. SJI could possibly lease or adopt a set of farms for a period of a couple of years wherein models of organic farming techniques can be created for other farmers to refer to. Produce from these farms can be sold under a cooperative umbrella to subsidize the farmers and this initiative. Work should be done in planning the model in a fair and sustainable manner.
6. Identify farmers who can be organized into PGS 'Local Groups' in different villages of each Geog and complete the process to set up the LGs.
7. Encourage expansions of forest since they will provide the lifeline in terms of water, timber and herbs. In case forests shrink the first casualty will be availability of perennial water sources which will be detrimental to agriculture in the long run.
8. Twin the PGS Local Groups at the higher and lower elevations to grow the widest range of vegetables and cereals required locally.
9. Set up one cooperative [with minimum 15 members as per Bhutan's laws], preferably from among the members of the 'Local Groups' of farmers but including persons familiar with

accounting and management/administration, to market the vegetables to the institutions and/or vendors, preferably starting with one from among these.

10. Identify sources of crop seeds and other inputs necessary to cultivate crops.
11. Plan a planting schedule as well as the crop mix and quantities to be grown and supplied by each farmer depending on his/her land holding and ability to grow.
12. Train the farmers in growing the selected crops as per the best practices for soil preparation, nursery, transplanting, covered cultivation, etc. Use Bhutan Ministry of Agriculture & Forests books, brochures, posters, etc where available and suitable. [Also make this literature available to the Samdrup Jongkhar Agriculture officials who appear not to be familiar with the same.]
13. Identify potential farmer- leaders for creating a cadre of local trainers through training of trainers [TOT] e.g. Mr. Jomo Tsering 17997088 for the Chirata collectors, Mr.Keshav Bhandari 17624430 and Dimiprasad Khatiwada 17863184 of Khamekham Bangtar
14. Trouble-shooting in pre-sowing, nursery, transplanting, crop growth, harvesting, sorting, grading, packing, transportation and marketing phases.
15. Monitoring, data analysis and periodic course correction.
16. End of season review of crops, successes, failures, economic and planning for remedial action as well as up-scaling.
17. Linking of existing Government schemes and subsidies, where available, to the ongoing SJI project farmers.
18. Consumer awareness through flyers/hand-outs, publicity for success stories, newspaper reports.

7 Annexure

7.1 Meeting with Bhutan Prime Minister, H.E. Jigme Y. Thinley

The Prime Minister of Bhutan, H.E. **Jigme Y. Thinley**, took time off on 25 February, 2011, during his visit to Samdrup Jongkhar town for the Mid-Term Review [MTR] of Bhutan's 5-year plan to evaluate the progress of Samdrup Jongkhar Initiative [SJI] activities to promote Organic Agriculture and collective marketing groups. Dasho Tashi Dorji and 'Tashi' Ronald Coleman represented SJI for the meeting along with the OFAI Resource Persons from India in an interaction scheduled for 15 minutes but that lasted almost one hour due to the keen interest of the PM in organic agriculture that was to be also dovetailed into the tourism policies of this Himalayan country. The Prime Minister was flanked by the Finance Minister, Mr. **Wangdi Norbu**; Health Minister, Mr. **Zonglay Drogba**; Secretary for Agriculture, Mr. **Sherup Dorji**, and the Protocol Officer.

The Bhutanese national objective of Gross National Happiness [GNH], the Buddhist culture of protecting all living creatures and the SJI aim of promoting livelihoods and food security in Samdrup Jongkhar Dzongkhag [District] of East Bhutan have a convergence with the practices of Organic Agriculture [combining tradition, innovation and science for benefit of all living beings in an environment friendly way]. The process has been set in motion with the SJI's flag off by the Prime Minister of Bhutan in December, 2010.

Tashi **Ronald Coleman** briefed the Prime Minister, Finance Minister, Health Minister, and Secretary for Agriculture, Mr. **Sherup Dorji**, of the training workshops conducted by SJI with the assistance of Navdanya-Dehradun members **Vandana Shiva, Vinod Bhat and Negi**, followed by **Jimmy and Janak McGilligan** of Barli-Indore and currently with the Organic Farming Association of India [OFAI] members **Ashish Gupta, Vikram Rawat and Miguel Braganza** to make the people of Samdrup Jongkhar self-sufficient in food at home and in every village while ensuring the health of all, soil, environment and every living creature through organic agriculture, value addition and collective marketing at local, district and national level.

Dasho **Tashi Dorji**, former People's Representative from Dewathang, detailed the programmes conducted by the OFAI team in various villages across Samdrup Jongkhar under his personal guidance since 18 February, 2011. He also touched upon the need to set guidelines for the collection of Bhutan's rich wealth of NTFP, specially the medicinal plant Chirata [*Swertia chirata*] that is collected and sold without any value addition by the villagers in the far-flung Eastern Geogs like Lauri in Samdrup Jonkhar Dzongkhag. There is also a need to develop local value addition enterprises, markets and marketing collectives to help farmers get fair returns as well as to enhance the production of fruits, vegetables and local chillies in the district.

Dasho informed the PM that an average of 60 farmers had attended each workshop and more than one hundred had attended the sensitization seminar at the Jigme Namgyel Polytechnic in Dewathang. Totally about 600 farmers had benefited from the visit of the Resource Persons from OFAI. Three members of the Organic Farming Association of India [OFAI], Mr. Ashish Gupta, Mr. Vikram Rawat and Mr. Miguel Braganza, conducted trainings with translation by Dasho Tashi Dorji, who has now the capacity [both knowledge and skills] to conduct the lecture-demonstrations independently. In fact, the OFAI team acknowledged that Dasho Tashi Dorji had conducted

demonstration of Cow Pat Peat pit preparation for Bio-Dynamic [B.D.] farming and also given independently the explanation in Bhutanese of the simple to understand Sanjivak and Panchagavya preparation in Orang village and Dewathang town during the preceding two days. He had keenly observed the demonstrations and taken notes of explanations to master the same. Some of the farmer participants in different villages had done the same. Dasho Tashi Dorji acknowledged that he had been unknowingly using the term 'organic by default' whereas the farmers were really '**organic by tradition**'. This needs to be acknowledged by all.

Speaking on behalf of the OFAI team, Miguel Braganza, Additional Director at the OFAI Central Secretariat in Goa, drew attention to the fact that Organic Agriculture was compatible with the Bhutanese national objective of Gross National Happiness [GNH] and the Buddhist culture of protecting all living creatures. **Organic Agriculture** is a production system that sustains the health of soil, ecosystems and people, **combining tradition, innovation and science**, and it promotes fair relationships and a good quality of life for all involved. PGS helps build Local Groups of organic farmers to achieve it. Poison-free food also reduced the pressure on the healthcare system by reducing incidence of ulcers, tumors, migraine headaches and cancers due to toxic chemicals used as insecticides, herbicides, etc. Thus OA has complete convergence with the objectives of GNH in Bhutan.

He explained that the core competence of the OFAI Resource persons in cultivation of fruits like oranges and vegetables organically in high altitudes, collection and marketing of the organic fruits and vegetables as well as capacity building and networking of farmer groups for collective marketing have been fully utilized during the past week. In most villages, the OFAI workshops, ably supported by Dasho Tashi Dorji with translations and local inputs laced with humour, were extended beyond the scheduled time to answer the various queries of the participating farmers, who were enthusiastic and wanting to learn more. In Orang village, the Agriculture Supervisor-1 Mr. Ashok Kumar Pradhan attended the full workshop, including the demonstrations, and provided inputs on the activity of the RNR Extension service for soil testing and crop cultivation. Ashish Gupta and Vikram Rawat also shared their experiences and assessment of the status and the possible organic way forward for the farmers in Samdrup Jongkhar Dzongkhag.

Ashish Gupta emphasized that organic agriculture was ahimsa in practice. The journey from the soil to the soul and vice versa would in fact build this into the very fabric of the agrarian society. In addition to soil health, chemical-free OA also enhanced the health of the consumers. Since OA and PGS promoted local consumption of the organic produce, health of the organic farmers was also ensured as they are the first consumers. OA will promote a healthier nation. He also discussed that all that was needed in terms of biomass was easily available in the soil due to the presence of a health forest eco system. In addition it should be the goal that all fruit present in the room should actually be made available locally in Bhutan and not have to be imported from other countries.

Vikram Rawat informed the PM and others that he was a farmer speaking from personal experience. In Himachal Pradesh, his apple-based production system also had other fruits and vegetables on the farm that catered to the market in Delhi. The Karsog Valley Farmers' Group had about 500 farmers networked through a number of farmer-managed micro-collection centres and five bigger collection centres for locally produced exotic vegetables that were marketed collectively. He volunteered to

help create similar capacities in farmers of a village that may be identified by SJI in Bhutan for collective marketing of organic produce.

The Agriculture Secretary, Mr. Sherup Dorji, responded to the PM's specific query and stated that SJI was a good movement further for OA in Samdrup Jongkhar Dzongkhag. He was happy to assist SJI to further its goals. He informed that there was a felt need to do value addition through post harvest processing of Chirata and perhaps solar driers could help in this direction. The NTFP collector should be able to earn more by some processing of chirata, he felt. He stated that the Bhutanese oranges needed more attention. Citrus dieback, Greening [or Tristeza], bacterial canker and other diseases needed to be attended to. Community Forest Management could include the production of Bamboo shoots as vegetable in addition to other local [eg Sag, red potato, chilli] and exotic vegetables [eg Cole crops] grown by organic farmers. Mr. Ron Colman informed that the Director had done his doctoral studies in NTFP and his services could be tapped for this.

The Health Minister, Mr. Zonglay Drogpa, exclaimed in jest, "I think I should now resign and come back to do farming."

The Prime Minister responded to the interaction and suggestions stating thus, "This was very educational for me. Earlier, I had the joy of launching the Samdrup Jongkhar Initiative, where I was deeply heartened to note the enthusiasm of the farmers. They listened attentively and had questions to ask from the resource persons. I did not know how far this initial enthusiasm would be sustained and converted into actions on the ground. I had tried before but we did not make much progress then. Now I hope to see it make a difference." He went on to add, "Chemical usage is quite recent in Bhutan, perhaps from the fifth Five-Year Plan about 25 years ago. I am happy to note that traditional wisdom and traditional agricultural practices still prevail in Bhutan."

In a telling remark, the PM said, "The Government agencies have promoted use of chemicals. The Government of Bhutan regrets what it has done to promote chemicals in farming. We want to change." He informed that he had made a statement about OA in April 2008 when the PM of India visited Bhutan and was asked by his counterpart where Bhutan would sell the organic produce. "I told him that we were not looking at distant markets like Europe and Japan. We would look at India as our market. After all, twenty years ago we did not believe people would buy bottled drinking water. Things change. Now people buy mineral water because of their health. They will also buy organic food."

Export is not the only market that the PM wants Bhutan to look for. "We will promote the consumption of organic produce within Bhutan. In Bumthang, we have promoted family-owned hotels for tourists. We are going to have an airport in this region. I have asked the local government to put a ceiling on the size of hotels. Also, all hotels of 'three star' and above category will have to use only organic produce for the food they serve. 'Soil and Soul' fits well in the Ahimsa philosophy. We will also need to pay attention to standards, packaging and marketing." he said, adding "The district of Haw has already declared itself as 'Organic'. The other Governors have also been sensitized on the need for organic systems. However, I have not seen a major involvement of the Ministry of Agriculture and the [RNR Extension] officers did not take the benefit of the resource persons at the SJI program."

Turning to the SJI representatives he advised, “You may need to be more specific in your planning and produce visible results. OA is high on the Government’s list of priorities and my personal priority. We love to live in harmony with Nature. I am happy that you are here today.”

7.2 Organic Farming Techniques Discussed

This section contains a description of certain organic farming techniques discussed by the OFAI team during their visits to various villages.

7.2.1 Sanjeevak or Amrut Paani

20 litres of Sanjeevak preparation Technique requires -

10litre Cow Urine – collected over 1-2 days.

10kg Cow Fresh Dung

1kg Jagerry [Gur]

Mix all these together in a bucket and keep covered with a cloth to avoid flies. The bucket should be stirred twice a day for 7 to 10 days. After 10 days Sanjeevak will be ready for use. It must be used in a dilution of 1:9 i.e. for 1litre of Sanjeevak 9 litres of water should be mixed to obtain 10 litres of solution.

Sanjeevak can be applied to plants as a spray or directly applied to the soil. In case of trees, a boundary basin of 2mx2m can be created and solution poured directly at this basin. Sanjeevak can easily be stored for 2 months in an earthen pot but must be kept moist and aerated.

7.2.2 Panchgavya

This powerful potentate and pest repellent is an excellent compound for Organic farming. It has a multipurpose mix which is easily made in every farm and gives excellent results when applied to the soil or the crops. The word Panchgavya is a portmanteau consisting of the words ‘*Panch*’ meaning five and ‘*Gavya*’ meaning products from a cow. To make 20 litres of Panchgavya requires –

- Fresh cow dung - 5kg
- Fresh cow’s urine – 3 litres
- Cow’s milk – 2 litres
- Cow’s curd – 2 litres
- Cow’s ghee – 500 gms

First cow dung and cow ghee are thoroughly mixed for 20 minutes and kept in a mud pot or plastic drum (it is important not to use a metal container for this preparation). This mixture is to be kept for 4 days with stirring twice a day. The container must always be covered with a moist cloth to avoid flies laying eggs in it. On the 5th day all remaining elements are to be added and stirred well for 20 minutes. After 15 days (with stirring twice a day) panchgavya is ready.

In addition to the 5 elements following can also be added for additional benefits if the materials are available –

- Jaggery -500gms
- Ripe Banana – 12 pieces
- Tender Coconut water – 3 litres
- Honey – 500gms

Panchgavya is to be applied in a 2-10% solution e.g. for 10 litres of water 200ml of panchgavya can be used for spraying directly on plants or if applied to soil, 1litre of panchgavya is stirred with 10 litres of water.

It can be applied once in 15 days on all kinds of crops. Seeds can be soaked for 1 hour in 1% solution before sowing and stem cuttings for plantations can be soaked in 1% solution overnight.

7.2.3 Cow Pat Pit

Cow Pat Pit of CPP is a highly specialized composting method which uses Fresh Cow Dung and biodynamic preparations to form an effective potentate. The quality of CPP depends of the quality of inputs used and the methodology adopted for making the compost. It is highly advised that cow dung be used from a lactating cow which has been fed organic grass only e.g. fodder from open or forest field of grass collected from own farm where no chemical inputs have been used. Preparation of CPP requires –

- A pit dug to the dimensions of 3feet width, 2 feet length and 1 feet depth. Multiple pits can be dug width to width or length to length.
- Bricks to line the sides of the pits
- BD Preparation Kit 502-507 made available by SJI through the RNR centre at Thimpu.
- Shaded ventilated area where the pits will be kept to prevent water logging during monsoons or harsh sun during summers.
- 60kg cow fresh dung per pit or watered cow dung in case it is hard
- 200 grams of powdered egg shells – preferably roasted on a covered vessel or oven for 10 minutes.
- 200 grams of powdered basalt dust from a quarry OR bore/tube well soil OR Silt from river beds as a last option

The preparation requires kneading the cow dung for 10 minutes to aerate it. Mix the powdered egg shells and basalt and continue kneading. While there is no limit to the time to knead, between 10 minutes to an hour should be enough. Drop this mixture into the pit and layer it such that it is one and half brick deep.

Six holes are made into this dung mixture in pit and in each hole 3 sets of BD preps are inserted i.e. in one of the holes 3 sets of BD 502, in second hole 3 sets of BD 503 and so on. The holes are then covered with the dung. One set is about 1 gram so about 3 grams of each prep in each hole is enough.

Take a 1 litre water bottle with about half a litre of water and add 1 set of BD 507 solution to it. Shake the bottle horizontally for about 10 minutes. Add half of this water to the final hole and remaining half to the bricks, gunny bag and on top of the layer. Alternately half of the BD 507 can be added directly to the last hole and remaining mixed in the bottle. Place a wet jute sack on top of this pit to keep it covered and moist.

Leave this for a month and then gently aerate it from the top with a fork in the 5th week. From 6th week onwards turn the compost every week to speed up breakdown. CPP will be ready in 3 to 5 months depending on climatic conditions.

1 pit with 60 kg of cow dung yields about 35-40kg of CPP. The application thumb rule is 1kg per acre. Some uses are –

1kg CPP in 40 litres of water is stirred for 10 minutes and strained. The solution can be sprayed directly on the plants and trees or applied directly to the soil.

Make a CPP paste and apply to trees to stop bleeding

Dip roots, stem and seeds in a CPP solution for 1 hour before sowing

CPP can be used as inoculants in other compost heaps of vermicompost also. Usage remains the same 1kg CPP in 40 litres of water and added to compost heaps by making holes on them.

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