

The Ministry of Agriculture and Forests is overjoyed by His Majesty's recognition of agriculture, livestock, and forest farmers' groups and cooperatives, and individual farmers on National Day 2014, highlighting the vital role this section of the society plays in our national economy and vision. We pray for the long life and perpetual guidance of our enlightened monarch, His Majesty The King Jigme Khesar Namgyel Wangchuck, on the occasion of His Majesty's 35th Birth Anniversary. We strive in our efforts to achieve our National Goals as envisioned by His Majesty The King.



SANAM DRUPDREY

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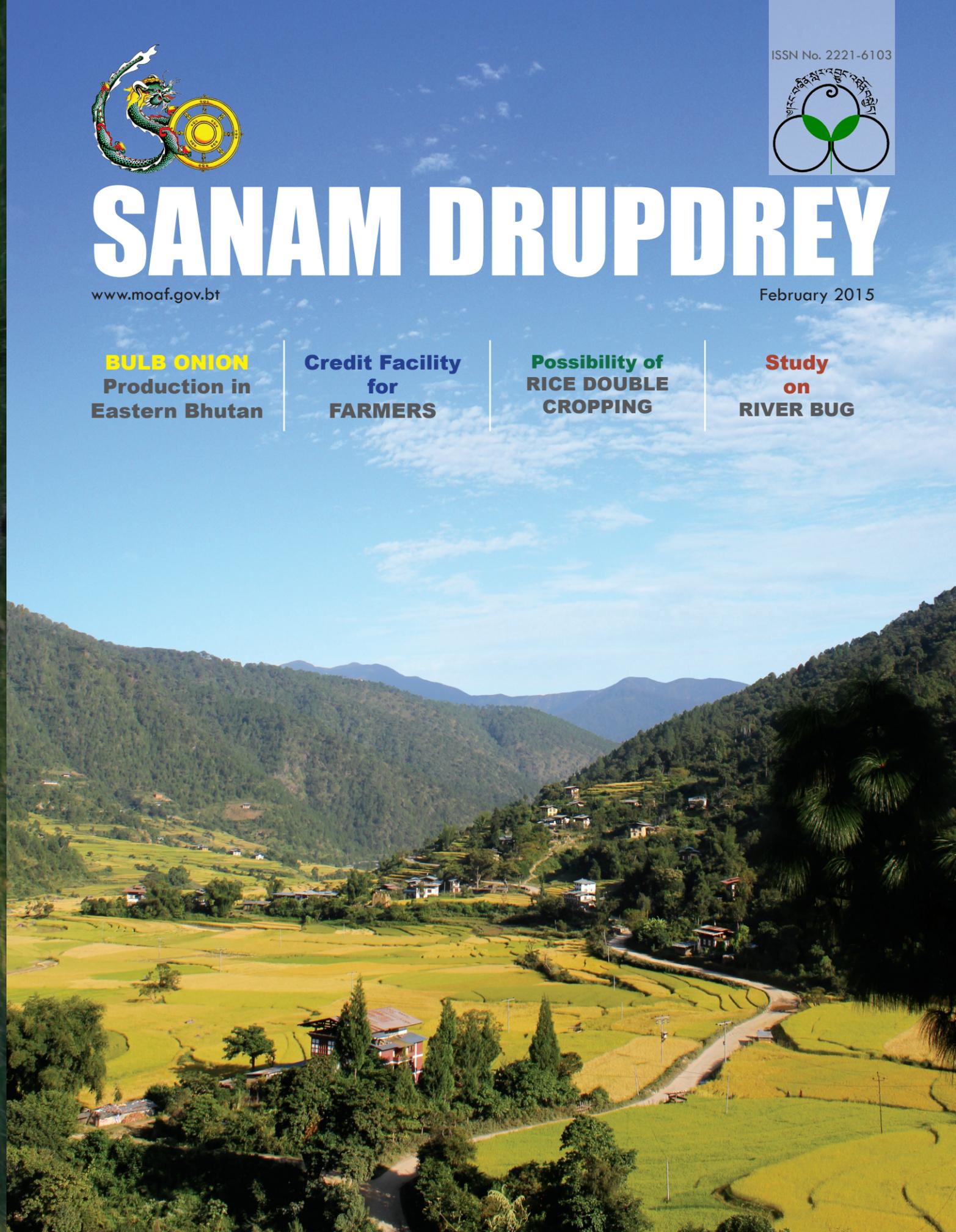
February 2015

BULB ONION
Production in
Eastern Bhutan

Credit Facility
for
FARMERS

Possibility of
RICE DOUBLE
CROPPING

Study
on
RIVER BUG





The Ministry of Agriculture and Forests rededicate ourselves to the service of the King, Country and People and join the nation in Celebrating the 60th Birth Anniversary of our beloved Fourth Druk Gyalpo, His Majesty The King, Jigme Singye Wangchuck.



The RNR family would like to wish everyone a very happy and prosperous WOOD FEMALE SHEEP YEAR 2015.

May the NEW YEAR bring you health, happiness and wisdom.

Losar Trashhi Delek!

Five keys to safer food



Keep clean

- ✓ Wash your hands before handling food and often during food preparation
- ✓ Wash your hands after going to the toilet
- ✓ Wash and sanitize all surfaces and equipment used for food preparation
- ✓ Protect kitchen areas and food from insects, pests and other animals

Why?

While most microorganisms do not cause disease, dangerous microorganisms are widely found in soil, water, animals and people. These microorganisms are carried on hands, wiping cloths and utensils, especially cutting boards and the slightest contact can transfer them to food and cause foodborne diseases.



Separate raw and cooked

- ✓ Separate raw meat, poultry and seafood from other foods
- ✓ Use separate equipment and utensils such as knives and cutting boards for handling raw foods
- ✓ Store food in containers to avoid contact between raw and prepared foods

Why?

Raw food, especially meat, poultry and seafood, and their juices, can contain dangerous microorganisms which may be transferred onto other foods during food preparation and storage.

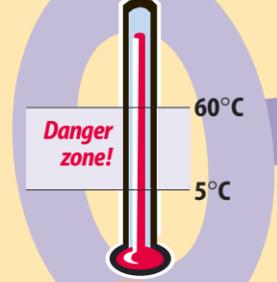


Cook thoroughly

- ✓ Cook food thoroughly, especially meat, poultry, eggs and seafood
- ✓ Bring foods like soups and stews to boiling to make sure that they have reached 70°C. For meat and poultry, make sure that juices are clear, not pink. Ideally, use a thermometer
- ✓ Reheat cooked food thoroughly

Why?

Proper cooking kills almost all dangerous microorganisms. Studies have shown that cooking food to a temperature of 70°C can help ensure it is safe for consumption. Foods that require special attention include minced meats, rolled roasts, large joints of meat and whole poultry.



Keep food at safe temperatures

- ✓ Do not leave cooked food at room temperature for more than 2 hours
- ✓ Refrigerate promptly all cooked and perishable food (preferably below 5°C)
- ✓ Keep cooked food piping hot (more than 60°C) prior to serving
- ✓ Do not store food too long even in the refrigerator
- ✓ Do not thaw frozen food at room temperature

Why?

Microorganisms can multiply very quickly if food is stored at room temperature. By holding at temperatures below 5°C or above 60°C, the growth of microorganisms is slowed down or stopped. Some dangerous microorganisms still grow below 5°C.



Use safe water and raw materials

- ✓ Use safe water or treat it to make it safe
- ✓ Select fresh and wholesome foods
- ✓ Choose foods processed for safety, such as pasteurized milk
- ✓ Wash fruits and vegetables, especially if eaten raw
- ✓ Do not use food beyond its expiry date

Why?

Raw materials, including water and ice, may be contaminated with dangerous microorganisms and chemicals. Toxic chemicals may be formed in damaged and mouldy foods. Care in selection of raw materials and simple measures such as washing and peeling may reduce the risk.



Foreword



MESSAGE FROM THE HON'BLE MINISTER
MINISTRY OF AGRICULTURE AND FORESTS



Dear Readers,

On the outset let me wish all the readers a very Happy Losar and prosperous Wood Female Sheep Year.

The Ministry is happy to present the fifth edition of the *Sanam Drupdrey*. This edition of the magazine highlights the performance of the Ministry and its relevant agencies in 2014, including numerous ongoing and successful projects implemented, lessons learnt and first hand experiences shared from the fields from various sectors. The magazine also examines market trends over the years, and provides various market insights into and information on the farming sector in Bhutan.

I once again congratulate Information and Communication Services for successfully publishing the 5th edition of the *Sanam Drupdrey*, my sincere appreciation to the authors and contributors of the articles; it is through such articles that we are able to showcase our achievements and create awareness to the general public.

Through this foreword, let me take this opportunity to remind ourselves that the overarching aim for the Ministry is to bring our country closer to our much cherished national goal of achieving food self-sufficiency.

Specifically, we would like to be a major catalyst in improving the overall economy of our country, by reducing imports of food commodities, producing export quality produce, carving a niche for ourselves in the organic and eco-

friendly produces. We are also very much aware that we have critical role to play in enhancing livelihoods of our rural communities and at the same time ensure environmental conservation.

Nonetheless, the sector is faced with many challenges; with many successes in the education system many younger and economically active generation have now moved to urban areas in search of jobs that do not involve agriculture, further less and less of our already small arable land is being used for food production. Our villages have become less populated, and productive agriculture lands are left fallow.

The consequences of dwindling interest in agriculture are a concern for the Ministry. It is obvious that this sector must be revived; the sector must be made attractive for youths and private sector for investment.

To this end, the immediate intervention from the Ministry is the establishment of Farm Shops in each geog, promote farm mechanisation and also mitigate the impacts of Human Wildlife Conflict (HWC) by installing electric fences in the HWC hotspots. The Ministry is also fortunate to have received immense support from the highest level, and the political will to revitalise this sector is huge.

His Majesty The King's National Day Address in Kanglung in 2014, as well as the National Order of Merit Medals awarded to farmers during that occasion has show cased the importance of agriculture sector, this has served to elevate the national

consciousness on the vital role that agriculture and farmers play in our economy.

Agriculture is a priority and the government has stepped up its support to increase production, access and marketing of agriculture produce. The introduction of attractive loan schemes by the Business Opportunity and Information Centre, has helped kick start numerous agriculture-based businesses within a very short span of time. Young, enthusiastic entrepreneurs have taken up a majority of these ventures.

These developments are extremely encouraging, and help us in the Ministry of Agriculture and Forests work with added enthusiasm to transform agriculture sector and take it to new heights. I believe that we have the resources and the capacity to address all the issues through an integrated and coordinated approach thus we can and we will take forward the Ministry as a team.

With this, on behalf of the Ministry, I would like to thank all our development partners and the family members of MoAF for your dedicated efforts, and wish you a prosperous and rewarding year ahead.

Trashi Delek!

Yeshey Dorji
Minister

Acknowledgement



MESSAGE FROM THE HON'BLE SECRETARY
MINISTRY OF AGRICULTURE AND FORESTS



“
The achievements would not have been possible without the generous support and cooperation of our development partners. We would like to acknowledge and thank the support of the relevant agencies such as GoI, JICA, EU, IFAD, GEF, World Bank, Helvetas, WWF, BTFEC, FAO, WFP, CSE, and others.
”

Dear Readers,

This is the fifth edition of the *Sanam Drupdrey*, annual publication of the Ministry of Agriculture and Forests. The magazine is a medium through which we showcase the performance of the Ministry and its relevant agencies.

The Ministry is proud to share many of the achievements that it was able to make within the short span of time. This is all due to the hard work, commitments, and dedicated efforts of everyone starting from Geog RNR extension offices, Dzongkhags, Research and Development Centres (RDCs), and the departments.

The achievements would not have been possible without the generous support and cooperation of our development partners. We would like to acknowledge and thank the support of the relevant agencies such as GoI, JICA, EU, IFAD, GEF, World Bank, Helvetas, WWF, BTFEC, FAO, WFP, CSE, and others.

The Ministry is well on its track towards achieving and helping research and development, mechanisation and commercialisation of the

agriculture sector in the country. With an allocated budget of Nu. 5 billion in the 11th FYP, which is expected to increase to Nu. 7 billion by the end of the plan, coupled with the greater ease and access to capital from financial institutions towards agriculture-based businesses, the Ministry is confident of achieving greater food production in the country.

This can be achieved with an enhanced market accessibility, which has been mandated to Food Corporation of Bhutan and Department of Agricultural Marketing and Cooperatives with support from the relevant departments.

I would like to thank all the stakeholders for your continued support and contribution rendered to the Ministry of Agriculture and Forests.

Trashhi Delek!

Tenzin Dhendup
Secretary

Editorial

Singye Wangmo
Program Director
ICS

“
The Ministry of Agriculture and Forests’ key strategy in the 11th Five Year Plan (FYP) has been to transform agriculture into a commercially viable sector that provides higher returns to farmers, improves rural livelihood, reduces imports and promotes exports, and offers attractive employment opportunities to youth.
”

The agriculture sector has certainly received a huge boost in recent times.

The Ministry of Agriculture and Forests’ key strategy in the 11th Five Year Plan (FYP) has been to transform agriculture into a commercially viable sector that provides higher returns to farmers, improves rural livelihood, reduces imports and promotes exports, and offers attractive employment opportunities to youth.

Environment conservation and sustainable, eco-friendly growth, with a focus on organic farming has been an important component of the Ministry’s endeavours.

With this fifth annual edition of the Ministry’s magazine *Sanam Drupdrey*, we illuminate some of the many projects geared towards achieving the objectives of the 11th FYP, and how these projects have impacted the production, community, the overall economy, and various other factors. The successes and experiences from the projects help us plan and add on future projects, and also allows us to understand what works best for us.

Some of the fairly successful projects have been the introduction of upland rice cultivation in places where irrigation is an issue, the commercial production of bulb onion in select Dzongkhags as a relay crop, development of orchard farming in eastern Dzongkhags, garlic production in Gasa, the immensely promising

mountain hazelnut venture, the support given to set up numerous dairy cooperatives, the setting up of the Bamboo shoot pickling plant in Sarpang, the installation of rice processing units, and the peri-urban Green Farm in Thimphu.

This edition also includes success stories of Chuzagang, Chubu, and Drujegang, and projects in the pipeline or midway, such as the search for viable rice varieties for double-cropping, and alternatives to the Sonalika wheat for higher yield amongst many others.

We have some inspiring articles on the tremendously thrilling discovery of a new species of catfish in Bhutan, and the exciting possibilities of medicinal benefits to be derived from the *Knabu* bug, which needs further study.

In addition to this, we have used this magazine to highlight issues we continue to face- with the difficulty for farmers to get access to credit and challenges in agricultural marketing, with the recognition that there is still a great deal to be done. Along with the issues, we also present possible solutions and ideas.

Overall, it has been an optimistic year for agriculture in Bhutan, and we hope that the Ministry will be able to continue to help the country’s farmers fulfil their aspirations, and help bring the nation closer to our national goals, through concerted efforts in research and development, implementation, and excellent partnership with our farmers.

Understanding the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)

The International Treaty on Plant Genetic Resources for Food and Agriculture (the Treaty) was adopted by the FAO Conference in November 2001 and entered into force on 29 June 2004. As of November 2012, more than 126 countries and the European Community are Contracting Parties to the Treaty. The two objectives of the Treaty are:

- The conservation and sustainable use of plant genetic resources for food and agriculture and
- The fair and equitable sharing of benefits derived from their use.

These two objectives are to be pursued in harmony with the Convention on Biological Diversity, with a view to achieving sustainable agriculture and food security. The Treaty, which took over seven years to be negotiated within the framework of the FAO Commission on Genetic Resources for Food and Agriculture, was deemed necessary for the following reasons.

The first reason is the special nature of plant genetic resources for food and agriculture (PGRFA). PGRFA of cultivated crops, on which humans depend for food and survival, are a form of biodiversity that is a product of human activity and that, for the most part, cannot exist without continued human interventions.

The second reason is the interdependence of countries on PGRFA. For centuries, PGRFA have been freely and widely exchanged across the world's continents and regions and almost all countries in the world are now heavily interdependence on PGRFA from other parts of the world for their agricultural economies.

Finally, continued access to PGRFA is essential to preserve the world's food security. Farmers and breeders depend on PGRFA as building blocks for the improvement of their crops in order to sustain production in the face of threats. In addition, the growing threat of climate change will impact negatively on agriculture in most developing countries and change the growing conditions for crops necessitating from other adaptation to new conditions. As a result, many countries will need to seek PGRFA from other countries where growing conditions may be similar.

The Multilateral System of Access and Benefit-sharing for PGRFA

The treaty declares that 64 of our most important crops- crops that together account for 80 percent of all human consumption- will comprise a pool of genetic resources that are accessible to everyone. These crops are listed under Annex 1 of the Treaty. On ratifying the Treaty, countries agree to make their genetic diversity and related information about the crops stored in their gene banks available to all through the Multilateral System. This gives scientific institutions and private sector plant breeders the opportunity to work with, and potentially to improve, the materials stored in gene banks or even crops growing in fields. By facilitating research, innovation and exchange of information without restrictions, this cuts down on the costly and time consuming need for breeders to negotiate contracts with individual gene banks.

Access to genetic materials is through the collections in the world's gene banks. These can include collections of local seeds kept in small refrigeration units of research labs, national seed collections housed in government ministries or research centre collections that contain all known varieties of a crop from around the world. Access to these PGRFA is provided through a Standard Material Transfer Agreement drawn up by the Governing Body of the Treaty. The Standard Material Transfer Agreement is a mandatory model for parties wishing to provide and receive material under the Multilateral System.

Benefit-Sharing

Those who access genetic materials through the Multilateral System agree that they will freely share any new developments with others for further research or, if they want to keep the developments to themselves, they agree to pay a percentage of any commercial benefits they derive from their research into a common fund to support conservation and further development of agriculture in the developing world. The fund was established in 2008.

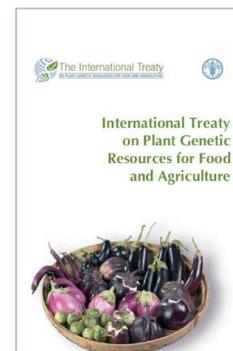


Bhutan and the ITPGRFA

Bhutan became a member of the ITPGRFA in 2003 and the National Biodiversity Centre under the Ministry of Agriculture and Forests is the designated national focal agency. In compliance with the International Treaty, the draft ABS policy of Bhutan directs that access to duly registered ex-situ collections of genetic resources for food and agriculture that fall under Annex-1 of the Treaty, and are under the management and control of the government as well as in the public domain, shall be in accordance with the terms and conditions of the Multilateral System of Access and Benefit-sharing, including the conclusion of a Standard Material Transfer Agreement (SMTA).

Currently, the NBC is coordinating the implementation of a project titled "Participatory Conservation and Utilisation of rice genetic resources for food security and livelihood" supported by the Benefit-sharing fund of the Treaty.

Similarly, NBC is also implementing a project funded through Biodiversity International to strengthen national capacities and establish national mechanisms to implement the multilateral system of the Treaty. (Source: National Biodiversity Centre, Serbitbang)



Contents

Sanam Drupdrey

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*Paddy fields in Punakha
Photo by Barun Gurung*

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| | |
|--|----|
| Foreword | 1 |
| Acknowledgement | 2 |
| Editorial | 3 |
| Bulb Onion Production in Eastern Bhutan | 6 |
| Mountain Hazelnut Story | 8 |
| Dairy Farmers' Group in Shari | 12 |
| BUCAP Initiative in Dryland Paddy Cultivation | 14 |
| Credit Facility for Farmers | 16 |
| Vegetable Cash Cropping in Chubu | 19 |
| Possibility of Rice Double Cropping | 20 |
| Dragonflies: A Natural Pest Management | 22 |
| Rice Processing Units Installation | 24 |
| Bamboo Shoot Pickling | 26 |
| Farmers Have an Alternative to Sonalika | 29 |
| Challenges and Way Forward for Agricultural Marketing | 30 |
| Khaling Torrent Catfish Discovery | 32 |
| Coming of Chuzagang Coffee | 36 |
| Upland Rice in Gasa | 38 |
| Highlights of 2014 | 40 |
| Fruit Orchards Development in Eastern Bhutan | 54 |
| Garlic Production in Gasa | 58 |
| Climate Smart Agriculture Initiative in Chuzagang | 60 |
| Green Farm Bhutan | 63 |
| Drujegang Mandarin Growers | 67 |
| River Bug Story | 69 |
| Shared Benefits of Haa Community Forest | 72 |
| Do You Know? | 73 |
| Farming Tips | 76 |

Bulb Onion Production in **EASTERN BHUTAN**

Emergence of green gold is more than an import substitute, a source of livelihood

By Tashi Phuntsho, Kinlay Tshering, and Lhap Dorji, RDC Wengkhār



Onion is one of the vegetables that are mostly imported from India despite huge production potential in the country. Studies conducted by the RDC Wengkhār in the past showed that farmers were able to make net returns of Nu. 60,000-126,450 per acre and net family labour returns of Nu. 309.00 –1046.00.

That indicates onion cultivation is a viable and profitable enterprise. Most of the wetlands in the region are left fallow after the paddy is harvested.

RDC Wengkhār with the support from HRDP-JICA and MAGIP in collaboration with the Dzongkhags, had initiated a commercial production of bulb onion as a relay crop in the paddy based farming system in potential pockets of the eastern region. It was aimed to minimise import and boost domestic production of vegetables in line with the commercial vegetable production initiated by Department of Agriculture (DoA). The concept of research outreach

programme was adopted and the site selection was carried out in consultation with the respective Geog Agriculture Extension Officer (GAEO). The selection of farmers was done by the respective GAEOs.

Based on the area estimated for bulb onion production, seeds of variety Pune Red was procured from National Seed Centre, Paro through financial support from RGoB, HRDP-JICA and MAGIP. The Pune Red was selected as this variety has low percentage of bolting when compared to others, short day type of hybrid and red bulbs are mostly preferred by the consumers in the market, compared to white bulbs. The Horticulture team from the Centre in collaboration with GAEOs organises trainings, demonstrations and field visits for the farmers.

All the production sites are located in lower elevations with altitude ranging from 300 to 950 masl. The bulb onion production was carried

out as a relay crop after paddy cultivation in the irrigated wetlands in all the sites.

The sites for Onion Production Programme increased from 14 in 2013 to 16 in 2014 across the six eastern Dzongkhags. The total area under onion cultivation increased from 19 acres to 29 acres in 2014. Besides the increase in onion production area, there was also increase in the number of households taking up onion cultivation. The collaborating farmers increased from 133 in 2013 to 226 households in 2014. In 2014, there were fewer farmers in Lhuentse and Trashigang involved in the project as compared to 2013, but there has been an increase in all other Dzongkhags.

The total onion production was 36.3 tonnes in 2013 while in 2014 44.6 tonnes of bulb onion was harvested. Samdrupjongkhar leads in onion production in the region and has produced about 50 percent of the total onion production. There

was increasing trend in terms of production in all the Dzongkhags.

Generally, about 50 percent of the total onion produced were sold in all the sites in 2013 and 2014.

The total income from the sale of onion increased from Nu.0.545 million to Nu.0.753 million in 2014. Samdrupjongkhar received the highest income from the sale of onion in 2013 with 0.256 million while Lhuentse received the highest in 2014 with 0.201million. Mongar had a drastic increase in income generated compared to the previous season. In 2014 Samdrupjongkhar has sold about 30 percent of the production as compared to 50 percent sold in 2013.

Onion cultivation in the region has proved to be a successful

venture. The success indicators are the increasing area of onion cultivation and farmers. In most of the markets and shops within the production sites, the local onions are available instead of imported ones. Farmers involved in the programme felt that the paddy-onion cropping system suits best in irrigated wetland, which otherwise, used to be kept fallow during the winter months. They also expressed that growing of onion was easier than the other cash crops because of the following reasons:

- Does not have to guard the crop since it is less damaged by stray/wild animals during the fallow phase
- Major pests and diseases do not attack the crop except

during the seedling stage there had been incidence of cutworms

- No frequent intercultural operations are required except for about 2-3 weeding and irrigation during the entire season and pinching of flowers when bolting occurs
- Thickly sown crops can be sold as green vegetable like spring onions especially in late March and April when green vegetable are scarce

With good success indicators of onion cultivation in the outreach sites, the Centre will continue to upscale the production in the sites and move further into additional potential areas in the region.

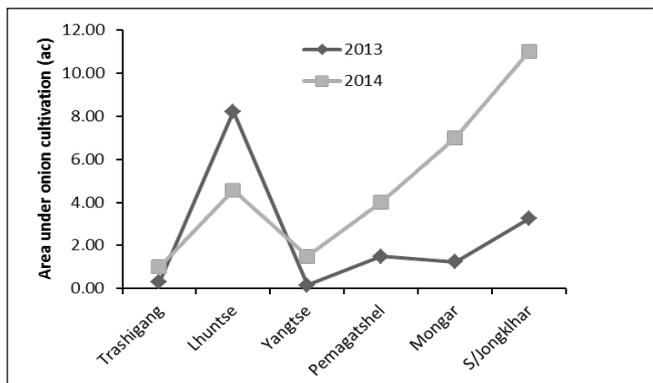


Figure 1. Trend in area under onion cultivation in the region

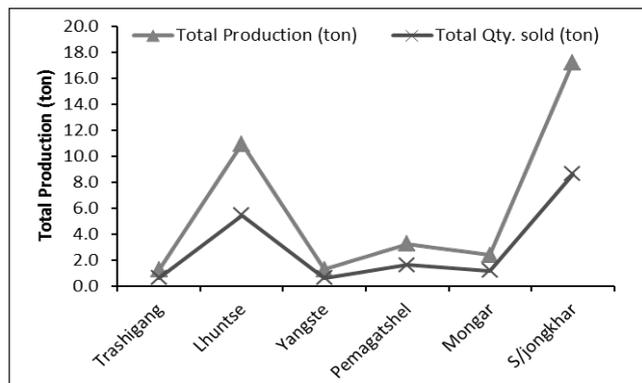


Figure 2. Trend of onion produced and sold in 2013

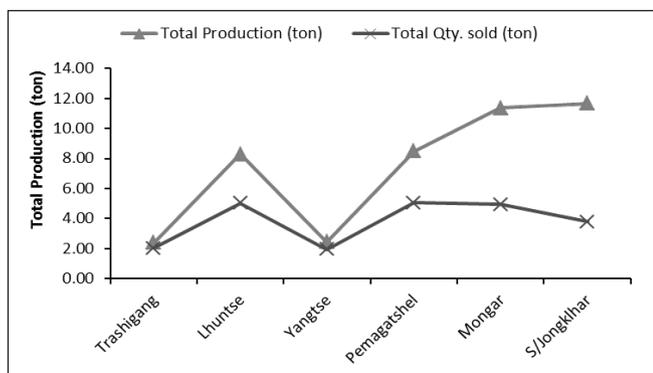


Figure 3. Trend of onion produced and sold in 2014

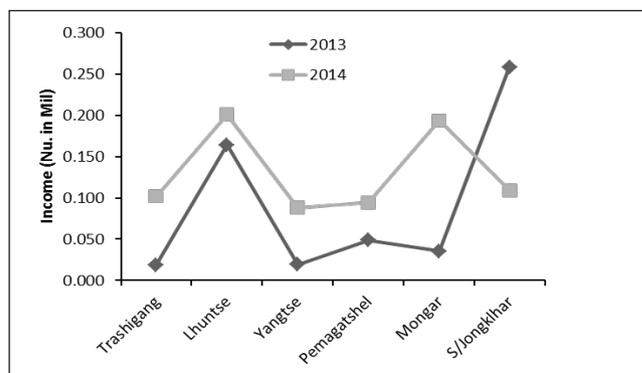


Figure 4. Trend of income generated by Dzongkhags from the sale of onion

Nearer to Fulfilling Dream

THROUGH MOUNTAIN HAZELNUTS

An Added Source of Income for Rural Farmers



By Rinchen Lhamo, MHVL, Thimphu

Ani Kinzang's dearest dream is to build a retreat centre (Drubkhang) for her nunnery. Her family owns ancestral land at Mukazor under Lumang geog in Trashigang, but the land, degraded by landslides, is difficult to work on. Her parents, along with most of their neighbours, have abandoned their homes to take up share-cropping in lower areas, where commercial agriculture is easier, or to look for employment in the urban centres.

Ani's mission has become the restoration of her ancestral lands, making them productive enough to support the nunnery. She hopes this will also encourage the community to return.

Ani Kinzang's difficulties are shared by most rural communities, which face similar challenges.

In recent times, Mountain Hazelnuts (MH) have emerged as a viable solution that has benefitted people trying to subsist on difficult land. MH was formed to develop a commercial solution to generate



income for mountain farmers, while restoring ecosystem health and keeping communities intact. MH engages farmers in planting millions of hazelnut trees on degraded slopes at altitudes of 1,600-3,000 meters, where few other income-generating crops are feasible.

MH provides trees and training to farmers, actively monitors the orchards, and guarantees the purchase of nuts, which it processes for export. Hazelnut trees are pruned annually after reaching maturity, providing a sustainable source of fuelwood. These

factors contribute to making farming profitable and attractive. MH's orchards can be maintained and harvested at different times from other major crop harvests, creating new income without impacting food supply.

All hazelnut farmers have been trained by MH in hazelnut tree planting, cultivation, and harvesting. Management practices are in compliance with the Global G.A.P certification system, ensuring best practices are followed by all growers. The crop is fully traceable and safe as a result.

MH also delivers fertilisers at a cost upon request of farmers, making access to fertilisers convenient and less expensive, and ensuring that the right fertiliser regimen is applied. Fertiliser regimens are based on both local soil types and the nutrient requirement of the plant at its current maturity level. These fertilisers can be supplemented or completely replaced by organic fertilisers, and MH provides guidance to farmers on both these options. Fertiliser requirements for MH are generally lower than other crops currently grown in the region. The farmers have been given the right to determine what level of organic protocol they follow.

MH has assembled a team of experienced international and local professionals with complementary backgrounds, including horticulture,

management, marketing, and finance. Key operational and administrative managers have been developed over the past five years and the company currently employs more than 500 people, nearly half of whom are women.

Additionally, more than 1,200 people benefit as service providers. Over 25 trucks are already routinely contracted by MH; additional small and medium sized enterprises will emerge to provide services to farmers in areas such as post-harvest and input provision. MH encourages farmer entrepreneurs who wish to develop larger hazelnut orchards in collaboration with the company and the government has agreed to lease appropriate land for this purpose.

Over 150 employees have received in-country training in management or technical areas, while several others have been trained in India, USA, Namibia, Nepal, Uganda, and Denmark. MH has also brought a number of international experts to Lingmethang (Mongar) to help train staff, including 13 operational and management consultants and five specialists in hazelnut or nursery management.

MH has built and operates the world's largest hazelnut facility, based in Lingmethang. Approximately 6,000 households, schools, monasteries and nunneries have planted hazelnut trees in 11 Dzongkhags (Punakha, Wangdue, Bumthang, Trongsa, Zhemgang, Mongar, Trashiyangtse, Pemagatshel, Lhuentse, Trashigang, and Samdrupjongkhar).

Planting hazelnut trees also offers income opportunities for absentee landlords who want to bring back their land into productivity, helping both the environment and the local community. In 2015, MH plans to start working with farmers in four additional western Dzongkhags; Chukha, Dagana, Gasa and Tsirang. Eventually, MH will partner with more than 15,000 households and local institutions.

Farmer groups and interested individuals are brought to MH headquarter in Lingmethang for training and planting demonstrations. Additionally, MH monitors and extension officers visit orchards regularly to provide technical support and guidance.

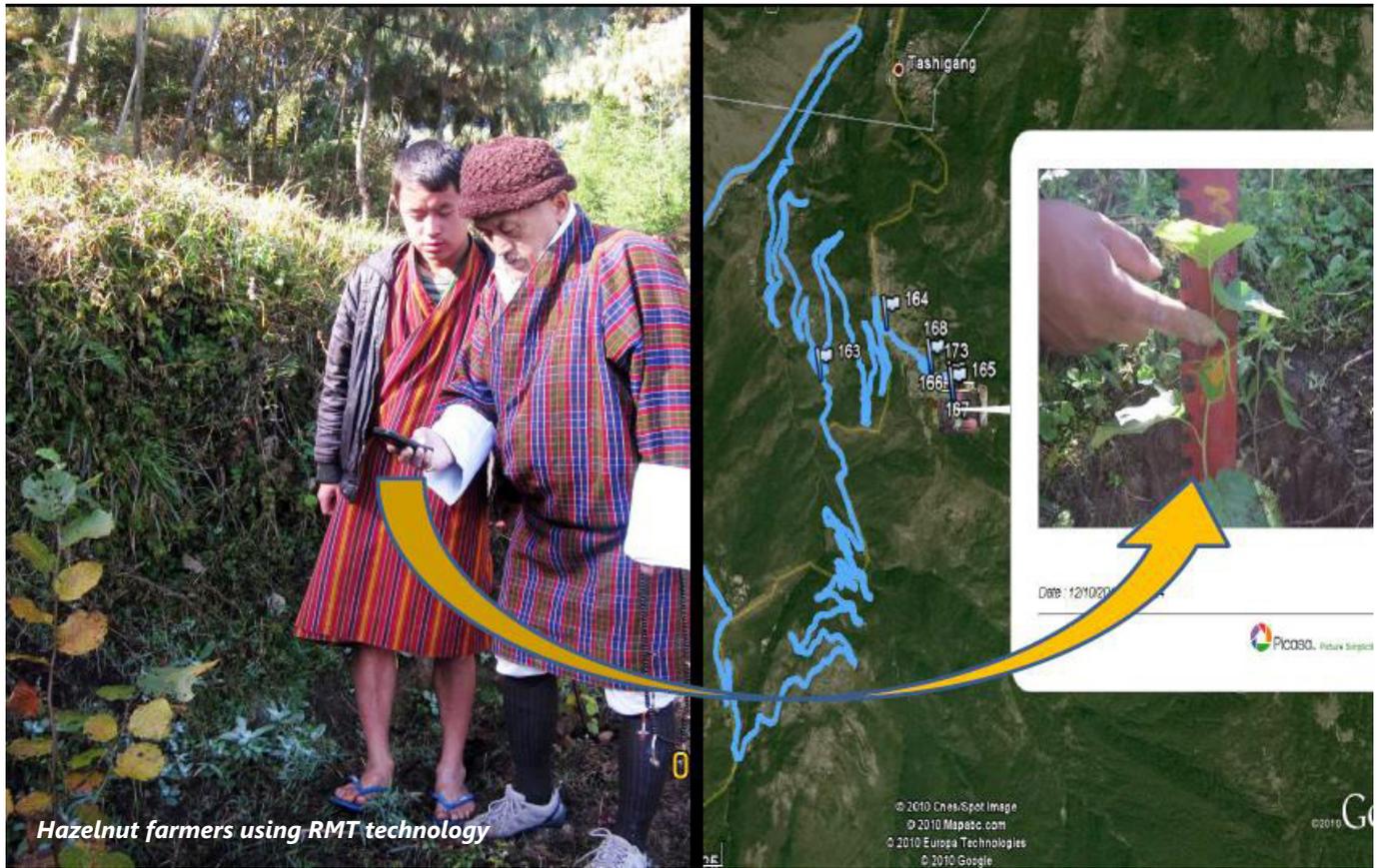
MH orchards produced the first hazelnuts after three years. Larger harvests are expected in 2015, with commercially significant quantities in 2016. A factory to process the nuts is being planned to be built in Mongar.

The Project is expected to more than double the income of participating farmer households, which may include up to 15 percent of the country's population.

MH collaborates closely with the Ministry of Agriculture and Forests in a unique Public-Private-Community Partnership. The long-lived hazelnut trees will stabilise eroding mountain soils, alleviate deforestation pressures from fuelwood, and sequester up to 1.5 million metric tons of carbon dioxide equivalent. The trees promote sustainable



Mountain Hazelnut facility at Lingmethang



landscapes, as all farmers are trained in contour hedge-row planting techniques and good land use practices. The trees mitigate soil loss, restore organic soil carbon, and reverse deforestation impacts.

As a 100 percent export-oriented venture, the production facility will meet international quality standards and adhere to industry best practices (HACCP, GMP, ISO). Due to the challenge of collecting timely and accurate data across widely dispersed hazelnut orchards in geographically remote areas, MH developed its Remote Management and Traceability system (RMT) to connect operational headquarters with field staff through mobile devices. RMT collects social and environmental baseline information with the hazelnut farmers, plus agro-climatic, traceability, tree health statistics, and other critical data to enable MH to better fulfill its social, environmental, and commercial objectives.

MH is strictly focused on the export market and at full production should become one of the country's largest foreign exchange earners, after hydropower.

MH expects to establish 3-4 percent of world production of hazelnuts.

Hazelnuts are typically eaten as a healthy snack food, used in chocolates and baked goods, or enjoyed as a delicious spread like Nutella. MH has a long-term objective of establishing Bhutan as a dependable source of premium quality food products. MH hopes that this will also attract other investors with similar sustainable and long-term oriented business models to come to Bhutan.

While MH is yet to reach all of its goals, it has already managed to make a difference for people like Ani Kinzang. After attempting to grow a variety of crops on her land, Ani Kinzang first heard about MH in 2012. The guaranteed floor price won her over, and she has been growing hazelnuts for two years. She has already finished building the first of seven buildings that will serve as the Drubkhang for her fellow nuns, and is confident that she will fulfill her dreams.

Shari Farmers Group

BENEFITS DAIRY FARMERS

By Tshering Wangmo, DAMC

As a milk collection pick-up truck trundles past villages, farmers like Aum Dawa from Shari are ready by 6 am with a bucket or two of milk to hand over. It is a busy scene, with farmers and collectors measuring the milk and pouring them in numbered milk cans, and then sealing them up.

The farmers are members of the Shari Lothuen Om Tshogpa, which was formed with the guidance and support of the Department of Livestock (DoL) in Dop Shari, Paro, in 2002. With support from DoL and Wang Watershed Management (WWM), a milk processing unit was also constructed in 2004 and equipment provided accordingly.

Membership is voluntary and open but will have to meet certain criteria as mentioned in the by-laws of the group, which has 63 members at the moment. Members must pay an entry fee and sign an agreement to supply a minimum of 150 litres of milk monthly.

The members supply the milk at Nu. 43 per litre, out of which Nu. 3 per litre is deposited to the group's saving account, to be used

or transportation and salary for office bearers- which amounts to Nu. 35,000 per month. The group collects about 800 litres of milk daily, and about 24,000 litres of milk from all its members in a month.

To ensure milk quality, enable traceability and avoid tampering /adulteration, numbered milk cans are assigned to every 2-3 members. The members lock the can after filling them up, and they are opened only at the milk booth in Thimphu before packaging and sale.

Members maintain a book of accounts to record the daily supply, which is simultaneously recorded by the group's treasurer, Sherab Zam. She was nominated to be the treasurer and has been trained on book-keeping. Aum Bida, the milk collector, collects the milk and delivers it to the Milk Booth in Hong Kong Market, Thimphu. The milk is sold to consumers at the milk booth for Nu. 55 per litre.

Membership to the group is sought after, because the payment to members for their milk is done promptly on the third day of every month. Such formation of groups provide a ready market for farmers, which allows them

to concentrate on other works. Additionally, there is a lot of cost saving on transportation, rent, and time, as well as better prices for their produce, and easier access to assistance, support and funds.

The group reported, with a degree of pride, that they contributed Nu. 300,000 towards the reconstruction of Wangduephodrang Dzong from the profits that they had generated.



There are, however, a few areas that still need attention for an enhanced production and benefit to members.

Members can avail a loan from the savings, but they are charged a monthly interest of two percent, which is far higher than the interest rates charged by financial institutions. In fact, members should be benefiting from such credit schemes within the group.

Through strengthened coordination and cooperation amongst members, and with good leadership, the group could appoint salesperson and take up marketing, to reduce the high profit margin that goes to middlemen in the current setup. This will result in increased savings for the group, and lead to increase in investment, expansion, and success.

With guidance and support from the DoL and Department of Agricultural Marketing and Cooperatives, further plans and activities are in the pipeline to form a dairy cooperative in Paro,

by merging farmers groups in the Dzongkhag, improving the milk processing unit and utilising it more efficiently, and improving marketing.



The Group's MPU at Dop Shari

BUCAP Initiative in Dry

By Gyeltshen,
Taraythang, Sarpang

Biodiversity Use and Conservation Asia Programme (BUCAP) was initiated in Taraythang geog under Sarpang in 2012.

RDC-Bhur and its Field Crop Research Officer, Neelam Pradhan, selected the project site. The farmers in the geog grow maize on dry land and wetland paddy after the harvest of finger millet and cassava as seasonal crops.

With the interventions from BUCAP under National Biodiversity Centre and support from RDC Bhur in 2012, a few trials were carried out in Pemacholing and Tashicholing villages as shown in the table:

| Sl. No. | Variety | Quantity of seed | Remarks |
|---------|----------------|------------------|--------------------|
| 01 | Bhur kambja I | 10kg | Dry land condition |
| 02 | Bhur kambja II | 10kg | Dry land condition |
| 03 | Sukha Dhan II | 0.3kg | Dry land condition |
| 04 | Sukha Dhan II | 0.3kg | Dry land condition |

The production trial for different paddy varieties was carried out on an area measuring 6 sq.m (3 sq. m by 2m).

| Sl. No. | Name of farmer | Village | Altitude | Variety | Crop cut sample | Grain yield (Kg/plot) | MC % | Grain yield (Kg) | Remarks |
|---------|-----------------|-------------|----------|---------------|-----------------|-----------------------|------|------------------|-----------------------------|
| 01 | Dhan Man Gurung | Pemacholing | 226masl | Bhur Kambja 1 | 1 | 2.90 | 17 | 1,956 | Trial under BUCAP programme |
| | | | | | 2 | 2.825 | 15 | 1,906 | Trial under BUCAP programme |
| Mean | | | | | | | | 1,931 | |
| 02 | Tenzin Namgyel | Pemacholing | 230masl | Bhur Kambja 1 | 1 | 2.7 | 18 | 1,820 | Trial under BUCAP programme |
| | | | | | 2 | 2.8 | 16 | 1,890 | Trial under BUCAP programme |
| Mean | | | | | | | | 1,855 | |
| 01 | Dhan Man Gurung | Pemacholing | 226masl | Sukha Dhan 1 | 1 | 1.75 | 16 | 1181 | Trial under BUCAP programme |
| | | | | | 2 | 1.5 | 16 | 1012 | Trial under BUCAP programme |
| Mean | | | | | | | | 1097 | |
| 02 | Dhan Man Gurung | Pemacholing | 226masl | Sukha Dhan 2 | 1 | 1.6 | 17 | 1080 | Trial under BUCAP programme |
| | | | | | 2 | 1.45 | 17 | 978 | Trial under BUCAP programme |
| Mean | | | | | | | | 1029 | |

Upland Paddy Production

Intervention leads to increased rice production by changing farmers' mindset

The table above shows the trend in paddy production under Taraythang and compares the production capacity for different paddy varieties.

It took three years for farmers to accept Bhur Kambja I for the mass production, as it was a new variety in the geog. However, in 2013 due to adequate rainfall, there was a bumper harvest amounting to 2,000 kg per acre. And it is understood that with this kind of initiative, rice self-sufficiency can be achieved.

Loss of wetland to developmental activities such as construction have led to decrease in rice production and consequently resulted in the increase of rice imports from India. The Bhur Kambja I comes as a rescue for the farmers, who have no wetlands to grow paddy. Farmers now can grow paddy on dry lands instead of maize. This can substantially reduce the import of rice and some farmers can also sell the surpluses.

In line with the 11th Five Year

Plan's objective of enhancing food and nutrition, BUCAP has made it possible to enhance rice and other cereals production. In the coming year, the geog plans to cultivate 100 acres of upland paddy.

BUCAP in two years has greatly changed the mindsets of farmers. Now they think that everything is possible if they work hard and dream big.

Following is the trend in paddy harvest between 2010 and 2014:

| Sl. No | Particulars | Qty (seeds in Kg) | Year | Area (Acre) | Production (Kg/acre) | Remarks |
|--------|---------------|-------------------|------|-------------|----------------------|-------------------|
| 01 | Bhur kambja I | Nil | 2010 | Nil | Nil | No intervention |
| 02 | Bhur Kambja I | 16 | 2011 | 2 | 1400 | RDC Bhur |
| 03 | Bhur Kambja I | 20 | 2012 | 1 | 1820 | RDC Bhur (BUCAP) |
| 04 | Bhur Kambja I | 100 | 2012 | 5 | 1820 | Dzongkhag |
| 05 | Bhur Kambja I | 740 | 2013 | 37 | 1893 | Dzongkhag |
| 06 | Bhur Kambja I | 20 | 2013 | 1 | 1893 | RDC Bhur (BUCAP) |
| 07 | Sukha Dhan I | 0.3 | 2013 | 0.10 | 1097 | RDC Bhur BUCAP) |
| 08 | Sukha Dhan II | 0.3 | 2013 | 0.10 | 1029 | RDC Bhur BUCAP) |
| 09 | Bhur Kambja I | SELF | 2014 | 40 | - | Under cultivation |
| 10 | Sukha Dhan I | SELF | 2014 | 0.2 | - | Under cultivation |
| 11 | Sukha Dhan II | SELF | 2014 | 0.2 | - | Under cultivation |
| 12 | Bhur Kambja I | - | 2015 | 100 | - | FYP plan 2015 |



Taking Credit Facility Closer to the Farmers

Rebooting agriculture sector in Bhutan

By Dhan Kumar Bhujel, RAMCO



Credit facility is one of the main drivers of economic growth and development in any country. And it is no exception in Bhutan. The country faces a lot of challenges in the agriculture sector and added to these challenges is a lack of credit facilities. Limited credit facilities and difficulties involved in accessing available facilities are the two major constraints that affect agricultural sector in the country.

Farmers face difficulties in availing credit facility for many reasons since they may not have collaterals or mortgages that are acceptable to the financial institutions. Moreover, the poor farmers also lack other bankable assets. As a result, poorer they are, lesser are their chances of borrowing from the formal sectors. The difficulty heightens as most of the rural communities are illiterate and unaware of credit schemes and their formalities.

One of the reasons why private sector is less interested in agricultural ventures is due to lack of credit facility. And the lending patterns of the financial institutions confirm it. Out of five commercial banks in Bhutan (Bank of Bhutan, Bhutan National Bank, Bhutan Development Bank Ltd., Druk PNB Ltd. and TBank Ltd.) today, only Bhutan Development Bank is involved in active credit lending to agricultural sector.

The agricultural sector, which contributes about one-fifth of the GDP and employs two thirds of the population never received more than 3 percent share in lending from the financial institutions from 2008 till 2012.



Table: Sector wise lending from banks and financial institutions

| Industry | 2008 | | 2009 | | 2010 | | 2011 | | 2012 | |
|---------------------|------------------|------------|------------------|-----------|------------------|------------|------------------|------------|------------------|------------|
| | Nu. | % | Nu. | % | Nu. | % | Nu. | % | Nu. | % |
| Agriculture | 573.50 | 3 | 403.27 | 2 | 499.45 | 1 | 843.23 | 2 | 1,193.82 | 2 |
| Service & Tourism | 2,958.90 | 13 | 3,718.64 | 14 | 5,905.93 | 16 | 5,239.20 | 11 | 6,374.50 | 12 |
| Manufacturing | 4,364.40 | 20 | 4,727.27 | 18 | 5,928.52 | 16 | 7,165.30 | 15 | 7,819.55 | 15 |
| Construction | 5,768.20 | 26 | 6,615.33 | 25 | 8,936.13 | 25 | 12,104.60 | 25 | 14,475.42 | 27 |
| Trade & commerce | 3,772.50 | 17 | 4,478.44 | 17 | 5,706.99 | 16 | 4,765.90 | 10 | 4,379.50 | 8 |
| Transport | 1,325.40 | 6 | 1,763.90 | 7 | 3,196.90 | 9 | 4,732.60 | 10 | 4,356.56 | 8 |
| Personal loans | 2,746.70 | 13 | 3,989.10 | 15 | 5,094.26 | 14 | 8,055.44 | 17 | 8,995.36 | 17 |
| Loan Against Shares | 118.00 | 1 | 200.43 | 1 | 221.11 | 1 | 490.80 | 1 | 569.43 | 1 |
| Others | n/a | n/a | n/a | n/a | 12.63 | 1 | 4,115.69 | 9 | 5,276.10 | 10 |
| Total | 21,961.49 | 100 | 26,283.10 | 99 | 36,005.02 | 100 | 47,512.70 | 100 | 53,440.24 | 100 |

Source: Statistical Year Book 2013, Page 183 and 184

Rural credit or financing has not been adequate, but the policies guiding it are becoming more stringent. It is another obstacle that stalls the development in the agriculture sector.

Moreover, the existing banks that deal with rural credit have their branches located mostly in the urban centres. As a result, it becomes difficult for the scattered rural population to access the facilities. In Bhutan, the concept of micro-credit is fairly new and is limited in its scope and accessibility.

The above constraints in accessing formal credits force farmers to borrow from their friends, family members and the money-lenders at much higher interest rates.

The country in recent times has seen more Farmers' Group and Cooperatives coming to rescue

farmers. However, as almost the existing Farmers' Groups and Cooperatives are production or marketing based, managing or facilitating tiny credit facility that they handled among the group/cooperative members is a huge challenge. At this juncture, the country also lacks other rural micro-credit providers such as Credit Union, Credit Cooperatives and Cooperative Banks. All that a person can turn to at the time of formal credit needs is the commercial banks alone and nothing more.

Recognising rural credit and micro finance as one of the major constraints in agricultural development, there is a great need to create simple and easy pro-poor credit facility, which is almost non-existent at present.

Therefore, innovative approaches

should be put forward if we want to help our rural communities. Rural credit programmes must consider new options and initiatives to serve rural farmers taking into account the following points:

- The credit scheme must have simple loan appraisal process
- New and innovative approaches to collateral and security may be sought
- Faster approval and disbursement process
- Deliver loans and other banking services at the places convenient to the farmers

It is needless to mention that by incorporating and considering few innovative initiatives, it can create a big impact on the agricultural practices in the country and will enhance farmers' incomes. Eventually, the country will achieve the national goal of self-sufficiency.

Reducing Poverty

THROUGH VEGETABLE CASH CROPPING



By Tshering Tobgyel, Agriculture Sector, Gelephu

The Horticulture Division, Irrigation Division, and researchers of the Ministry of Agriculture and Forests, along with Dzongkhag Office, have made a fair degree of success in convincing farmers across the country that the optimum use of agricultural land can help them generate good income.

An example of this success is Chubu geog, which lies between Phochu and Mochu rivers in Punakha. Chubu has six chiwogs with over 250 households, and the population consists of an equal ratio of men and women. The area is dominated by wetlands, with huge potential for cereals as

well as vegetable crops. Farmers' attitudes towards agriculture is changing, with an increasing interest in mid-commercial agricultural ventures.

Farmers in Chubu mainly grow chilies, beans, mandarin and guava. The vegetable products from the geog is seen to be competing with imports, and there have been observable competition among the farmers themselves.

A majority of farmers are busy with oxen, power tillers, and other agricultural tools, cultivating chilies and beans after paddy harvest. Each chiwog owns three to four utility vehicles to transport

produce to markets in Thimphu, Khuruthang town in Punakha, and Wangdue.

Farmers earn anything between Nu. 30,000 to Nu. 200,000 from chilies alone- which is a matter of intense pride for them. This income is further supported by earnings from beans, fruits, rice, and zaw (fried rice).

However, there are some immense challenges ahead of us as we work to achieve the aspirations of the farmers and fulfill our national goals in economy and food self-sufficiency, based on the lessons, observations and experiences of Chubu geog from 2006-2013.

Possibility of

RICE DOUBLE CROPPING

Testing short duration rice varieties to enhance production

By Neelam Pradhan (RDC Bhur); Ngawang Chhogyel, and Mahesh Ghimiray (RDC Bajo)

Rice is among the most important crops for food security in Bhutan, but the national production of about 78,000 tons meets only about 50 percent of the requirement. This means that we depend on imports for half of our most important food staple. There is a need to enhance rice production in the country, if we are to achieve our goal of food self-sufficiency, and the Department of Agriculture (DoA) has been tasked with this onerous duty.

An important initiative to enhance rice production in the country is through rice double cropping. There is immense potential to harvest rice twice a year in the entire southern belt and mid-altitude regions of the country. For this, the farmers must grow higher yielding short duration varieties to fit in well with the rice-rice cropping system.

As part of this initiative, RDC

Bhur has tested 12 varieties during the 2014 spring season. At the moment, the DoA has only one short duration variety (IR20913) which was released in 1989. There is a great need to find more varieties, and give farmers more options. The initiative to test more varieties answers this need.

The 12 rice varieties were tested for their adaptability, maturity duration, yield potential, plant height, and resistance to common diseases and pests under lowland rice environments. Out of the 12 varieties (ten from Bangladesh known as the BRRI varieties, and two from Nepal) which were tested against the standard local checks - the IR20913 and Hardinath, several were found to be promising.

Among the test varieties, BRRI dhan 58 yielded 2.67 tonnes per hectare, which was higher than that of check variety IR20913 (1.72 t/ha). Few of the varieties

also took fewer days to flower compared to the check varieties. Based on the test results, three BRRI varieties (BRRI dhan 26, BRRI dhan 28, and BRRI dhan 58) and one introduced from Nepal (Sukha than 2) were selected for further testing in the next season.

The seeds from the best performing entries in the second year experiment will be multiplied and made available to farmers. The DoA targets to have at least 3-4 short duration varieties for spring rice.

In addition to the tests at RDC Bhur, there are ongoing experiments at RDC Bajo to screen introductions for spring rice. Thus, we can expect to release a couple of high yielding short duration rice varieties for double cropping within the next few years, and contribute significantly to increasing the total rice production in Bhutan.



Table: Agronomic traits and yield of different entries

| SI No. | Varieties | Days to flower (days) | Plant height (cm) | Tillers/hill | Yield (t/ha) |
|--------|-----------------|--------------------------|----------------------|--------------|--------------|
| 1. | BRR I Dhan 26 | 118 | 84 | 15 | 2.01 |
| 2. | BRR I Dhan 28 | 115 | 80 | 15 | 2.14 |
| 3. | BRR I Dhan 36 | 118 | 72 | 15 | 2.22 |
| 4. | BRR I Dhan 45 | 113 | 74 | 14 | 1.71 |
| 5. | BRR I Dhan 49 | 131 | 87 | 13 | Discarded |
| 6. | BRR I Dhan 56 | 114 | 78 | 12 | 1.57 |
| 7. | BRR I Dhan 57 | 124 | 82 | 17 | Discarded |
| 8. | BRR I Dhan 58 | 119 | 82 | 14 | 2.67 |
| 9. | BRR I Dhan 60 | 103 | 66 | 19 | 1.12 |
| 10. | BRR I Dhan 61 | 110 | 63 | 15 | 1.73 |
| 11. | Sukha Dhan 1 | 119 | 80 | 12 | 1.48 |
| 12. | Sukha Dhan 2 | 114 | 90 | 14 | 1.57 |
| 13. | Hardinath Check | 104 | 67 | 16 | 1.61 |
| 14. | IR 20913 Check | 110 | 104 | 13 | 1.72 |



Dragonflies

USEFUL INSECTS THAT ALSO INSPIRE POETRY *A natural pest management*

By Tshering Tobgyel, Agriculture Sector, Gelephu

Dragonflies, throughout the summer, skim surfaces of ponds and hover in thousands over paddy fields, inspiring strange sentiments in an acute observer. It is not surprising that Japanese poets and artists have found inspiration from these wonderful insects, and have included it in their compositions as symbols of tranquil beauty.

Known as *Jamtsbogem* in Dzongkha, the dragonfly has many names in various local languages: *Bjaye Aum*, *chew tap*, and *Achuphento*. Dragonflies are among the oldest insects on earth,

and over 6000 named species in 600 genera, from 8 super families, 20 families, and 58 sub-families, have been described in the world, according to Silsby.

Dragonflies belong to the order odonata, along with damselflies, their cousins who can fold up their wings at rest. Dragonflies are believed to be able to consume food equal to its own weight in about 30 minutes, and can move at an amazing 45 miles an hour (McGavin, 2001).

While other insects and worms, like earthworm, ladybird, and

beetles get significant attention, dragonflies are largely ignored by the Bhutanese farmers, who do not have much information on their contribution to the economy or their uses as pest managers.

A study was carried out as a part of the B.Sc. Agriculture Programme at College of Natural Resources, Lobeysa in Jibjokha village (Toewang geog) in Punakha from August to November 2014. The objective of the study was to observe the habitat of dragonflies, as well as identify species, feeding habits, and the economic importance to agricultural crops.

The study began with interviews of local farmers on their perceptions and observation of dragonflies, and the results were rather interesting.

Farmers consider the activities of dragonflies as herald of new seasons, and take cues from their appearances and disappearances to carry out major agricultural activities. When the dragonflies multiply and large numbers begin to swarm over the paddy fields, it is time to weed the fields, whereas a decrease in the population around autumn signals the time for harvest and the approach of winter. They also believe that there is a decline in the population over the last 15-20 years.

However, farmers are not aware of the uses of dragonflies for organic pest-control. The most prominent species found during the study were the *Orthetrum villosorittatum* (fiery skimmer), found in paddy fields.

Oryzothemis coccinea and *Othetrum testaceum*, and *Pachydiplax longipennis* (blue dasher) were found over the streams and ponds.

Some other unidentified species were also observed flying over streams and ponds. A few damselflies were also seen in paddy fields and over streams and ponds.

The fiery skimmer has a wide range of prey, such as bugs, hoppers, mosquitoes, etc. They have large eyes with about 30,000 facets, which enable a nearly 360-degree field of vision, but they are nearly blind and therefore inactive during the early mornings and at nights, when they can be caught easily.

During the daytime, however, as the temperatures rise and the dew in the fields begin to dry, they become the master of

flight. Many fall prey to birds and cobwebs.

Females lay their eggs on weeds and grasses, half submerged in water. They support their bodies on the weeds, and their abdominal parts remain submerged as they drop eggs while shifting from weed to weed. The eggs are threatened by water beetles.

Some dragonflies mate in flight, on plants, and even on water as the females are dropping eggs. The aggressive-seeming males keep watch over the females as they lay eggs.

The blue dasher lays eggs during flight, on moss, and submerged weed in shallow and calm water.

We were interested to observe more and learn about naiads (larvae) but it was not possible given the time constraints.



Dragonfly Nymph

Dragonfly Emerging from Nymph Stage

Adult Dragonfly

INSTALLATION OF NEW RICE PROCESSING UNITS

That promises significant increase in production, thus increased income

By Ngawang Chhogyel, Mahesh Ghimiray, and Cheku Dorji, RDC Bajo

With the installation of three modern rice processing units for Wagdue-Punakha, Tsirang-Dagana, and Samdrupjongkhar, the Department of Agriculture (DoA) has a reason to expect increased production in the coming years, and a significant benefit to the national economy through agriculture.

The three rice mills of 0.5 MT per hour capacity have undergone successful test run capacity and are being installed as part of an ongoing rice commercialisation programme by the DoA. The rice commercialisation programme, which commenced in 2010, is being pursued through the 11th Five Year Plan, and aims to enhance rice productivity and production, empower rice farmers through increased profitability, and formalise marketing of domestic rice by establishing improved rice processing facilities in the country.

It is hoped that such interventions will bring about major changes in various levels of rice value chain

in the country. The 1.5 MT per hour capacity modern rice mill at Chuzagang has been immensely successful, and adequate for the needs of Sarpang at the moment. The need for similar rice mills at various other locations across the country has been identified in the 11th FYP and five more units are expected to be up and running by the end of the plan period.

Unlike conventional rice mills, the modern mills are combined single units of a modern rice processing plant; consisting of efficient husker, de-stoner, pre-cleaner and cleaner, paddy separator, rice

grader, length grader, and rice whitener/polisher.

The rice mill sets also include separate units of one ton capacity motorised flat-bed type grain dryer, stitching machines, weighing scales, hydraulic trolley and wooden pallets.

Taking cue from the operational and utilisation capacity of the rice mill at Chuzagang by the farmers, DoA has signed a memorandum of understanding with the Food Corporation of Bhutan Limited (FCBL) for operation and management of the new



mills. Inadequate working capitals and inefficient management of farm business enterprises by the existing farmers groups and cooperatives are some of the DoA's major concerns. Therefore, the centralised rice mills are going to be operated and managed by FCBL, who has adequate expertise, experience and working capital.

As part of the Accelerating Bhutan's Socio-Economic Development (ABSD) Initiative charter for rice productivity improvement programme in 2010, potential cluster Dzongkhags for rice commercialisation programme were identified. The cluster Dzongkhags with huge potential for rice commercialisation programme include Wangdue-Punakha, Tsirang-Dagana, Samtse, Sarpang, Samdrupjongkhar and Thimphu-Paro. The DoA has initiated various interventions to improve rice productivity and production in these clusters, and rice yields are reported to be increasing at the rate of 8-10 percent per annum. According to Bhutan RNR

Statistics (2012), rice was grown in an area of 59,607 acres with a total production of 78,730 MT. The six cluster Dzongkhags together constitute about 69 percent of the total area (41,416 acres) under rice cultivation in the country. Currently, these cluster Dzongkhags account for more than 68 percent of the country's total production (53,760 MT). With vigorous interventions, such as construction and renovation of irrigation channels, farm mechanisation, promotion and supply of improved seeds, and intensified farmers' trainings, rice yield is projected to increase by at least 10-15 percent, enhancing rice production from 78,202 MT to 84,753 MT in 2014 (as shown in the table below). Such a trend in production increase (6551 MT) should follow every year. By the end of 11th FYP, the total rice would go up by 32,755 MT to 110,957 MT.

From the cluster rice commercialisation areas where modern rice milling facilities are being created, a modest 20

percent collection from farmers would amount to 14,382 MT of paddy for milling every year. For rest of the Dzongkhags, the yield projection and percent collection were estimated at 5 percent and 10 percent respectively.

Considering milling recovery of 65 percent, the projected 14,382 MT paddy would yield 9,346 MT of head rice for sale, which is worth over Nu. 280 million (cost of milled rice calculated @ Nu.30/kg). The amount of paddy for milling and hence milled rice for sale should increase every year as rice farming becomes more market-oriented.

Capitalising on the rice commercialisation programme will greatly increase availability of local rice in the domestic market, thereby reducing import from India and outflow of rupee. This will have a positive impact of agriculture to the national economy. Taking 9,346 MT rice into the mainstream circulation or Bhutanese market will be an achievement for the department.

Table: Projection of production increase and additional rice for domestic market.

| Dzongkhag/ cluster | 2013 production (MT) | 2014 Production (MT) @10 yield increase | Market surplus @20 collection | Head rice @ 65% milling recovery | Revenue Gener- ation @ Nu.30/ kg (million) |
|---------------------------|-------------------------|---|----------------------------------|--|--|
| Sarpang | 8704 | 9574* | 1914 | 1244 | 37.32 |
| Samtse | 8867 | 9753* | 1950 | 1268 | 38.04 |
| S/Jongkhar | 1986 | 2184* | 437 | 283 | 8.49 |
| Wangdue- Punakha | 12887 | 14175* | 2835 | 1842 | 55.26 |
| Tsirang-Dagana | 10884 | 11928* | 2385 | 1550 | 46.5 |
| Thimphu-Paro | 10432 | 11475* | 2295 | 1491 | 44.73 |
| Rest of the Dzongkhags | 24442 | 25664** | 2566* | 1668 | 50.04 |
| | 78202 | 84753 | 14382 | 9346 | 280.38 |

N**: 5% increase over the current projection; n*: 10% collection from the projected production.

Bamboo Shoot PICKLING

Boosting Rural Livelihood in Jigmecholing

By Jigme Tenzin, Jigmecholing, Sarpang

Introduction and Objectives

As other forest products, bamboo also provides interdisciplinary uses. However, in Bhutan it is restricted only to scaffolding, souvenir, construction and sometimes in bamboo pickling. In Jigmecholing geog 150 farmers of 20 households have come together and formed ‘**Tashiling NWFPs Management and Marketing Group**’. These farmers have started bamboo shoot pickling to increase their rural livelihood. The project is funded by Helvetas Swiss Inter-Cooperation and initiated by the Geog Forestry Extension officer under the support of Rural Livelihood Project (RLP) II.

Among 12 geogs of Sarpang, Jigmecholing has the second highest poverty incidence with 33 percent while Chudzom geog at 39 percent stands as the highest in the Dzongkhag. The main stakeholders of the project, people of Chungshing, are of ethnic Monpas with poor socio-economic background. And unlike the other villages, Chungshing has strong community cohesion between the members. Orange is the source of income for some farmers.

Among the 16 different species of Non-wood Forests Products (NWFPs) approved for collection until 2018, bamboo (*Dendrocalamus hamiltonii*) is one of them, whose shoots are edible. Locally called ‘*Choya Bans*’, the bamboos are found naturally grown in great abundance within their approved NWFPs collection area. Preliminary bamboo survey conducted revealed that the resources are abundant

and area was feasible for initiating micro-bamboo pickling plant.

With technical support from Integrated Food Processing Plants (Dagana and Zhemgang), administrative support from the geog office and Dzongkhag Forestry Sector in Sarpang, bamboo-pickling project was implemented in 2014.

The objectives are:

- To enhance production, processing and marketing of NWFPs
- To build the capacity of the NWFPs group of Chungshing and Chakpai in bamboo shoot processing and management
- To establish small enterprises on Bamboo Shoot Processing for sustainable rural income generation

Before starting the project, a sensitisation and awareness meeting was held with the farmers to advocate on the scope and opportunities of marketing bamboo-shoot pickles. The bamboo experts also demonstrated sustainable management and harvesting of the bamboos including scientific bases of harvesting bamboo (both culm and shoot harvesting technique) at Romgang (Block I) and Ranjapong (Block II).

About 3,000 acres of natural forest area within the proximity of Chungshing and Chakpai villages was approved and designated as NWFPs collection area,



but approximately 150 acres (60.73Ha) forested area are covered by natural grown picklable bamboo forest. According to the preliminary bamboo survey, the area has a capacity to produce minimum of 1,800 kilograms of bamboo shoots annually and enable production of 3,600-4,000 bottles of pickles.

Pickling Processing

Pre-processing

- a. **Shoot Collection-** About 25 percent of bamboo shoots from the total shoot grown in a clump is harvested. 1-2 foot tall shoots are cut using sharp cutting saw from the mid-junctures of soft (Aerial portion) and hard portion, beneath the ground. The insect-infested, broken, wounded and animal bitten bamboo shoots are avoided to minimise microbes/diseases transmission as per standard of Hazard analysis for critical control point. Members harvested about 400 to 500 kilograms of bamboo shoots during the trial year (2014).
- b. **Shoot Slicing-** Shoots are segregated into two parts; the tips (softer parts) are used as vegetables while the lower portions, which are slightly harder, are used for pickling. The shoots are crosscut and further sliced into four equal parts with 3-5cm slices lengths.
- c. **Blanching-** Slices are then put into steel pots with water and blanched to 100 degree celsius.

Water is drained immediately and the contents are immersed in cold water to retain colour, shoot textures and nutrients in the slices. Blanching removes cynic acid/astringency from shoots and retains nutrients and inactive enzymes that are good for the health.

- d. **Fermentation-** Slices are put in a solution of 8 kilograms of salt and 100 litres of water. Every weekend, the content is stirred with a ladle to obtain a uniform solute distribution. Fermentation retains the quality of the products for a longer duration. Bamboo shoot can be preserved under fermentation for minimum of three months to one year.

Processing, Sealing, Labeling, and Packaging

Fermented slices are further sliced into pickle sizes using stainless knife on plastic chopping boards, ensuring proper hygiene. Members are required to wear uniforms (apron, hat, mask and plastic glove) during the process. Slices are measured using a digital weighing machine and put into a steel drum or aluminum pot.

The other ingredients such as chili powder, cumin (jeera), turmeric powder, mustard seeds, mustard oil, fenugreek (methi), mixed masala, etc. are added as per the ratio prescribed by the integrated food processing unit. For example, for a kilogram of bamboo shoot slices, 10g of mustard seed, 2g of turmeric powder, 4g of cumin, 4g of mixed masala,

4g of fenugreek, 4g of chili powder and 180 ml of mustard oil are added and mixed thoroughly with the help of ladles. Mixtures are then put into other jerry cans and basked in the sun for 2-3 weeks. The process is called curing. It facilitates the slices to observe the ingredients added and changes their aroma, taste, flavour and colour.

After curing for 2-3 weeks, the cured slices are filled in the pickle bottles according to the sizes of the bottles (200g, 400g bottles, etc.) and tightly sealed. The bottles are then kept upside down to check the leakages prior to packaging. Then they are labeled as per specification and packed in the coagulated paper cartons.

Marketing

During the first harvest, the group had produced about 183 bottles of pickle, which were sold during the first Agri-Flori Expo conducted by Bhutan Chamber of Commerce and Industry (BCCI) in Thimphu. Regional BCCI Office in Gelephu facilitated the marketing of the produce since it was carried out on a trial basis. The Secretary and a member from the group had also represented in the Expo and sold the pickles. RLP Project II supported the traveling and transportation cost and the cost of stalls during the Expo. During the three-day Expo, bamboo shoot pickles received good customer turn-up and good customer feedback. The group also received more orders from various suppliers across Thimphu, Paro and Gelephu.

Therefore, we expect better progress during the second year. The group had planned to operate community market at geog level and then gradually expand to Dzongkhags to regional market at Gelephu then finally to Thimphu. When the production increases and becomes viable, the group will also explore the options to export the products branding them organic. Quality assurance, customer satisfaction, affordable price, and market accessibility are the main marketing strategies of the group.

Socio-Economic Analysis

Cost and benefit analysis on bamboo pickling was done after accounting all the parametres. Cost of labour, utility charges, ingredient costs and

other overhead expenditures are the main elements considered for economic analysis. For instance, single bamboo culm cost about Nu.60-70 in the local area, but a single shoot weighs almost one kilogram when fresh. A kilogram of shoot can produce up two and half 400g bottles that can fetch up to Nu.130 per 400g-bottle and Nu.75 per 200g-bottle respectively. In total, we get sum of Nu.335 only after adding substantial values to a shoot. On the other hand, sale of bamboo culm is costly and labour intensive. So, pickling is economically viable and cost effective compared to sale of bamboo culm.

Bamboo pickling is green business since it is both profitable and environmentally friendly being purely organic. While harvesting bamboo shoots, various silvi-cultural operations are also done. Comparative analysis shows that bamboo shoots have more advantage than production and sale of culms. Even women are able to do pickling job, but they cannot harvest and sell bamboo culms since it is labour intensive. Therefore, 16 women from the group will have employment during the season and need not look for other work during winter.

Acknowledgement

Tashiling NWFPs Management and Marketing Group would like to acknowledge Helvetas/SDC and RLP Project Phase II and the Ministry of Agriculture and Forests for supporting such projects that would directly benefit the socio-economic conditions of the Monpa community. Besides that the project would create employment opportunity in rural areas and empower women, we hope it would decrease the instance of rural-urban migration in the future.



Wheat farmers in Bhutan now have an alternative to SONALIKA

Wheat Farmers Have Option to Grow Better Varieties

By Sangay Tshewang, RDC Bajo

Considering the acreage, wheat is currently considered a secondary cereal in the country as it is grown over an area of about 5,540 acres. However, its contribution to the Bhutanese farming system in terms of food and other requirements is greatly acknowledged. This is particularly relevant in far flung and remote farming communities, where access to import wheat products is limited. The wheat cultivation, however, has been challenged by many constraints, most notably pressure from diseases (particularly rusts).

Sonalika, an obsolete and disease susceptible cultivar, is still a mega-variety occupying a significant area. It has been in the field to date since its release in 1988, either from the farmers own saved seed or through government's promotional programme, which was met from the seed imported from North East India.

However, with its break down to rusts, neighbouring countries have replaced Sonalika with a number of high yielding and disease

resistant cultivars. It is reported that India has released about 326 varieties, followed by Pakistan (63), Nepal (25) and Bangladesh (23) as an alternative to Sonalika after its commercialisation.

Considering the urgency and opportunities, the national wheat programme collaborated with regional and international wheat centres (Nepal Agriculture Research Council, Indian Council of Agriculture Research, International Centre of Maize and Wheat Improvement Centre, Durable Rust Resistance in Wheat Project, to name a few) on wheat improvement.

The collaborations, though late, have been very effective and fruitful. The most tangible output of the collaboration is the release/notification of two new improved wheat varieties as Gumasokhaka (KIRITATI/HUW234+LR34/PRINIA) and Bajosokhaka (ATTILA*2/STAR/4/SNI/TRAP#1/3/KAUZ*2/TRAP//KAUZ) in August 2014.

Apart from possessing good

resistance to rusts, these varieties produced yield advantage of more than 50 percent than Sonalika in multi-location trials in the farmers' fields. This is a significant achievement as farmers now have better varieties after 20 years, and can cultivate rusts free and healthy crop, which can provide higher yields from the same amount of work and inputs.

While the breakthrough had been made in the spring ecosystem, it may take a few more years to have a similar level of success in winter wheat production. This is because access to improved varieties of winter or facultative nature is limited both in regional and international centres. However, adaptability trials are on-going with limited seed quantity received from the neighbouring country, Nepal. It is expected that it will be not too far to obtain conclusive results from these trials.

The National Seed Centre is entrusted to coordinate the seed production of these new spring varieties for wider promotion and dissemination to replace Sonalika.





AGRICULTURAL MARKETING: Challenges and the way forward

Increased intervention has enhanced agricultural marketing activities and productivity, but is that sufficient?

By Dhan Kumar Bhujel, RAMCO

With a significant contribution of 16.8 percent towards the country's GDP, agriculture is one of the most important sectors in the Bhutanese economy. The sector directly employs about 59.4 percent of the total population, accounts for 4.3 percent of total exports income and serves as a catalyst for the other sectors by providing raw materials.

The national objective for the 11th Five Year Plan (2013-2018) is to achieve self-reliance through inclusive green socio-economic development. Thus, the agriculture sector has an important role to play towards achieving the national goal. The sector was termed as

the "second jewel" (the first being hydropower) of the nation by the current Prime Minister of Bhutan, Lyonchhoen Tshering Tobgay in his 2014 State of the Tsa-Wa-Sum address.

Since the start of planned development activities in the country from 1961, agricultural sector had been following production access marketing (PAM) approach, where the production was the main focus. However, starting the 10th Five Year Plan (2008-2013), the Royal Government of Bhutan, realising the importance of agricultural marketing, shifted its focus from PAM approach to market access

production (MAP) approach.

As a landlocked country, Bhutan faces many challenges. With an area of just 38,394 square kilometres, most of the region is rugged terrain and mountains leaving only 2.9 percent of the total land as cultivable area and most of the farmers are involved in subsistence farming. The destruction of crops by wildlife, traditional mode of production, farm labour shortage, and higher cost of production are some of the challenges. The other challenges include limited landholding, lack of proper irrigation channels, inadequate market infrastructures, lack of

credit and rural finance, loss of agricultural lands to other developmental activities, rural-urban migration, and lack of public interest in farming.

The country with an open border policy and free trade agreement with India has made it increasingly dependent on agricultural imports from India. In 2012 alone Bhutan imported food items worth Nu. 4,936.59 million from India, which included rice, cooking oil, vegetables, meat, fish, butter, cheese, milk and other milk products.

The rupee crisis that the country faced in 2011 was an eye opener for the government and the people at large. Since then the agricultural sector has caught the attention of the policy makers and increased intervention has led to an enhancement of agricultural marketing and productivity. Despite these interventions in the sector, it has not been sufficient to attain rural prosperity including food security and combating rural poverty. Although the country has been successful in reducing the rates of poverty in general, rural poverty is still a great cause for concern.

Today, the country is gearing

towards self-sufficiency in terms of agricultural produce. This has led to increase in production of cereals, vegetables and fruits. But it is not about production alone. It takes effective marketing to help us achieve the greater goal of self-sufficiency. Effective agricultural marketing will not only bring proper distribution of food and other commodities but will also bring efficiency, accessibility and equality in distribution. It is the marketing process that is credited for making goods available to all areas by collecting from the area that has surplus to an area that is deficit, through formally organised channel.

Recognising the challenges that affect the agricultural sector, it is crucial for the government to further intervene. Such interventions can come in the form of linking rural producers to urban market to other institutions, increasing public investment in agricultural sector, making rural credit and micro finance easily accessible to the farmers and mitigating human wildlife conflicts. It is also important for the government to involve NGOs and CBOs in agricultural sector, encourage use of ICT in agricultural marketing and further strengthen farmers group and cooperatives. It is equally important to develop the

capacity of farmers and introduce recognition and reward system in the agricultural sector. It is sad to see that farming as an oldest profession in the country has no recognition and reward system in place. Other popular events such as farmer's fair, workshops/seminars and agricultural events can also be planned for leveraging the image of the sector. We need to develop the capacity of farmers and introduce a recognition and reward system in agricultural sector. Product diversification and making agricultural products accessible and affordable are other areas that demand the government's attention.

It is also equally important to have a dynamic agricultural marketing policy to guide and prioritise marketing activities. In order to encourage productive agricultural sector and prosperous rural community, we need to adopt a holistic and multi-dimensional approach. It is a well-known fact that the isolated interventions are often ineffective in bringing a desired change. Therefore, we must work towards multi-facet approach and interventions.

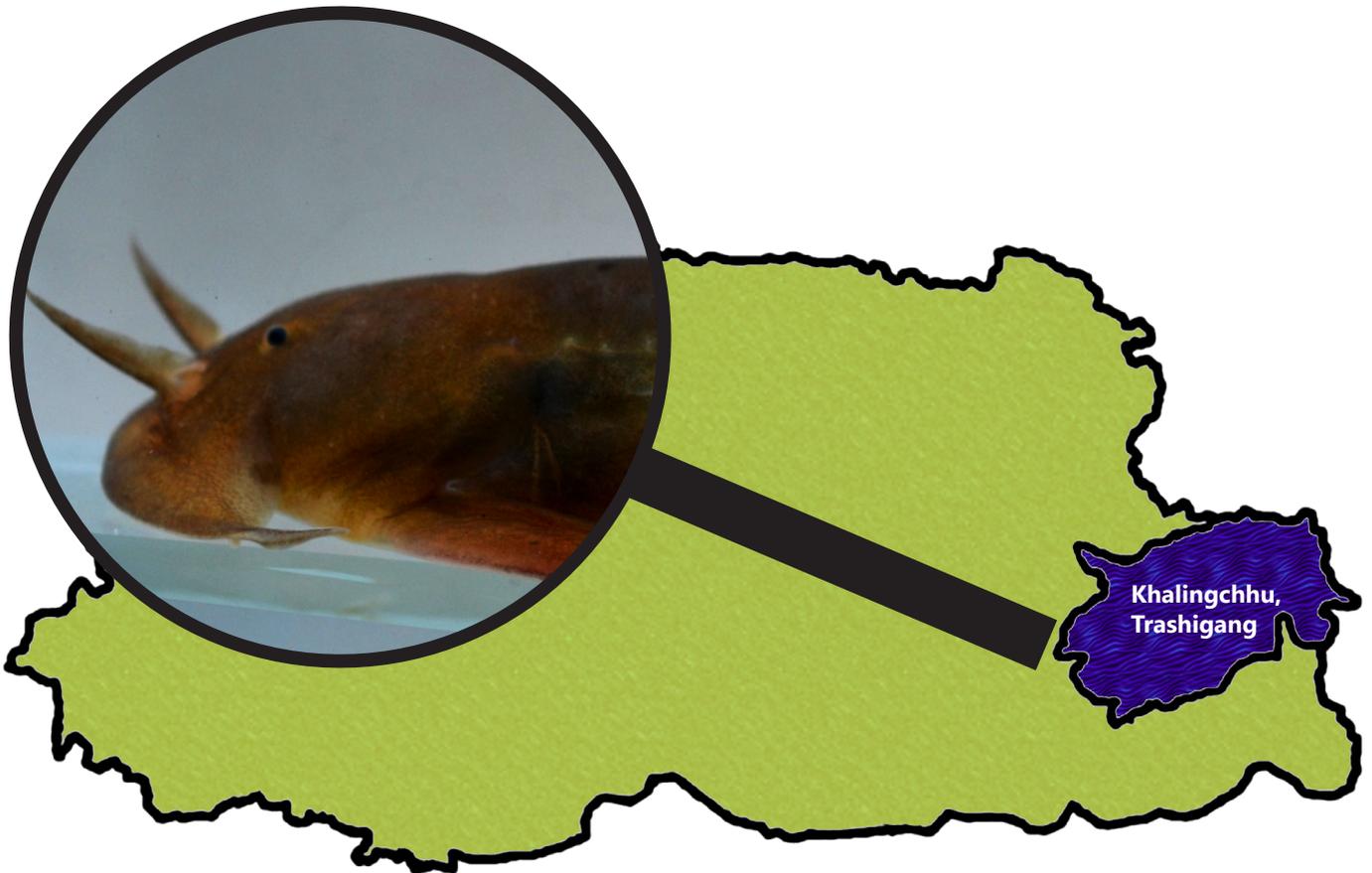
How best we can tackle the agricultural issues today will determine the country's future.



Discovery of

KHALING TORRENT CATFISH

An insight into the hidden underwater world in Bhutan's rivers



By Ugyen Tshering, College of Natural Resources, Lobeysa

It goes without saying that Bhutan is undeniably a home to huge diversity of floral and faunal species. Its unique location in the eastern Himalaya, with huge altitudinal ranges and different rainfall patterns, climatic conditions and other geographical variations, provides perfect conditions for the flora and fauna to thrive.

While many of these species have been officially documented and recorded, many more species however remain veiled, within the deep gorges, towering mountains and torrential rivers. In fact, it is believed that many of the species both worldwide and in the country are getting extinct even before they are discovered.

The torrential rivers and streams that meander through the deep ravines of Bhutan harbour significant number of fish species. Although the number of fish diversity recorded in Bhutan has gone up to 93 species from the previous record of just 52, scientists strongly believe that this is not the exhaustive documentation and that the

diversity of fishes found in Bhutan will cross over 100.

From the months of August to November last year, two researchers, Dr. D.B. Gurung of the College of Natural Resources (CNR) and Ryan Thoni from St. Louis University travelled almost throughout the Country with a mission to conduct a nationwide fish diversity survey. They visited almost all the Country's rivers and streams so as to obtain a working list of fish diversity and in doing so, they managed to capture live photos of all species, and collected DNA from all species to both verify and to understand the relatedness of species in Bhutan to those in other parts of the region.

During this project, the team discovered an unusual catfish, which they aptly named *Parachiloglanis bhutanensis*, just outside the eastern village of Khaling in Trashigang. In addition to the scientific name, they gave it a fitting common name- Khaling Torrent Catfish. Their original article was published in *Zootaxa*, a scientific journal dedicated to

zoological taxonomy.

The researchers describe the fish as having a flat body with broad, blunt and rounded head, rising at roughly a 45-degree angle from snout to point vertical with eye.

They measured the fish as having the length of 101 mm from the tip of snout to the end of its tail. Researchers also record the fish as having other features such as thick and leathery fins. The ventral view of the mouth and snout resemble the shape of a hammer or bell, which is one feature that makes it a unique fish. Such a shape is due to the posterior flap of tissue connecting maxillary barbel to the mouth.

Another important aspect that this study makes is that the genus *Parachiloglanis* was earlier recorded as having only one species *P. hodgarti*. But now, "with the discovery of *P. bhutanensis*, the genus *Parachiloglanis* is no longer monotypic. This means that now there are two species under the genus. The scientists describe the two species having many differences between them. "They differ in meristic, mensural, and

coloration characters."

Further, *Parachiloglanis bhutanensis* is confirmed as a member of the genus by the absence of a post-labial groove on the lower lip, which is present in other genera of the subfamily Glyptosterninae.

During their studies, R.J. Thoni and Dr. D.B. Gurung found that the newly discovered endemic fish is known from Khalingchhu stream and an adjacent, unnamed stream in the headwaters of the Dangmechhu in the Brahmaputra drainage. However, they do not rule out its presence in other streams in other parts of the Country.

They write, "The common name, Khaling Torrent Catfish is in reference to the small village in the east," and add that the small stream in which they discovered the new fish, flows about one kilometre east of Khaling Village.

R.J. Thoni and Dr. D.B. Gurung, in their scientific report state that *Parachiloglanis bhutanensis* was discovered in a high-velocity, small order stream at 2211 m above sea level. But unlike its congener in similar streams, they are found in low numbers.

Even with several hours of effort of trying to net as many live specimen as possible, they could collect only three specimens. The researchers claim that this may indicate that the fish does not occur in high abundance.

Like its sibling species, the newly discovered fish is known to adhere to the bottom side of boulders, favouring areas of cascades and white water rather than pools.



“They were associated with large rocks with deep undercut areas versus rocks with only small refuge from the current,” researchers write.

They also describe the two streams in which they were found as having clear, cold-water, sourced from mountain springs, precipitation runoff, and snowmelt. The streams are found to have little algal growth and frequent high-flow events.

“This species is adapted to a high-velocity environment with adhesive striations on the leading rays of the paired fins for clinging to rocks and an inferior mouth adapted for scraping algae and invertebrates from the substrate.”

In addition, researchers say that the catfish has many specialised body parts and behaviours suitable for surviving in the cold and swift waters of Bhutan’s mountainous terrain. It is one of only a handful of species in the region that can withstand incredibly strong current, which it does so by clinging to the rocks with specialised tissue striations on its thick pectoral and pelvic fin bones.

The bottom of the fish is flattened and can be used as a suction cup to adhere to the stones in which it lives. The ability to withstand cold temperatures enables the species to survive at altitudes much higher than its relatives south of Bhutan.

During their study, the research team also recorded 90 additional known species, and several more that are currently being described as new to science. They took

live photos of nearly all species including those that are pending scientific description using a specialised aquarium designed for taking into the field. DNA samples were obtained from all species by taking a small, painless snip of the fin tissue, which is regrown like fingernails in humans. The DNA will be used to verify species identification and create trees of relatedness called phylogenetic trees.

Parachiloglanis bhutanensis is the first of the new species described because its difference is obvious from the rest. “As soon as I saw it, I knew it was unlike any species of catfish known,” says Thoni. “It had more than 30 white pores along its side, a trait never encountered before”.

It is the first endemic fish species to Bhutan; the kind of fish species that one can expect to find only in Bhutan. Hence, it was a discovery not only significant to the scientific community, but also for the country.

“It is the first endemic fish species to be discovered in Bhutan, but certainly not the last,” says biologist and doctoral candidate Ryan Thoni. “The laboratory analysis and formal description process takes meticulous effort and time, so expect to see more as we continue our collaborative research.”

They describe the discovery as an important milestone in conserving fish diversity in Bhutan. They point out that due to its small range and low density, as well as the highly stochastic and increasing nature of floods and

droughts in streams of this region, *P. bhutanensis* may be a species of conservation concern.

The researchers hope that the further research will be conducted to determine its range and understand its biology and life history to ensure its existence far into the future.

The study is being continued to make an exhaustive documentation of the fish diversity in the country. The documentation is important from the perspective of climate change and a number of major hydropower projects being developed around country, which will have direct impact on the fish diversity and its population structure.

There are about 32,000 species of fish known worldwide. However, the discovery of this *Parachiloglanis bhutanensis* is more than just a number; it is a beacon for the scientific and ecological advancement of Bhutan, and a prize to herald the diversity of Bhutan’s underwater world that is only just now starting to be understood. “I am really excited and thankful to be part of this. And with the highly cryptic behaviour of this species, combined with little to no fishing ever being done, it is possible that this species has remained hidden from human eyes for centuries or possibly forever!” exclaims Thoni. “We hope that our discovery will help bolster pride and encourage enthusiasm for the preservation of the aquatic environment in Bhutan.”

FUNCTIONS OF NATIONAL SEED CENTRE

BACKGROUND

The National Seed Programme was established in 1984 as the National Seed and Plant Programme (NASEPP) under the Ministry of Agriculture and Forests. The NASEPP was responsible to produce and supply certified seeds and plants of recommended and released varieties to the farmers. In 1995, NASEPP was corporatised and instituted Druk Seed Corporation (DSC) with an additional commercial mandate.

As corporation, DSC was responsible to generate revenue and sustain its operation from its own revenue from the sale of seeds, seedlings and agricultural inputs. DSC was reverted to the government as the seed programme in 2010 and renamed as the National Seed Centre (NSC). Currently, the NSC is pursuing both social and commercial responsibilities which were inherited from the erstwhile DSC.

VISION

To be a vibrant, dynamic and sustainable centre ensuring national seed security through production of high quality seeds and planting materials.

MISSION

To produce and promote high quality seeds, planting materials and other agricultural inputs in adequate quantities and at affordable price to improve the livelihood of the farmers.

MANDATES

The Centre is mandated to function as the “National Seed Grid” to meet the in-country farmers’ demand for quality certified seeds and plants of recommended and released varieties, and other agricultural inputs including fertilisers and herbicides in adequate quantities at affordable price to the Bhutanese farmers.

ACTIVITIES: Production and supply of seeds/planting materials and agricultural inputs are coordinated by the NSC headquarter located at Chundudingkha, Paro. The activities are implemented by the regional farms strategically located in different parts of the country; Paro (Chundudingkha, Jeuphu, Bondey), Bajo (Bajo, Phobjikha, Nangsiphel), Jachedphu and Bhur and the fertiliser store at Phuentsholing. The centre supplies recommended and released high yielding varieties of seeds of cereals, vegetables, oilseeds, pulses, potatoes, and planting materials of temperate and sub-tropical fruit crops and fertilisers at an affordable price.

Anyone interested to avail the quality seeds, planting materials and fertilisers in adequate quantity and on time is recommended to contact us at the following:

| Location | Contact address |
|---------------------------------|---|
| NSC Head Quarter, Paro | Telephone: 08-271465/271709/271516 Fax: 08-271605 Email: nsc@druknet.bt |
| Regional Farm, Bajo | Telephone: 02-481872 Telefax: 02-481259 |
| Regional Farm, Bhur | Telephone: 06-252265 Fax: 06-252261 |
| Regional Farm, Jachedphu | Telefax: 04-781178 |
| Nasiphel Farm, Bumthang | Telefax: 03-631124 |
| Fertiliser Store, Phuentsholing | Telephone: 05-252932 Fax: 05-252931 |

A Story of Coffee Growing:

COMING OF COFFEE IN CHUZAGANG

How one man's dream of planting coffee inspired the fellow farmers to...

By Tashi Dawa, RNR-EC, Chuzagang

With no expertise involved, the origin of coffee plants in Chuzagang is a unique story in itself. The pioneer, Tashi Rinchen of Dzombabi, planted a single coffee plant and now, after seven years, he has seven fruit bearing plants that have been giving him at least 1.5 kilograms of coffee for the last two years.

Tashi brought a single plant from his uncle in Zhemgang, who had brought a few beans for trial from a nearby border town of India.

However, with no knowledge on the cultivation and processing, Tashi had directly seeded the beans in his plants. It was a failure. Yet without losing hope, with technical advice and support from Chuzagang Geog RNR Centre, he raised a nursery to multiply his coffee plants.

He started a nursery with about 300 seedlings planted in the poly pots that he had made himself. Later, the Centre requested for some standard poly pots from RDC Bhur, where Tashi could transfer the seedlings. The seedlings have now been transplanted in his barren field and Tashi has even distributed some to his close friends in Chuzagang.

Lungten Penjor of Pangzor also has a similar story. He too started his coffee plantation trial in 2009 with some seedlings from Lopen Kezang of Chaskar (one of the pioneers). Lungten's efforts in raising a nursery failed, but that did not dampen his interest in the plantation. At the moment, he has around 10 coffee plants around his house.

Lopen Kezang, who teaches at Norbuling Higher Secondary School next to Chuzagang, also has a unique story. His family had resettled in Chaskar, Chuzagang in 2002. He was a former Teacher in Panbang of Zhemgang and he had a colleague from Kerala who got transferred together to the present School in the year 2005. It was their friendship that brought some additional coffee to

Chuzagang. The Keralian Teacher brought him some coffee seeds from Kerala, with which he raised a nursery. Since then, the available coffee around Chuzagang and some in Umling are their fruit of friendship.

The Teacher has two types of coffee plants in his garden; 17 are dwarf ones and 14 little bushy ones. They are all fruiting, but he is worried about marketing his produce.

Rana Rai of Tashithang also has a few coffee plants in his areca nut field. His story is no different from Tashi, Lungten, and Lopen Kezang's.

Like all those enthusiasts, there are many farmers, who are interested to take up coffee plantation. The Centre discussed this with the officials from RDC Bhur, who, upon request, provided the centre with 300 coffee seedlings in 2014. The seedlings were distributed among 42 interested farmers. The farmers planted them in their areca nut fields and until now the crop has been performing well. The plants of the preliminary programme have given fruits already and are being harvested selectively. The beans are washed to separate them from the outer skins and are sun-dried.

Our farmers are working towards producing our own home-grown coffee grown and produced in Chuzagang. We have realised now that coffee can be one of the most potential crops that can enhance income for the farmers in Sarpang.

The keen interest of the farmers coupled with timely interventions from the government can go a long way in promoting income generating avenues for farmers. However, we feel that they need proper support and training to build their capacity for post harvest. Providing them with appropriate machineries is another success factor.



KNOW YOUR *Coffee*

Everyone recognises a roasted coffee bean but unless you have lived or traveled in a coffee growing country, you might not recognise an actual coffee tree. Pruned short in cultivation, but capable of growing more than 30 feet high, a coffee tree is covered with dark-green, waxy leaves growing opposite each other in pairs.

Coffee cherries grow along the tree's branches. It takes nearly a year for a cherry to mature after the flowering of the fragrant, white blossoms. Because it grows in a continuous cycle, it is not unusual to see flowers, green fruit and ripe fruit simultaneously on a single tree. The trees can live as long as 20-30 years and are capable of growing in a wide range of climates, as long as there is no harsh fluctuation in temperature. Optimally, they prefer a rich soil and mild temperatures, with frequent rain and shaded sun.

The Anatomy of a Coffee Cherry

The coffee cherry's outer skin is called the exocarp. Beneath it is the mesocarp, a thin layer of pulp, followed by a slimy layer called the parenchyma. The beans themselves are covered in a parchment-like envelope named the endocarp, more commonly referred to as 'the parchment.' Inside the parchment, side-by-side lie two beans, each covered separately by yet another layer of thin membrane. The biological name for this membrane or seed skin is the spermoderm, but it is generally referred to in the coffee trade as the 'silver skin.'

Botanical Classification

Coffee traces its biological heritage to a genus of plants known as *Coffea*. Within the genus there are over 500 genera and 6,000 species of tropical trees and shrubs. The genus was first described in the 18th century by the Swedish botanist, Carolus Linnaeus, who also described *Coffea arabica* in his *Species Plantarum* in 1753. Botanists have disagreed ever since on the exact classification.

This is understandable considering that coffee plants can range from small shrubs to tall trees, with leaves from 1 to 40 centimetres in size, and from purple or yellow, to the predominant dark green, in colour. It has been estimated that there are anywhere from 25 to 100 species of coffee plants. In the commercial coffee industry, there are two important coffee species- arabica and canephora, more commonly called robusta.

Interesting Coffee facts

- It takes three-to-four years for a coffee seed to grow into a tree that produces coffee beans.
- Seeds are first planted in nurseries. Six months to one-year later, seedlings are transplanted to open fields. Workers must prepare the planting ground for the small seedlings by loosening and grading the soil.
- Approximately two-and-a-half years after transplantation, the trees begin to flower and the flowers produce a small fruit known as a coffee cherry. In the centre of each cherry are two green coffee beans.
- Coffee plants grow best where there is plenty of rainfall at certain times of the year.

Courtesy: National Coffee Association, USA

Farmers in Gasa

GROW UPLAND RICE

Growing their own red rice

By Tanka Maya Pulami, RDC-Bajo; Tshering N. Penjor and
Chewang Gyeltshen, Gasa



Upland rice (Kambja) has been popular in Eastern part of Bhutan for a long time. It is grown in rain-fed areas prepared and seeded when dry, much like wheat or maize. The Research and Development Centre (RDC) Bajo in collaboration with the National Organic Program and the Dzongkhag Agriculture Sector of Gasa introduced upland rice in Khatoe geog as a demonstration and on-farm trials in small areas in 2012.

The objective was to evaluate the performance and adaptability of upland rice in the area. The result of the first year trial was promising and the performance was well accepted by the farmers. The idea was to encourage more farmers to try growing it in larger areas. In 2013, the upland rice programme was up-scaled to seven farmers cultivating it in small areas with an average of half

langdo land. By 2014 there were 10 farmers of Zamina and Baychu under Khatoe (2285 to 2465masl) growing upland rice, covering almost 3 acres in total.

The land preparation begins between February and March with the clearing of area, followed by application of farm yard manure which was spread evenly in the field. The land was then ploughed and prepared by removing the vegetative matters. After the land preparation, the Kambja seeds were spread (30 kg per acre) in the beginning of March. The first weeding was carried out when the seedlings attain three to four leaves during the month of May. Due to prolonged monsoon and weeds, three additional hand weeding were done. Upon maturity, the crop was harvested in the month of November and the yield assessment was done through crop-cut.

Crop-cut is carried out with 7 farmers taking three samples of 6m.sq., randomly selected area.

In total, there were 21 samples of crop-cut. The average yield was computed based on the crop-cut result in 2014 was 1.13 tons/acre (SD 0.31) and the average number of tillers counted was 8.66 per hill. Although the yield was lower than in Eastern Bhutan, which is 1.80 tons/acre, yet the technology was quite promising and farmers showed interests to go for larger promotion of upland rice.

Although in smaller quantity farmers are convinced that they can have their own red rice produced from their fields. Apart from its yield, farmers are more interested on the straw-production, which comes useful as fodder for their cattle and horses. An average of 3.33 tons/acre of straw was produced to supplement the livestock feed during winter. Further, it reduces the cost of purchasing rice straw and transporting them all the way from Punakha, which was the usual practice earlier.

The upland rice demonstration concludes that the farmers are satisfied with the crop performance and its yield. The feedback from farmers indicates that more farmers in the localities are now interested in cultivating upland rice and would like to continue in the coming season on larger quantity covering more areas.

The upland rice production program is expected to ultimately contribute towards increased rice production in the areas on top of making rice straws available for their livestock.



Highlights of 2014



4th Takin Festival

February 21, Gasa: The 4th Takin Festival held at the Jigme Dorji National Park was organised to create avenues and strive towards financial sustainability by providing off-season ecotourism opportunities to the tourism sector. It was also aimed to provide supplemental income opportunities to the highland communities.

On the day, students from Bjishong Middle Secondary School enacted a short skit on the downfall of poaching to create awareness on the need to protect Takin. In addition, various cultural programmes were also performed. Guests were also taken on a trekking through Tashithang-Kabina trail for Takin sighting.



5th Nomad Festival

February 23, Bumthang: The annual Nomad Festival brings together the herders of the north-eastern and north-western Himalayan frontiers in an unforgettable celebration of their unique habitat. It showcased the tradition and culture of the nomads including their dairy products, handicrafts, weaves and nomadic way of life among others.

Speaking at the 5th Nomad Festival held at Tang, Bumthang Dasho Dzongdag shared that the festival is a platform for commoners to comprehend the imperative roles played by the nomads in beefing up border security along international frontiers, and for the nomads to apprise themselves with latest scientific advancements on farming.



Integrated Agriculture Technology Farms launched

March 20, Thimphu: The Hon'ble Prime Minister, Lyonchhoen Tshering Tobgay launched the Integrated Agriculture Technology Farms at Wang Sisina, Mewang geog. Also present at the launching were the Hon'ble Agriculture Lyonpo and Thimphu Dasho Dzongdag along with the senior officials, farmers and other dignitaries.

During the launch, the Lyonchhoen and the team visited farms that included a multi-purpose greenhouse, drip irrigation technology demonstration site, electrically fenced fields, seeds at greenhouse, integrated agriculture fields and the plots distributed by lucky-dip to civil servant farmers.

Highlights of 2014



Hon'ble Lyonchhoen and Hon'ble Lyonpo sign Performance Agreement

March 27, Thimphu: The Ministry of Agriculture and Forests was the first Ministry to sign the annual Performance Agreement (PA) on the five key objectives and three mandatory objectives. Hon'ble Lyonpo and the Hon'ble Prime Minister signed the PA at the General Assembly Conference Hall for the financial year 2014-2015 which indicates the importance that the government accords to the Ministry. Lyonpo shared that the PA provides an opportunity for the Ministry to reposition to play a crucial role in fulfilling its objectives and mandates.



First batch of farmers trained on Turkey farming

April 2-3, Sarpang: The National Poultry Development Centre (NPDC) and the Dzongkhag Livestock Sector conducted training on Turkey farming for the first time in the country. Thirty-three farmers from the four geogs of Dekiling, Gelephu, Gakidling and Shompangkha took part in the training. The training included the general management aspects of Turkey on house design, site selection, feeding practice and processing, and value addition of the Turkey meat. NPDC is targeting 60 farmers from Sarpang, Tsirang, and Samtse with a goal to produce 1MT of Turkey meat.



Bumthang BAFRA office inaugurated

April 4, Bumthang: The new Dzongkhag office for the Bhutan Agriculture and Food Regulatory Authority (BAFRA) was inaugurated by Hon'ble Lyonpo Yeshey Dorji with the aim of ensuring and strengthening the effective food safety and bio-security system in Bhutan. The two-storied office was constructed with a budget of Nu. 5.4 million to implement further integrated approach to bio-security to safeguard its people and farming system among others. At the inauguration, Lyonpo highlighted that the changing global environment demands greater emphasis on managing the whole bio-security continuum both within the country and across the border.

Highlights of 2014



1st certificate course on Horticulture opened

April 14, Zhemgang: The first Horticulture certificate course has been opened at the Rural Development Training Centre (RDTC). The opening was graced by the Chief Guest, the Hon'ble Secretary for the Ministry of Agriculture and Forests and the guests including of Dzongdag, Drangpon, Dzongrab, regional and Dzongkhag sector heads. On the occasion, participants carried out commemorative fruit plantations around the RDTC campus. The Secretary also awarded prizes to enterprising youth who had taken up farming. Forty trainees completed a six month long horticulture certificate course at RDTC.



Second Rhododendron Festival

April 18-20, Dochula: Hon'ble Lyonpo Yeshey Dorji, the Minister for Agriculture and Forests graced the opening of the second annual Rhododendron Festival by launching the book 'Rhododendrons of the Royal Botanical Park' and inaugurating the 'Rhodo Trial' at the Royal Botanical Park, Lamperi. The festival was showcased under three village themes, viz., Culture and Entertainment Village, Education and Awareness Village, and Food and Beverages Village; along with other attractions like free guided walks through 124-acre Rhododendron garden. Tourists, guests and officials alike experienced the local culture, local cuisine, and the natural environment.



South Asian Regional Workshop on Biosafety

May 26-29, Paro: The South Asian Regional Workshop on the theme 'Ensuring Biosafety through legal and regulatory instruments' focused on knowledge and experience sharing about modern biotechnology innovation and its application towards food security and poverty alleviation. The workshop had participants from FAO, SAARC Agriculture Centre and six SAARC member states of Bangladesh, Bhutan, India, Nepal, Pakistan, and Sri Lanka. It aimed at strengthening institutional and technical system of the National Biosafety Framework through the establishment of regional cooperation on biosafety among SAARC member states. It also helped to understand the existing biosafety regulations in the SAARC region and important biosafety related issues.

Highlights of 2014



Understanding the basics of Climate Change

May 28, Pemagatshel: A quiz competition on a theme 'Understanding the basics of Climate Change' was conducted to create awareness on the useful information related to climate change. The Information and Communication Services (ICS) in collaboration with Dzongkhag RNR Sectors, Pemagatshel organised the quiz among 11 geogs. A total of 33 farmers participated in the programme. Competing a tough three rounds of the quiz, Yurung geog turned out to be a winner followed by Chongshing and Chokorling geogs. The winners were awarded with cash prizes and certificates. Farmers were also awarded with participation certificates and prizes.



14th Congress of ISE inaugurated in Bumthang

June 1-7, Bumthang: Her Royal Highness, Ashi Chimi Yangzom Wangchuck inaugurated the 14th International Society for Ethno-Biology (ISE) at the Ugyen Wangchuk Stadium in Chamkhar. There were 200 Bhutanese participants and 400 international participants of 56 countries from six continents. The ISE is a global, collaborative network of individuals and organisations established in 1988 with this year's theme as 'One earth for all, regenerating bio-cultural ecosystem resilience' to preserve the vital links between human societies and the natural world. The ISE ended with an election of representatives for the 15th ISE congress to be held at Uganda.



Bhutan's first ever Drone successfully flies over Chamkhar town

June 1, Bumthang: Coinciding with the 14th ISE Congress, the Ugyen Wangchuck Institute for Conservation and Environment conducted a successful test flight of Bhutan's first ever drone acquired for conservation purposes. Drones are unmanned aerial vehicles (UAVs) that offer a new and exciting approach for environmental research, monitoring, and management in difficult landscapes. Drones fly pre-programmed missions, acquiring high-resolution (10 cm pixels) aerial photographs or videos along the specified flight paths. In a single 50-minute flight, a drone can survey an area of 10 square kilometre. The aerial photographs can be stitched together to produce near real-time land cover maps.

Highlights of 2014



3rd JSW-OESA conferred

June 1, Bumthang: The 3rd Jigme Singye Wangchuck Outstanding Environmental Stewardship Award (JSW-OESA) was conferred by HRH Ashi Chimi Yangzom Wangchuck.

The winner, the Forest Protection and Surveillance Team, Department of Forests and Park Services won the award of Nu. 300,000 (Three hundred thousands) for their dedicated and sincere service to protection of the environment and curbing the illegal wildlife trade in Bhutan.

In the past two years at great risk to their own lives, the team has made six seizures of tiger skin and bones, musk pods, bear biles, leopard skins and bones, elephant tusks, live Tokay gecko lizards, and other contraband.



Social Forestry Day Celebration

June 2, Chuzom: The Social Forestry Day was celebrated through a mass tree plantation along the Thimphu/Paro/Chukha highway at Chuzom. This year's theme was 'Plant Trees for Green Bhutan'. The inaugural planting was graced by the Hon'ble Prime Minister, Lyonchhoen Tshering Tobgay, Managing Director and staff of Punatsangchhu, the Dzongdas of Paro, Thimphu, Chukha and Haa, Desungs and over 350 volunteers and forests officials from the four Dzongkhags. They planted about 3000 willow stumps and 200 seedlings of various species along the identified areas.

The day is being celebrated widely across all schools and institutions in Bhutan since 1985.



MoAF website ranked third amongst all Government Websites

June 6, Thimphu: Hon'ble Lyonchhoen, Tshering Tobgay awarded the certificates signed by the Minister for Ministry of Information and Communications at the Prime Minister's Office complex to IT representatives of the highest evaluated websites.

The first ranked was the Department of Information Technology and Telecom scoring 3.55 out of 5, the second was the Ministry of Finance with 3.29 while the third position was bagged by the Ministry of Agriculture and Forests with 3.13.

The websites were assessed on six categories: usability and reliability, content and aesthetics, security and privacy, services related information, citizen participation, and additional features.

Highlights of 2014



A museum in memory of Late Dasho Keiji Nishioka inaugurated

June 17, Paro: The President of JICA, His Excellency Mr. Akihiko Tanaka and Hon'ble Secretary, Dasho Tenzin Dhendup, Ministry of Agriculture and Forests jointly inaugurated a museum in memory of Late Dasho Keiji Nishioka at the Agriculture Machinery Centre (AMC) in Bondey.

Late Dasho started working in Bondey Agriculture Farm as an agriculture expert in 1964 and brought major developments in farming that has changed the livelihood of Bhutanese farmers. He also initiated the establishment of research centres like AMC, National Seed Centre and National Post Harvest Centre to provide services across the country.



World Day to Combat Desertification

June 17, Lhuentse: To promote public awareness on desertification and combat the issues, the National Soil Services Centre observed the World Day to Combat Desertification at Jarey geog.

The theme for this year was 'Ecosystem based adaptation' with a slogan 'Land belongs to the future, Let's Climate Proof it'. It highlighted the benefits of mainstreaming sustainable land management policies and practices into collective response to climate change.

Preventive land management measures to combat desertification were carried out on 18 acres of land in Jarey and on 20 acres of land in Metsho geog. Along with the technical experts, farmers from the five chiwogs of Jarey participated in the event.



Departments and Agencies sign performance agreements with Ministry

June 20, Thimphu: In order to ensure a sustainable and adequate access to food and natural resources, the Departments and Agencies signed performance agreements (PA) with the Ministry, an important mechanism to ensure accountability and help inculcate a performance based culture at all levels of the government.

PA includes the key objectives, priorities, actions, success indicators, and target for respective offices for the financial year July 1, 2014-June 30, 2015. During the signing, Hon'ble Lyonpo said that such initiative will help to deliver better results by focusing and prioritising on what we need to do.

Highlights of 2014



11th BAFRA Annual Conference

July 11-12, Thimphu: The Bhutan Agriculture and Food Regulatory Authority (BAFRA) organised its 11th Annual Conference with a theme 'Enhancing Bio-security through modern risk based approach' for 46 participants .

The conference began with the highlights on the important milestone in the progress and development of BAFRA by the Director General, Mr. Karma Dorji. It also saw the discussion of pertinent issues and the gist of resolutions of the last Ministry's offsite executive meeting. The field officials were also highlighted on the 11th Five Year Plan and the performance compact agreement signed with the ministry.



Handing/taking of the Japanese KR-II Grant 2012

July 21, Paro: With the handing-taking ceremony of the KR-II Grant 2012 at the Agriculture Machinery Centre, His Excellency Mr. Takeshi Yagi, Ambassador of Japan to Bhutan officially handed over 152 units of power tillers to Hon'ble Lyonpo Yeshey Dorji, Minister for Agriculture and Forests. Acknowledging the assistance, Lyonpo informed the gathering that the relationship between the two countries has continued to grow ever since the late Dasho Keiji Nishioka came to Bhutan in 1964. Bhutan has received the KR-II grant 23 times in the past amounting to more than Nu. 1.7 billion, making the farming practice easier and profitable.



National Park Conference

August 14-16, Thimphu: The opening session of the 'National Park Conference and Global Tiger Day Celebration' was graced by Hon'ble Lyonchhoen Tshering Tobgay at the Convention Centre. The theme for this year was 'Enhancing conservation programmes in the protected areas in the changing environment' with six main sessions and specific sub-themes.

The conference will be an annual event where the protected area managers meet annually to share, update, learn and deliberate on the conservation issues, challenges and possible solutions. For three consecutive years, the conference will be funded through the WWF Bhutan programme project on 'Sustaining ecosystem for livelihood: eco-life'.

Highlights of 2014



Mass Sterilisation and Vaccination Programme 2014

August 16, Thimphu: The Community Animal Birth Control was launched at the Clock Tower. It was attended by the Agriculture Secretary, Dasho Tenzin Dhendup and the Thimphu Thrompon, Dasho Kinley Dorji along with senior officials.

On the day, a Memorandum of Understanding was also signed between the Department of Livestock and Thimphu Thromde to make the Mass Dog Sterilisation and Vaccination Programme an annual event and continue it for a period of three years with clear cut terms of reference for all the stakeholders.

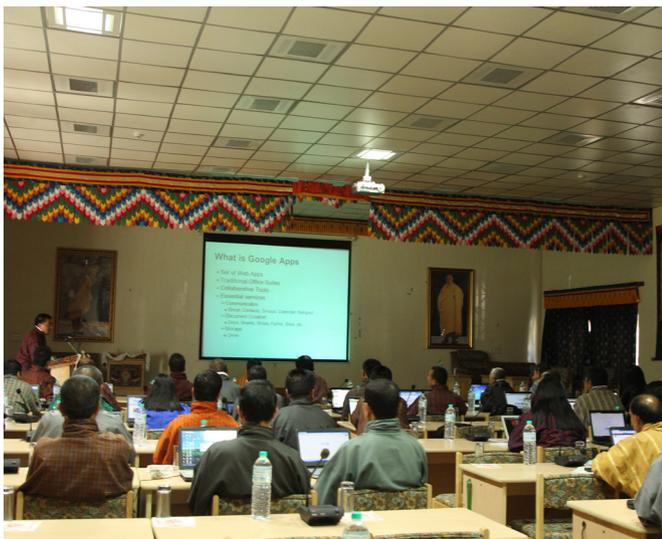
The programme was officially launched from August 18 and continued till September 6 at the National Animal Hospital.



Field demonstration for multi-functional Mini Power Tiller

August 19, Paro: The Hon'ble Lyonpo Yeshey Dorji, Minister for Agriculture and Forests along with the senior officials attended a field demonstration of multi-functional mini power tiller products of M/S SAS Motors Limited from Haryana, India.

Lyonpo informed the gathering that the Ministry is always exploring alternatives to overcome farm labour shortage in Bhutan by introducing handy and affordable farm machineries. He also added that the machines demonstrated will be thoroughly examined by the Agriculture Machinery Centre and its technical professionals based on the appropriateness of introducing such farm machines in our soil.



Google Apps training for MoAF officials

September 2-3, Thimphu: In order to help achieve Government's initiative to go paperless, 140 participants from the Ministry of Agriculture and Forests (MoAF) attended a Google Apps training. The Apps is a cloud-based suite application to promote a paperless working environment and a secure email system for official correspondence. It will also allow a working collaboration across the whole of the government.

During the training, participants were familiarised with the Google Apps overview including its features such as drive, calendar, contacts, groups, sites and security. Participants also learned how to create document, presentation, forms, and share the same among others.

Highlights of 2014



MAGIP participates in the 6th NEAT Fest in Shillong

September 2-5, India: The North East Agro Trade (NEAT) Fest is an annual event held to market different community based products from the North Eastern Region Community Resource Management Project (NERCORMP) areas.

There were about thirty stalls including a display stall and a food stall from Bhutan. A Bhutanese team was led by the MAGIP's Project Director along with six farmers and two senior officials. Their participation was the first of its kind which helped particularly the farmers to see the scope of external markets for their agriculture products and interact with project beneficiaries of NERCORMP.



Wangchuck Centennial Park office inaugurated

September 5, Bumthang: Nasiphey village saw the inauguration of the Wangchuck Centennial Park (WCP) by Her Majesty the Queen Mother, Ashi Tshering Pem Wangchuck accompanied by the Hon'ble Lyonpo Yeshey Dorji, Dasho Dzongrab, Dasho Drangpon, RNR sector heads, and other dignitaries.

WCP comprises an area of 4914 square kilometre which is the largest national park in the nation. WCP is filled with diverse species of flora and fauna, recording 693 species of vascular plants, 39 mammal species, 250 bird species and 42 species of butterfly which are rare, endangered and endemic to the region.



Sri Lankan participants attend local dairy production training

September 22-27, Bumthang: Five participants including two farmers and three officials from Sri Lanka attended training on local dairy products processing upon request from His Excellency, Mr. S.B. Dissanayake, the Minister for Higher Education, Sri Lanka. The training was conducted at the milk processing unit, Tamshing and RDC-Jakar with resource persons from the National Dairy Development Centre, Yusipang, Haa and Bumthang, and the Brown Swiss Farm. The participants were taught the basic bio-chemistry of milk and milk products, procedures on conducting platform milk tests, the butter and cheese production techniques including the operation of equipment.

Highlights of 2014



'Karan Fries': A new dairy breed in Bhutan

September 28, Samtse: The Department of Livestock (DoL) released a dairy breed called 'Karan Fries' at the National Jersey Breeding Centre (NJBC) on a trial basis to provide more options of dairy breeds for the livestock farmers in the country. As envisioned by Lyonpo Yeshey Dorji to look into providing more choices of dairy breeds for Bhutanese farmers to help boost milk production, DoL imported 30 numbers of Karan Fries from Haryana, India in June 2014. The cattle are stationed at NJBC to evaluate its adaptability, production, and reproduction performances under Bhutanese conditions.



Trongsa and RLDC Wangdue celebrated World Rabies Day

September 28, Trongsa-Wangdue: More than 100 participants celebrated the World Rabies Day (WRD) in Trongsa, organised by the Dzongkhag Livestock Sector for the first time. The programme created awareness among the general public to combat Rabies for safety. It was also conducted considering the coming up of the Mangduechhu Project which has increased the human and stray dog population creating threat to public health. RLDC Wangdue also celebrated the WRD in Karmaling geog under Lhamoizingkha to eliminate rabies. The geog is identified as a rabies endemic area in the west-central region.



Second Mt. Jomolhari Festival

October 8-9, Soe: The second Mt. Jomolhari festival was held in Dangojang near Jomolhari base camp. It is an initiative to conserve the Snow Leopard which is primarily found in the Jomolhari areas, involving Soe Yaksa and Soe Yutoed communities. It also aims at promoting Bhutan's rich natural heritage, and the local culture and tradition to promote tourism opportunities. The festival saw the local tribute song 'Yak ley bai Lhadar Gao', sporting competitions like shot put, Khuru, Horse and yak riding, documentary screening, and trekking etc. It was organised by the Forestry Department with fund support from the Bhutan Foundation.

Highlights of 2014



Mastiff Dog (Bjopchi) Exhibition

October 8-12, Soe: The first ever dog exhibition held in Bhutan was organised by Thimphu Dzongkhag for Soe and Lingzhi geogs. It focused on the declining breed of our native Mastiff dog (Bjopchi) and created awareness on its importance. A total of 136 dogs were showcased during the competition and prizes were awarded in three categories: male, female, and puppy. Incentives were also given to the participants for bringing their dog to the exhibition. Out of 100 dogs from Lingzhi, 70 were selected to have the bloodline and out of 36 dogs from Soe, 10 were selected to have the bloodline.



First Bhutan-ICIMOD day celebrated

October 10, Thimphu: Considering the successful thirty years of partnership, the Ministry and the International Centre for Integrated Mountain Development (ICIMOD) celebrated the first Bhutan-ICIMOD day.

The day was aimed to ensure that the centre is responding to the needs and specific priorities of the country in its medium term action plan 2013-2017 for the eight region countries along the Hindu Kush Himalayan (HKH).

Addressing the day, the Prime Minister, Lyonchhoen Tshering Tobgay shared reasons that make HKH, a special one in the world. He added the region have a spectacular landscape, young mountain and biodiversity hotspots among others.



Phobjikha observes its first World Food Day celebration

October 16, Wangdue: The 34th World Food Day celebration was held in Phobjikha Middle Secondary School with a theme, 'Family Farming: Feeding the world, caring for the earth'.

In Bhutan, the day is celebrated in remote schools that have feeding programme and school agriculture activities. The day covered various cultural programmes, quiz and display of farmers' products. The prizes for the literary competition held on the School Agriculture Programme were also awarded. The Council for RNR Research of Bhutan, the Department of Education, and FAO jointly organised the day.

Highlights of 2014



Greening and landscaping to be promoted in the capital

October 24, Thimphu: A project called, 'Urban Revitalisation by enhancing capacity on floriculture and amenity landscaping' has been approved for the enhancement of floriculture, horticulture, and landscaping related human resources. The project (November 2014-March 2017) will be implemented by the Fukushima Taki-Sakura Bhutan Committee and Town of Miharu, Fukushima Prefecture jointly with the Department of Agriculture and Royal Projects Coordination Office. During the project, experts from Miharu will train 50 staff including public gardeners in Thimphu. Some of them will be also invited to Miharu for on-the-job training experiences in floriculture, and tree management etc.



First International Snow Leopard Day

November 4, Haa: Bhutan observed the first International Snow Leopard day and presumably is the first country to celebrate it! This year's celebrating theme was 'Conserving Snow Leopards to secure a healthy mountain ecosystem'. The celebration included an educative quiz competition, a skit performance by theatre artists, and numerous entertaining Bhutanese dances by school children and Dzongkhag dancers among others. The day henceforth will be celebrated annually on October 23 worldwide to affirm collective action to conserve this rare species and its fragile habitat.



Opening of B-Coop Shop at Motithang

November 22, Thimphu: The Hon'ble Lyonpo Yeshey Dorji, the Ministry of Agriculture and Forests inaugurated the B-Coop shop at Motithang dedicating it to the 60th Birth Anniversary of His Majesty the 4th Druk Gyalpo. The shop is the second such facilities opened by the Ministry to set up standards for quality, grading, packaging, and price control besides helping the unemployed youths in the business. The shop is being managed by the Youth Business Cooperatives, a newly formed and registered youth group for one year on trial basis which will sell agricultural products from the farmers groups and cooperatives with Ministry's assistance.

Highlights of 2014



Getting practical to combat avian influenza

November 27- December 3, Gelephu: Fifty-eight officials from the livestock, health, disaster management, regulatory and quarantine, and police along with two farmers from Juprey, Gelephu attended a simulation training on avian influenza A (H7N9 and H5N1) to understand the real bird flu outbreak situation for its effective containment.

The training included both theory and practical sessions based on the revised National Influenza Pandemic Preparedness Plan (NIPPP) 2011, a living document that details the arrangements and specific actions required for the pandemic influenza management to help reduce its impact. Similar training was also organised earlier in Phuentsholing from September 15-22.



MoAF Celebrates Royal Civil Service Award Day

December 12, Thimphu: The Ministry of Agriculture and Forests celebrated the Royal Civil Service Award Day at the conference hall of the Department of Agriculture.

It was attended by the Hon'ble Lyonpo Yeshey Dorji and Secretary Dasho Tenzin Dhendup along with the departmental and agencies heads and senior officials. The former Agriculture Secretaries Dasho Sherub Gyeltshen and Dasho Sangay Thinley were also present.

The Award is a way of acknowledging, thanking, and expressing gratitude to our civil servants for serving the Tsa-Wa-Sum with much dedication for a long time.



10th Biodiversity Fair at Samdrupjongkhar

December 17, Samdrupjongkhar: The 10th Biodiversity Fair was organised to stimulate farmers to maintain crop diversity in their fields, and provide them the opportunity to exchange seeds and knowledge about the crop diversity in the Dzongkhag. Seventy farmers along with the sector heads, students, and teachers participated.

The National Biodiversity Centre in collaboration with the Dzongkhag Agriculture Sector, Samdrupjongkhar and RDC Bhur organised the fair dedicating it to the 60th Birth Anniversary of His Majesty the 4th Druk Gyalpo.

Calendar of activities for Citrus Orchard Management Practices

| Crop stage | Citrus orchard management practices | |
|--|--|---|
| After harvest  | <ol style="list-style-type: none"> 1. Pruning. 2. Basin making. 3. Soil nutrient management. 4. Mulching . |   |
| Flushing  | <ol style="list-style-type: none"> 1. Monitor for psyllid and spray Dimethoate (2 ml/l of water) if found. 2. Provide irrigation depending on soil moisture content. |  |
| Bloom  | No spray | |
| Fruit set  | Monitor for powdery mildew and spray following chemicals if found. <ol style="list-style-type: none"> 1. Copper oxychloride (3g/l of water) OR 2. Sulphur WP 80 (2 gm/l of water) 3. Provide irrigation depending on soil moisture content. 4. Keep orchards free of weeds |   |
| Marble size fruit  | <ol style="list-style-type: none"> 1. Spray following insecticides for Chinese fruit fly. <ul style="list-style-type: none"> ● First spray of Cypermethrin @0.5ml/l of water ● Second spray of Dimethoate @2ml/l of water after two weeks of first spray. ● Third spray of Cypermethrin @0.5ml/l of water after two weeks of second spray. Add sandovit @2ml/l of water in every spray as sticker. 2. Collect dropped fruit every ten days and destroy by either burial in pits or burning. 3. Provide irrigation depending on soil moisture content. 4. Keep orchard free of weeds. |   |
| Walnut size fruit  | <ol style="list-style-type: none"> 1. Shield bugs nymphs can be easily killed by swatting with a piece of wood on the trunk. 2. Spot spraying using a contact insecticide can be used instead of swatting when young nymphs group together particularly early in the morning. 3. Poke established borer holes with wire to kill the larvae and fill the holes with cotton soaked in petrol. Plug the holes with mud or a mix of mud and cow dung. 4. Keep orchard free of weeds & provide irrigation |   |
| Harvest  | <ul style="list-style-type: none"> ● Do not pick fruits on a hot day ● Do not pick when fruits are wet. ● Harvest fruits using clippers or by twisting with a gentle twist. ● Handle fruit carefully. ● Do not leave harvested fruit in the sun. | |

Source: Horticulture Division

Developing fruit orchards through multiple extension approaches promoted under HRDP- JICA

By HRDP Project Team members, RDC Wengkhlar

Fruit orchard development with improved management practices packages is one of the main components of the JICA's horticulture research and development project (HRDP) to increase the area under horticulture in the eastern region. To utilise the project resources effectively and generate visible impacts in line with the ministry's development strategies, the following three different

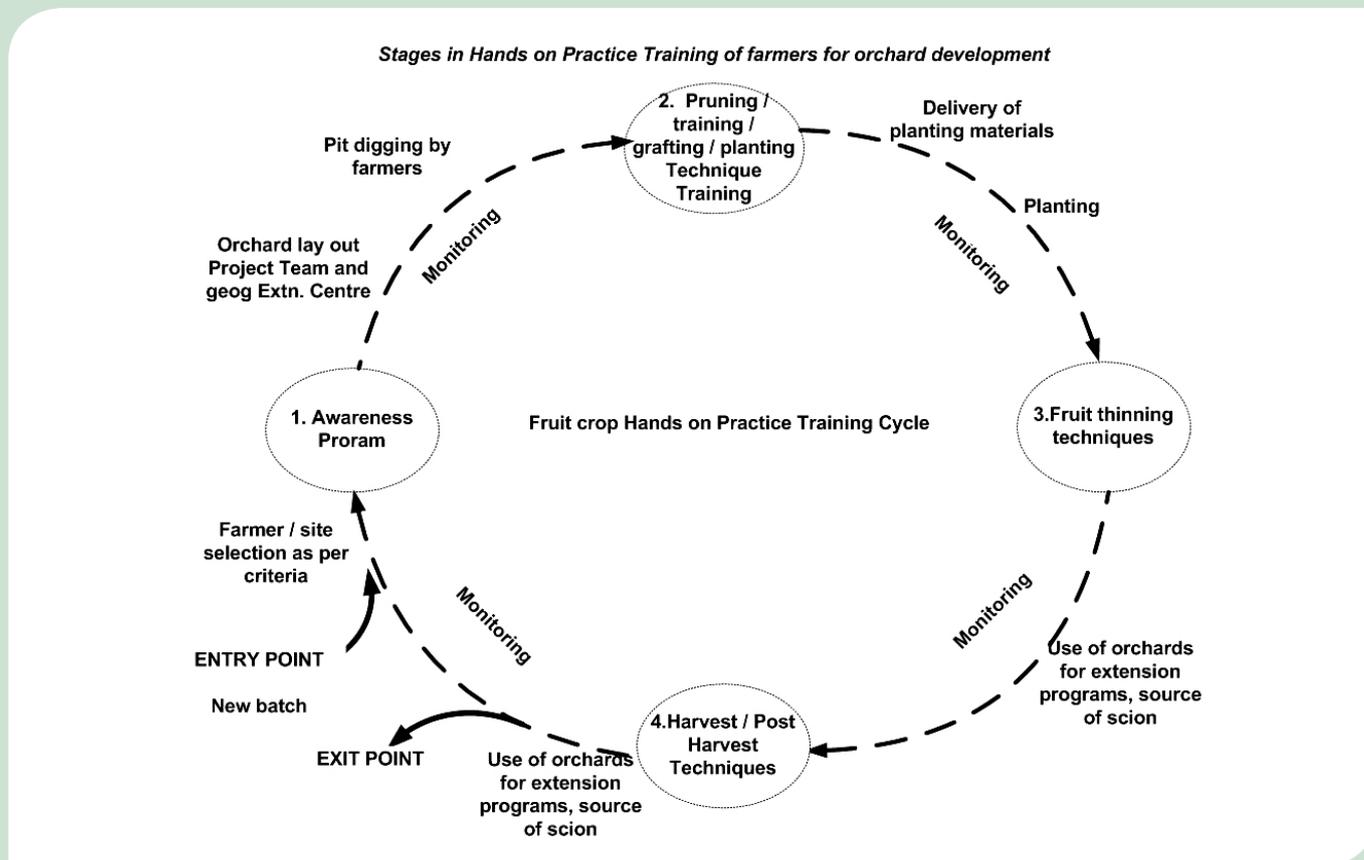
approaches were used in fruit crop development:

1. Systematic training and orchard development approach;
2. Village development approach;
3. Direct support programme.

The implementation methodologies of the three different approaches are different.



Systematic Training and Orchard Development Approach





This approach is aimed at providing a complete package of management practices along with the fruit saplings so that appropriate crop management practices for the crops promoted are provided to enable them to carry out post training activities. This is different from the conventional distribution of seedlings only in the orchard establishment.

The programme starts in August every year with the selection of farmers through the respective geogs and Dzongkhags following a standard criteria such as crop potential, technologies available with the project, agro ecological conditions, land topography, and farmers' interest among many others. A manageable size of about 30-35 farmers is targeted every year.

The selected farmers begin a four part training programme following the concepts of awareness creation, information sharing, demonstration and hands on practice.

The training is conducted in different seasons spread across the year as follows:

1. September/October:

Farmers are made aware on the crops to be promoted in their field and other research activities. They are also advised on the layout, pit size, soil and farmyard manure requirement. They return to start pit digging and arrange other preparations until January.

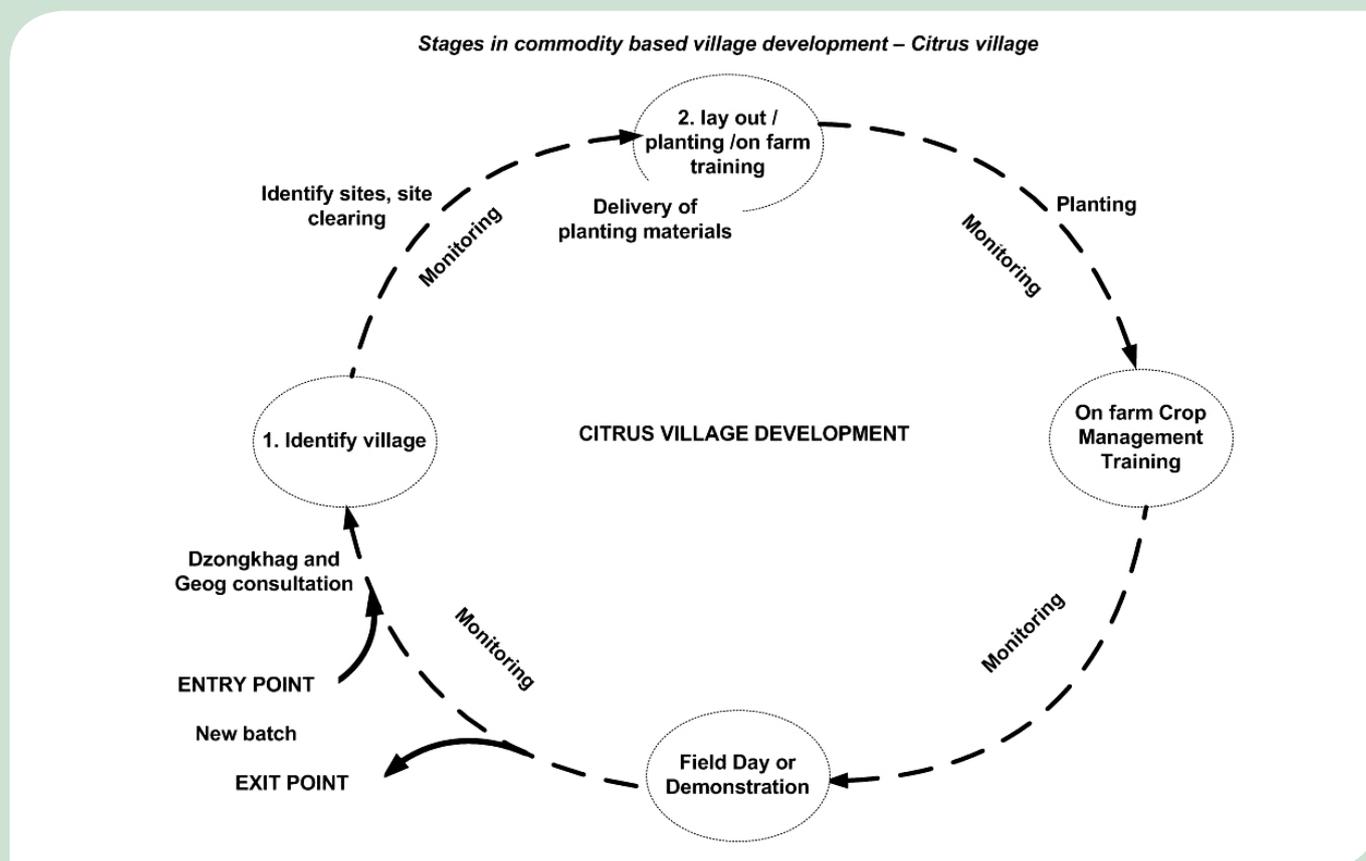
2. January-February: The same group of farmers then attend a ten-day training

on plant propagation, orchard establishment, tree training and pruning. Upon completion of the training, seedlings are delivered to them and they begin planting, which is usually completed by February.

3. June-July: The farmers again attend the third phase of the training on fruit thinning and its benefits.

4. September: The farmers attend the last phase of the training on harvesting methods, postharvest packaging and marketing. A certificate for participation and completion of the training is awarded to those who complete the entire course.

Village Development (Focus Village) Approach



The Village Development approach is applied mainly to ensure effective utilisation of the available resources and generate visible impacts in a specific area, i.e., a village so that at least by the end of the project, the five villages in each Dzongkhag would have established the orchard. This overtime when it reaches fruiting in four to five years will provide sufficient produce for marketing. It is also in view of the concepts of one geog three products (OGTP) of the 10th FYP and One Village One Product Concept commonly followed in Japan.

The project applied this concept for development of citrus and pear in the villages. Here, a particular village suitable for particular crop is selected from

a Dzongkhag every year in consultation with the Dzongkhag and the Geog Extension Office. General criteria such as crop suitability, land topography, farmer's interests, market access, field location, etc. are used in the selection of the farmers once a suitable village has been identified. The project focal persons appointed from RDC Wengkhar with support of the geog extension office carry out the orchard lay out.

Farmers prepare the land and the seedlings are delivered to them on time. Representative farmers from these villages attend one training programme on citrus crop management practices and awareness at Wengkhar before the plantation. The programme also encourages the farmer-to-

farmer knowledge sharing when the trained farmers return to their respective villages.

Direct Support Programme

Unlike the other two approaches, Direct Support Programme approach is similar to the conventional approach in free distribution of seedlings. Since the other already described approaches take longer, the direct support to farmers with seedlings was found to be useful in promoting the crops identified under the project. Unlike the conventional approaches where seedlings are delivered to farmers, this approach demands the farmers to visit the Centre with their request once they attend the awareness programmes. Depending on the availability of seedlings, the Centre

supports farmers to establish new orchards on top of what they already have. These orchards are not systematically planned as compared to the ones in the other two approaches, but provide additional coverage and access to seedlings.

Achievements

Since the start of the project in 2010 until March 2014, a total of 619 fruit orchards with 25,444 plants have been established in the

six eastern Dzongkhags following the approaches described earlier. All the orchard owners under systematic training and orchard development are fully trained with well-established fruit orchards nearby their house for application of post-training activities. In the case of village development approach, representative farmers (5-6 farmers from each of the villages) are trained in RDC Wengkhari and the concept of farmer-to-farmer extension is applied for the rest of the farmers.

The trained farmers transfer their skills acquired to the fellow farmers in their respective villages. The direct support program is not systematically planned and is based on the request and availability of the planting materials, and no formal trainings are provided. The common feature among these three approaches is that the farmers adopt the concept of Integrated Fruits and Vegetable Programme, wherein each of the orchard owners grows vegetables underneath the fruit trees.

Table: The number of orchards established through different approaches in the region (2010-2014)

| Dzongkhags | Systematic Training & Orchard development | | Village Development Approach | | | Direct Support Program | |
|--------------|---|---------------|------------------------------|-----------------|---------------|------------------------|---------------|
| | Orchards (Nos.) | Plants (Nos.) | Villages (Nos.) | Orchards (Nos.) | Plants (Nos.) | Orchards (Nos.) | Plants (Nos.) |
| Mongar | 27 | 1515 | 3 | 40 | 1883 | 108 | 3486 |
| Lhuntshe | 26 | 1379 | 4 | 47 | 2470 | 6 | 285 |
| Tashiyangtse | 14 | 755 | 4 | 44 | 1807 | 10 | 312 |
| Trashigang | 20 | 1158 | 5 | 60 | 2287 | 128 | 2810 |
| Pemagatshel | 16 | 1023 | 4 | 38 | 1667 | 5 | 292 |
| S/jongkhar | 19 | 1035 | 4 | 57 | 2251 | 4 | 145 |
| Total | 122 | 6865 | *24 | 286 | 12365 | 261 | 7330 |

*Out of 24 villages – 1 village is Pear Village with 21 orchards and 578 plants in Rongthung, Trashigang and rest are Citrus Villages spread across the region.



GARLIC PRODUCTION:

A low volume, high value crop in GASA

With farmers motivated and encouraged by the outcome, the garlic production is expected to double in the coming year

By Tanka Maya Pulami, RDC-Bajo, Tshering N. Penjor, Singye Wangchu, and Chewang Gyeltshen, Gasa

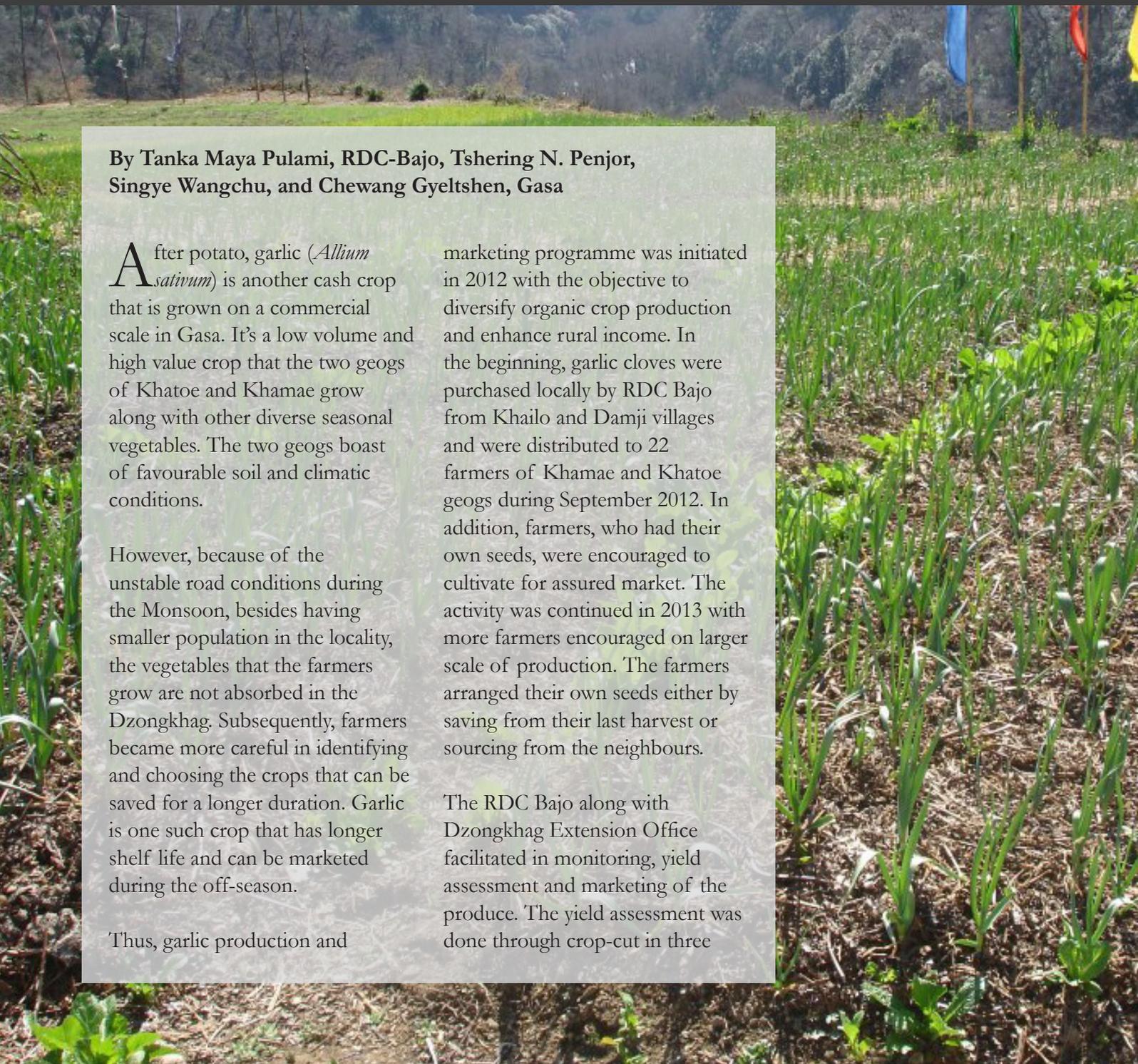
After potato, garlic (*Allium sativum*) is another cash crop that is grown on a commercial scale in Gasa. It's a low volume and high value crop that the two geogs of Khatoe and Khamae grow along with other diverse seasonal vegetables. The two geogs boast of favourable soil and climatic conditions.

However, because of the unstable road conditions during the Monsoon, besides having smaller population in the locality, the vegetables that the farmers grow are not absorbed in the Dzongkhag. Subsequently, farmers became more careful in identifying and choosing the crops that can be saved for a longer duration. Garlic is one such crop that has longer shelf life and can be marketed during the off-season.

Thus, garlic production and

marketing programme was initiated in 2012 with the objective to diversify organic crop production and enhance rural income. In the beginning, garlic cloves were purchased locally by RDC Bajo from Khailo and Damji villages and were distributed to 22 farmers of Khamae and Khatoe geogs during September 2012. In addition, farmers, who had their own seeds, were encouraged to cultivate for assured market. The activity was continued in 2013 with more farmers encouraged on larger scale of production. The farmers arranged their own seeds either by saving from their last harvest or sourcing from the neighbours.

The RDC Bajo along with Dzongkhag Extension Office facilitated in monitoring, yield assessment and marketing of the produce. The yield assessment was done through crop-cut in three





different villages. In each village, three garlic-growing farmers were randomly selected and three sample crop cuts were taken from each farmer from the area of 2 x 3 metre square. The samples were properly dried and measured. The result showed that the average yield was 861.9 kilogram per acre. Based on the total land area of 5.8 acres, the total garlic production in 2013 was estimated to 5 metric tonnes.

The garlic cloves were checked and sorted for appropriate quality and size to meet the market preferences. From the total production, the RDC Bajo in collaboration with Horticulture Division facilitated in marketing 3.5 metric tonnes of garlic as seed for distribution to farmers in other Dzongkhags at the rate of Nu. 100 per kilogram, generating revenue of Nu. 0.35 million. Farmers sold the remaining

produce of 1.5 metric tonnes in smaller quantities at the local markets in Punakha and Damji, Gasa. The remaining stock was kept for home consumption and also stored as seeds for next season.

Based on the income generated from the sale of garlic, farmers are now further motivated and encouraged to go for larger production and increasing the area of cultivation. The production is expected to double in the coming year.

To mitigate the marketing issues, Gasa Dzongkhag Agriculture Sector and RDC Bajo will continue to build the capacity of the farmers on garlic product diversification and production of garlic pickles, garlic flakes, powdering and help them identify potential niche market for these products.

Climate Smart Agriculture in **CHUZAGANG**

***On the path to achieving self-reliance
and self-sufficiency***

By Tashi Dawa, RNR-EC, Chuzagang

Chuzagang geog under Sarpang was one among the many other geogs of the three pilot Dzongkhags that received support from the collaborated venture of Climate Smart Agriculture (CSA) - SNV and the Department of Agriculture in 2013.

Primarily to assess usefulness, understanding and adoption to the present climate variations, and to get feedback with opportunities for improvement of the programme for future development for both the farmers and geog RNR officers, the CSA/SNV conducted a pre-test training and workshop on the Climate Smart Agriculture. This was followed by CSA vulnerability

assessment and action planning workshop and training for the farmers of Chuzagang and Sershong, which were conducted at Chuzagang.

The set plans and the activity scenario reflected for Chuzagang were as follows:

1. Organic ginger production trial and demonstration to minimise soft rot in ginger crop;
2. Introduction of upland paddy cultivation to cope with the irrigation problems;
3. Electric fencing at upper Chaskhar to mitigate crop damage by wild animals;
4. Trial and demonstration

of nitrogen fixation in the soil by growing red lentil (*Mousori dal*) after paddy cultivation.

All the plans and activities mentioned above were adjusted as per the seasonal suitability and the comfort of the farmers and the stakeholders involved.

I. Organic ginger production trial and demonstration to minimise soft rot in ginger crop

Out of the 610 kilograms of ginger rhizomes provided by the CSA/SNV, 510 kilograms were cultivated by groups of five farmers and a farmer alone cultivated 100 kilograms. The



Electric fencing at Chaskar



farmers were also trained on the management practices of the ginger cultivation.

The ginger rhizomes were initially treated organically by using *Jeevatu* solution. Then, at a later stage, organic pesticide (*Lastram*) mixed with water at a ratio of 5ml per litre was sprayed over the plantation. The pesticide was obtained for free from the National Organic Program. There was no sign of soft rot in the crop throughout the growth.

The farmers planted at once, approximately 100 to 200 grams of rhizome with an intention to achieve double income from both the mother seed and the final produce as is usually done in

Chuzagang.

The ginger was marketed to the auction yard at Gelephu during the month of August and the amount fetched was lower compared to the peak season in September. A total of 420 kilograms of ginger was collected from the 610 kilograms ginger rhizomes cultivated, and the gross income was Nu. 26,900. The net profit was Nu. 13,700 with an individual profit of Nu. 2740.00. Since the crop was almost mature and assuming a good harvest by the end of January, the final production from the field was expected to give 90 percent profit taking in to account 10 percent for the labours and transportation.

II. Introduction of upland paddy cultivation to cope with the irrigation problems

Local rice varieties of Chuzagang are already renowned in the country and now, with the introduction of CSA/SNV's upland paddy cultivation programme, the geog has another fine produce in line to offer. Through the programme,

Bhur Kamja-I is expected to hit the Bhutanese market and receive the same consumer applause for its taste. The rice is not only easy to thresh, but also brings out higher yields.

With the farm mechanisation support provided by the programme for the first stage land preparation, 12 households took up the Bhur Kamja cultivation. The programme started with 540 kilograms of Bhur Kamja that was expected to be cultivated on 20 acres of land with an estimated 25 kilograms per acre. The farmers followed different types of sowing methods such as line sowing, sowing behind the plough and dribbling and broadcasting, out of which, farmers preferred broadcasting and planking afterwards.

After the harvest, the farmers positively reckoned their inability to carry out proper weeding, when it was required, that actually resulted in poor yield. As pioneers of upland paddy cultivation, an endeavour that was first of its kind, farmers were initially sceptical and even planted on their wetlands at the same time. Later, when it was time for weeding, they faced shortage of labour. It was difficult for them to find enough people to weed both upland and wetland cultivations.

Nevertheless, the farmers were optimistic with the next upland paddy cultivation. And to top it, looking at the crop performance this time, even those farmers with limited wetlands have shown interest for upland paddy cultivation.

In addition to the shortage of labour, the farmers also faced

difficulties associated with the wildlife such as rabbits, peacocks and elephants. For instance, the actual targeted area of 20 acres could not be met and was brought down to 17 acres due to constant damage of crops by the wild elephants. As a result two of the households with about 3.5 acres had to harvest their paddy earlier than the expected.

The first upland paddy cultivation has proved to be a case of trial and error for the Chuzagang farmers. They had to start their cultivation on fallow lands and did not realise the importance of using fertilisers and manures. However, they have learnt from their mistakes and now plan to do the next cultivation taking into consideration all the factors.

Although the exact number of households and size of cultivation have not yet been decided for the 2015 the farmers in Chuzagang have already placed demand for Bhur Kamja at close to 2,000 kilograms.

III. Electric fence at upper Chaskhar to solve the crop damages by wild animals

The farmers of Chaskhar had been complaining of year round intrusion of their fields by the wild boar. But with the establishment of the 2.795 kilometres of electric fencing at around 100 acres of land, farmers of 29 households are finally at peace.

CSA/SNV Project conducted a weeklong Training of the Trainers (ToT) for electric fencing at Sershong geog. The training



involved the electric fence focal person of RDC Yusipang and other related agencies, who helped towards building an electric fence of 2.8 kilometres at Chaskhar. With the establishment of these amenities, a comparative study of the past and present yield will be carried soon after the geog's paddy cultivation and threshing. According to the farmers, with the electric fencing they were able to save at least 300 kilograms of paddy from every acre they cultivated.

IV. Introduction of Red lentil (Mousori dal) cultivation to increase income level and help with soil fertilisation (Nitrogen fixation in the soil)

Two farmers of Chuzagang undertook the red lentil cultivation in the winter of 2013. While it proved to be very fruitful for one of the farmers, the other one proved unsuccessful. A total of 10 kilograms of red lentil seeds was procured from the nearby border town, of which one of the farmers took 7 kilograms while the other farmer collected

just 3 kilograms. The former's cultivation failed due to excess water in his field, but the other farmer could harvest 70 kilograms of red lentil from the 3 kilograms seeds that he had sown.

In the winter of 2014, for the second cultivation, we added 15 kilograms more to the 70 kilograms that we have produced. The seeds were distributed to 28 farmers; 16 are farmers of Umling geog. The programme has been further extended to Umling as per the interests expressed by the farmers in that geog.

We are optimistic about the red lentil production and we will know the final outcome by March 2015. The red lentil cultivation is expected to change the cropping pattern of Chuzagang and Umling geogs and as the production rises, so will the income of the farmers.

We are happy to report that these collaborated activities did bear fruits and the Chuzagang agriculture community would like to thank all the agencies and stakeholders, who contributed towards the success of these programmes.

GREEN FARM BHUTAN

An integrated peri-urban Agriculture Farming

By Bindu M Tamang, PPD

Green Farm Bhutan is an integrated peri-urban agriculture farming temporarily set up in Hongtsho in 2012 with new idea, strategy and model of agriculture farming business. “Peri-Urban” being near the urban peripheral areas provide ample of opportunities for the farm to be viable with immediate and high demand market. It is run by a group of farmers combining poultry with vegetables, nursery and strawberry farming.

“Integration” refers to the combination of three sub-sectors; agriculture, livestock and forests, which are the three indispensable components of the Bhutanese farming system. These sub-sectors harmonise and complement each other harnessing an optimal utilisation of available resources geared towards producing economical volume of agricultural goods and services.

In Bhutan, over 80 percent of the agricultural products consumed are imported, but the preference for the domestic products is still high although the domestic

products are relatively expensive compared to those imported. If the domestic agricultural commodities are fresh, organic, and high quality, it can easily beat the imported products which are chemical infused and harmful for health. This makes agriculture farming business viable in Bhutan at least in select products and other high end products. However, shortage of farm labour, unavailability of timely input, high transportation costs and lack of appropriate knowledge challenge its success.

The mission of the Green Farm Bhutan is to “Promote self-reliance in agri-business and agriculture business leadership among Bhutanese women and farmers, and to demonstrate local farmers to set up SMEs through capacity building and experiences”.

The Green Farm Bhutan operates with the following objectives:

- (i) To create innovative business ideas among youth and demonstrate peri-urban

integrated commercial farming in agriculture and livestock using value chain approach;

- (ii) To promote integrated agriculture farming practices harnessing larger economies of scale in production, distribution and marketing;
- (iii) To empower women and promote farmers’ entrepreneurship skills in the country;
- (iv) To enhance knowledge and skill on production, packaging and marketing of agriculture products;
- (v) To promote agriculture business awareness, generate employment opportunities and enhance rural income.

Overall operational framework

The farm operates on a green farm model, which is different and new as compared to the existing practice in the country. The Farm has adopted the strategic

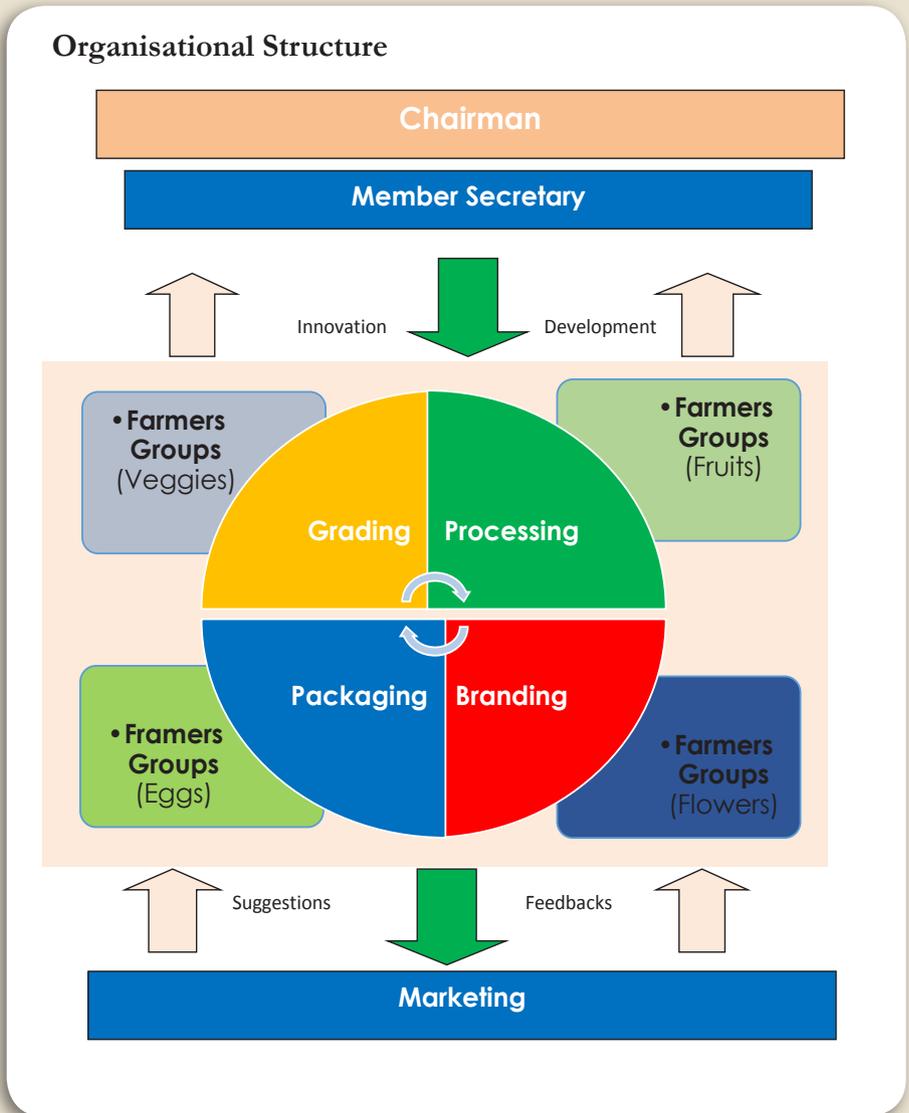
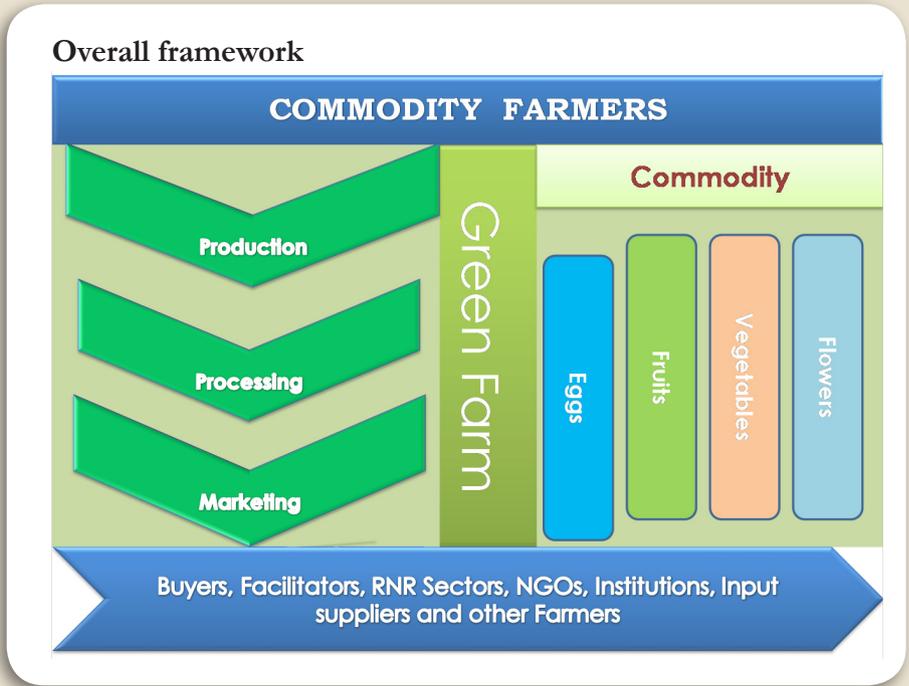
essentials from the three different existing models in Bhutan; FGs and Coops, Contract Farming and PPP and had come up with a unique operational framework. The ultimate beneficiaries are the farmers' groups.

The Farm Strategies

The Farm operates using PPM model (Production, Processing and Marketing) where the farm monitors the whole processes of commodity and maintains the quality throughout value chain course.

The farm ensures proper and attractive packaging with good presentation and design with our cultural technology. Farmers Commodity Groups interested in a particular produce can join the farm with a one-time registration fee. The size of the Commodity Group shall be open initially depending on their quality of product, interest and subject to review upon success of the farm. The farm will partner with government agencies and donors for support especially the RNR sector.

Constant research on new products, technologies, improving quality and operational strategies are also the part of the Farm's programme. Participation in different forums both at national and international to enhance the output of the



farm is some of the other strategies. So far Green Farm has won two awards; first is National level, best innovative business idea competition of 2014 in female category and second is FAO 2014 International poster competition on: “Family Farming: Feeding the world and caring the earth” which was drawn on “Green Farm Bhutan”.

The Market

Immediate buyers are Centenary Farmers’ Market vendors, super markets, hoteliers, schools, offices, institutions, retailers, and individual buyers. Once the farm is successful, it has plans to explore markets outside Thimphu and at a later stage, if the farm can brand it organic and come up with special products the farm will venture; it looks forward to export the produce in the markets abroad.

Green Farm Products

Currently, the Green Farm deals with only four products listed below:

- 1. Egg:** The eggs are sold fresh and clean. They are at the moment sold only in Thimphu. The Farm also plans to improve the packaging of the eggs in future.
- 2. Vegetables:** The Farm produces common vegetables, such as broccolis, cauliflowers,



cabbages, radish, and variety of spinach, carrots, peas, beans, turnips and coriander. The manures, which are produced from the poultry farm, are used to fertilise these vegetables. The vegetables are sold in Centenary Farmers Market, Thimphu. The vegetable group has earned more than Nu. 1000, 000 in 2014. Due to shortage of land, the vegetable farmer is at the moment using the private leased land.

- 3. Flowers:** Thimphu receives a high demand for flowers. The office goers, hoteliers, government offices, schools and other

individuals look for flower since the culture of growing flower is increasing in the capital city. The Farm is producing potted flowers as well as cut flowers, hedges, bush, ornamental bamboos and also some forest tree seedlings.

- 4. Strawberries:** Strawberries are high in demand and Thimphu has the best market. In the previous year, the farm produced about 50-60 kgs of strawberries and fetched average prices of about Nu. 500 per kg. Hongtsho is the best place for growing strawberries in the open field.



New Discovery

Otter species and new bird sighted at Thrumshingla National Park

In the Thrumshingla National Park, an Asian Small-clawed Otter or Oriental Small-clawed Otter (*Aonyx cinerea*) was found being placed in an enclosure by a farmer. It was caught from the agriculture field located by the side of a stream called Morichu in Saling, Mongar.

The otter, the smallest in the world under Mustelidae family is a new record. It is evaluated as 'vulnerable' under the Redlist of threatened species (IUCN, 2014) and Appendix II (CITES) due to habitat destruction and reduction in its prey-biomass owing to over exploitation and pollution. The Otter was released into the Morichhu and is being monitored.

A dead female Barred Buttonquail (*Turnix suscitator*) sighted in the dry chirpine forest area by the staffs of the central range office in Lingmethang (630m) confirms its presence in the park. It was also reported that the bird was sighted once in 2004 by Sherub (Ornithologist) and team in the same forest area.

The bird is considered to be a new record of Buttonquail species and is listed as the Least concern on IUCN Red list of threatened species. It is known to be resident in Bhutan and recorded only in Samtse at an elevation of 610m.

New sighting of Lapland Bunting at Dungzam

Mr. Tshering Chopel, the Forester at the Bumdeling Wildlife Sanctuary, attached to Dungzam Range Office has, recorded the Lapland Longspur/Lapland Bunting (*Calcarius lapponicus*) from Dowalingju under Bumdeling geog. The bird species is a new record in Bhutan.

The Lapland Longspuris a robust bird, with a thick yellow seed-eater's bill. During summer, male has a black head and throat, white eye stripe, chestnut nape, white underparts, and a heavily streaked black-grey back. Other plumages have a plainer orange-brown head, a browner back and chestnut nape

and wing panels. IUCN Status: Least concerned.

New species record for Bhutan

The Chinese Pond Heron (*Ardeola bacchus*) was spotted by the team of Bumdeling Wildlife Sanctuary at Singye Dzong. The Heron is a freshwater bird of the heron family (Ardeidae). As per the literature, the Heron is 47 cm long with white wings, a yellow bill with black tip, yellow eyes and legs. They usually feed on insects and fish.

The species is sighted for the first time in the country as the presence of species was not recorded in any published documents in Bhutan.



Oriental Small-clawed Otter



Lapland Bunting



Barred Buttonquail



Chinese Pond Heron

DRUJEGANG

Mandarin Growers

in HIGH SPIRIT



By Kinley Dorji, RDSC-Mithun (Tsirang); Sonam Dechen Dorji and Yeshe Zangpo, RNR Drujegang, Dagana; Sonam Chopel, RDC Bajo, and Birkha Tamang, NSSC, Semtokha

Ap Needup (ex-gup) of Drujegang more than two years ago said, “We followed the advice and sprayed chemicals, but it was in vain. Looks like there is no solution to this disease”. Currently, he is the Chairperson of Pangna Citrus Management Group and is much happier now.

While the outbreak of citrus Huanglongbing (HLB) disease is not yet confirmed in Drujegang, the decline of citrus orchards is obvious.

Mandarin is an important crop in Drujegang community. It is the mainstay of livelihood for majority of Drujegang community. However, over the years, farmers have been increasingly worried due to the decline in the yield, production and deteriorating fruit quality. Annual household income has begun to take a dip with direct consequences on their everyday life. Some orchards in low-lying areas have completely declined and remain neglected.

Although Bhutanese farmers have been growing oranges for a while, systematic adaptive research on citrus started only about a decade ago. Substantial information on the management is now available for mandarin farmers in the country. However, these

With basic orchard management practices improved, income from the sale of mandarin as well as household income has increased by two folds

management information and technology have largely failed to reach the farmers. Therefore, the decline in orchards is the direct result of the non-adoption of management practices by the growers around the country.

Starting June 2012, the RDC Bajo selected Drujegang geog as an area for wide management project pilot site. The main objective of the initiative was to identify the causes of the decline in mandarin orchards and provide possible solutions. A meeting was conducted with the growers to gather baseline information such as response of growers to improved management practices and to develop strategies and incorporate them into annual action plans. The project started in 2012 covering a total of 320



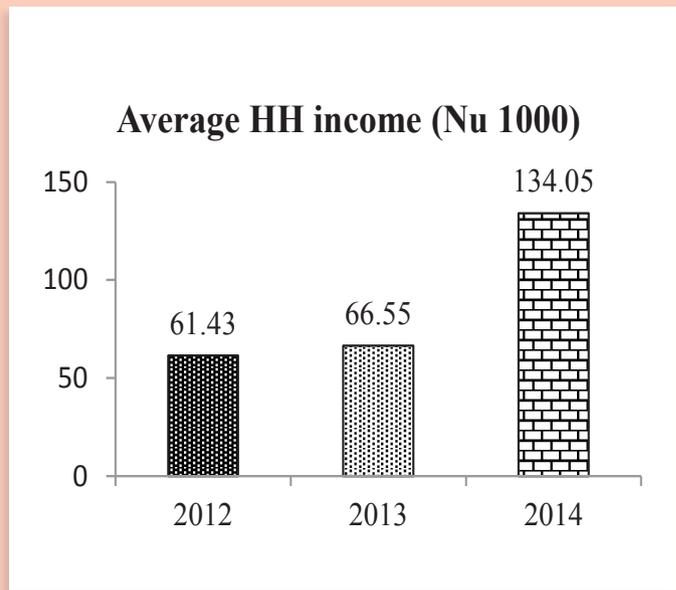
households from three chiwogs (Pangna, Thangna and Pangserpo). Initially, the growers were informed on the status of citrus industry in Bhutan with respect to yield and production. Researchers from Bajo also conducted community awareness programme on citrus HLB, which included introduction on citrus HLB and its devastating impact on citrus industry and household income. The geog administration then submitted a letter of undertaking based on which a consultative action plan was drawn. Several rounds of trainings were conducted based on the calendar of management activities for citrus.

Key management components like canopy management (basin preparation, mulching, integrated nutrient management, farm yard manure, inorganic fertiliser application), integrated pest management (PP chemical application, mechanical control, biological control, etc) and irrigation and water management were identified and farmers were trained on them accordingly.

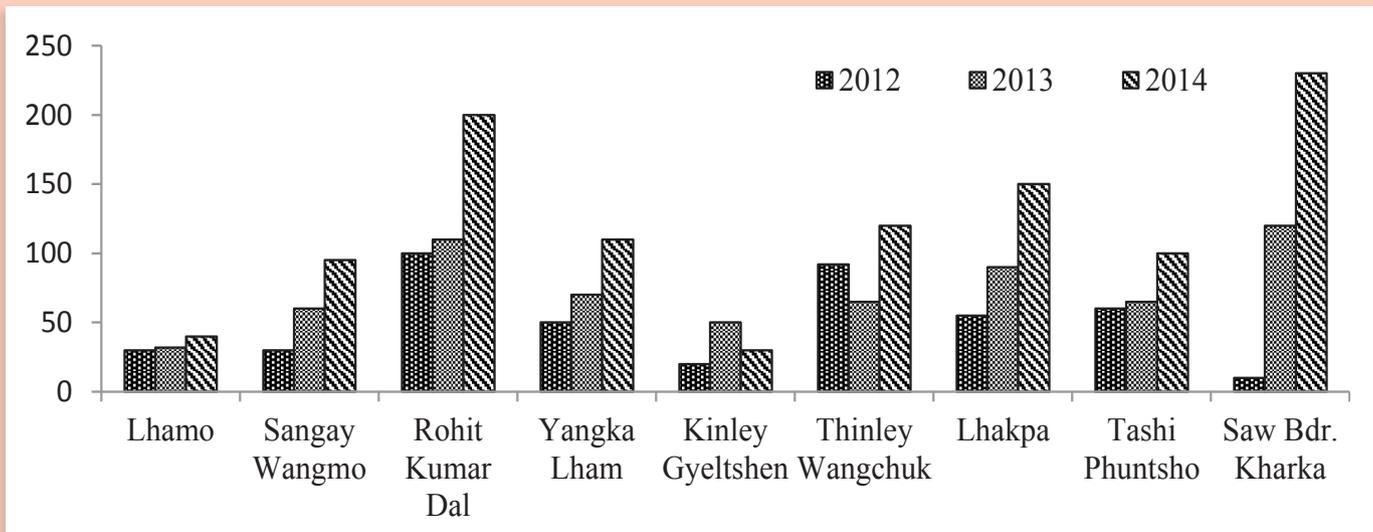
While presence of *psyllids* and citrus HLB were not confirmed, the main cause of orchard decline was found to be due to the lack of basic orchard management practices. The management of citrus orchard encompassing all the essential components that the growers took up following the initiative was found to have considerable impact on the improvement and revival of the orchards, which were initially on decline.

Income from the sale of mandarin has increased

more than double in 2014. The average annual household income is observed to have increased by more than two folds – from Nu.61,400 in 2012 to Nu.134,000 in 2014. Almost all the growers (small, medium and large orchard owners) saw an increase in their household earning in 2014 – after the interventions. Despite the alternate bearing habit of local mandarin, an increase in income (about Nu. 5000) was also experienced in 2013. The increase in cash income for some of the randomly selected growers in Drujegang is indicated below.



Average household (HH) income of Drujegang community



Household income trend for randomly selected individuals



Can an in-depth study of “RIVER BUG” reveal many economic and medicinal secrets?

If fewer people suffer from gastritis, piles, UTI or for that matter any other ailments, then it seems Knabu bug is truly a nature's gift

By Ugyen Tshering, College of Natural Resources, Lobeysa

Background

Goshing village is located in lower region of Zhemgang. For a long time, the region remained isolated from the rest of the country. Until the developmental activities started coming in the region, almost reluctantly, the community members have been living all within themselves. The Mangdechu in the Northwest and the Darangchu in the Southeast literally fenced the region and guarded the community and brought the people together. These giant rivers barred them from intermixing with the neighbouring communities.

In order to supplement food shortage during the lean season,

people in this region have found delicacy in certain insects that are abundantly found in the water. The insects may taste awful for the first-timers or the consumption may even be a taboo in other parts of the country, but for the local people it is a delicacy. The insects are consumed mostly by boiling them.

Although they can be mixed with any other vegetables the insects particularly go well with fermented bamboo shoots, some local cheese and red chillies. The local people also consume the insects raw, roasted or fried. The surplus is sun-dried or stored for the lean season when the gardens run out of vegetables.

How did the community discover their taste for the insect?

It is a gift of isolation. Not many years ago, the rugged terrain, torrential rivers, thick, and unexplored jungles often plague-ridden by fiercest wild animals and other hostile landscapes permitted limited interaction among the people of different neighbourhood. And this confined people to one community and offered them a little choice of what to eat. The circumstances forced them to develop survival techniques based on what was available to them.

What is this insect?

Khengpas call it *Knabu* while it is known as *Padani* in Lotshamkha.

People in western region call it *Heyhem*. But in absence of an English name for the insect, it is referred to as 'river bug' as it resembles a bug and is found only along the river banks.

Observations show that the insect is a close cousin of a brown marmorated stink bug, which is a common agricultural pest. Perhaps they share the same line of speciation or phylogeny, as is evident from the similar taxonomical characters.

For instance, both emit a fluid with strong pungent stench. Such a secretion is a defence mechanism that helps the insect to protect itself from the predators. It is of same size usually ranging from 1/4 to 1/2 inch corresponding to 6 to 13 mm in length. However, comparatively, river bug is round in shape, more fleshy and appears to live under the well-weathered stones along the river bank.

It is known to come in dull colours, usually gray or brown. The insect's unique feature of red or orange markings makes it easy to distinguish from other species. Like all other insects, it has three-sectioned body: head, thorax and

abdomen. It has a hard shell. The bug has two pairs of wings. While the back wings are comparatively thinner and transparent, the wings on the front are thick and tough at the base and thin at the tips.

The consumption pattern

During the first to third Bhutanese months that correspond to February and April, farmers' maize supply dips low, threatening them of imminent hunger. The cultivation of finger millet would have started, but farmers would have less to eat.

And when such a time comes, the wintry sky would suddenly turn reddish-yellow. The sky would feign sunset and the nearest horizon would grow darker. And for the people of Goshing, it is their protective deity, who has come to their rescue; raining and showering them with their delicacy, the fleshy food to supplement their last few 'Changbre' (a unit of measuring grains) of maize. It is the '*Knabi*' falling down from the sky and fill the river banks. This is what people believe!

Men, women and children would ready for the collection. But they

would require no fancy tools. All they need is a bag in which the collected insects can be carried home.

Once near the river, they would knock over and dislodge stones in the water. Every stone, they capsize would expose a handful of the insects, which are hoarding inside, shielding themselves from cold winter. The farmers skilfully pick them and hurl them into the bags. When they have collected enough, the villagers would return home. The insects are kept in a bowl of water and then properly rinsed. The edible ones are segregated from those that are unfit for consumption.

The ones with red chest are avoided since they are known to cause sickness. If someone carelessly consumes a red-chested bug, he/she will be bed-ridden for not less than a week. The victims suffer from acute vomiting and no modern medicines can be taken. This is known to trigger more vomiting. The victim would appear like he/she is overdosed. Yet, the village elders advise the infected to keep their eyes closed and sleep till giddiness subsides. The illness is normally said to recover on its own without any medication.



The segregated insects are then boiled thoroughly to rid of stinking stench after which the heads of individual insects are removed. The insects are mixed with bamboo shoots and added some cheese to cook curry.

The supposedly medicinal value of the insect

If the region has fewer people suffering from gastritis, piles, UTI, for that matter, any other minor ailments, it seems the insect has great medicinal values. Although it needs to be scientifically confirmed, media articles have quoted Institute of Traditional Medicine Service saying that the insect contains medicinal properties. In addition, traditional medicine experts cite that the consumption of bugs has multiple medical benefits. It can be particularly helpful to ulcer patients, fix digestion problems and many forms of stomach problems. The insect is also known for being an appetiser.

However, if investigated or analysed under laboratory setting, there is a lot more to the medicinal value of the insect than what is believed. And if the insect is proved to contain curing effect for gastritis, piles and UTI, it can be of a huge selling advantage.

What is lacking up until now?

There is a little written or research report on the insect until now. Except for the local knowledge, which is orally passed down the generations, nothing is officially documented. This is evident from the lack of readily available information. Hence, this is an area where we need to encourage people to carry out in-depth research works.

We know nothing about its lifecycle, reproduction, why it appears only in winter while it disappears during the other seasons. We do not know what it feeds on and how long it survives. However, the locals believe that it comes as a gift from their guardian deities.

The insect is known to occur in many of the major rivers. Its presence is confirmed in Phochu and Mochu in Punakha. The author, as part of the CNR degree assignment, collected live samples. In addition, it is reported from most of the rivers in southern and eastern Dzongkhags. If this is true, its distribution is wide and abundant in the country. Hence, there is greater need to do a thorough survey and map out its distribution. Further, the insect is collected rampantly without any due respect for the sustainability.

So, there is every risk of over exploitation.

What governmental agencies could do to help?

There is an urgent need for the government agencies to intervene and initiate a thorough study of the insect to garner information that is currently lacking. One important area is its medicinal and nutritional value. If it is confirmed that the insect has not only good nutritional value, but also huge medicinal properties, the product can be developed for export to other countries in addition to making them available in the local markets. This can be done through creating publicity in partnership with the community.

The government and other stakeholders could also explore markets. There is a need to train farmers on the collection practices, do proper packaging, labelling and marketing. This can be done effectively through formation of farmers' group or incorporated with existing RNR farmers' group. If this is done, it can ensure equitable benefit sharing, proper administration and management of the expenses and incomes. In the end, this will enhance living standard of the community and release from the shackles of poverty.



Mutual benefit sharing from **COMMUNITY FOREST in HAA**

By Gem Tshering, Haa

The funds generated by Community Forest offer crucial and significant resources for the members of Doreb Yargel Phuensum Community Forest in Haa. The fund was basically raised from the sale of wood from bark beetle affected forest.

The Dzongkhag Forestry Sector assessed the size of the fund and how it was utilised. At moment, the group has generated a sum of Nu 1,452,789.16. It revealed that the income from community fund significantly increases local development resources.

The major part of this income (Nu. 1,200,000) was spent to provide loans to 24 community forest management group (CFMG) members. Thus, each member received Nu.50,000 each. The members have used the money to renovate their houses and buy zinc sheets while some members used it to buy jersey cows or spent for their children's education. The loans, thus disbursed, were meaningfully utilised. The fund benefitted the members as it included non-poor, poor and less advantaged members since the executive committee members managed the fund.

Currently, there is no major issue with the Group. However, there are no 'pro-poor programme' initiated within the group and in future some problems are likely to arise when members are unable to pay back the loan- the principal amount with interest. We feel that providing smaller loans to the members can mitigate this risk to some extent.

Further, to narrow down the benefit sharing, the Group members have unanimously agreed to hire private vehicles while the forestry officials are on official duties to their locality. This includes only the tasks, which are directly related to the community forest development activities in their jurisdiction. The officials are provided with the transport facility to perform the designated tasks. The hire charge is borne by the community forest fund. In the process, it reduces the use of scarce Government resources such as pool vehicle and the cost of fuel.

Currently, the Group has spent Nu 5,000 for vehicle hiring and Nu 14,070 to conduct CFMG workshops and meetings. In addition to that, the Group pays a monthly salary of Nu 1,500 to the CFMG Secretary. This is agreed as an incentive for maintaining books and record keeping.

Similarly, while conducting CFMG workshop, the expenditure incurred for the working lunch is met from the Community Forest fund as well. This brings down the financial support received from the Participatory Forest Management Project 3rd phase under the Social Forestry and Extension Division. All these cut costs to the Government and the service delivery on time benefits the people.

All this began in 2013 and has gained a momentum. It is a win-win situation for both the community and Dzongkhag in particular.

Do you know?

What is *ex-situ* and *in-situ* conservation?

Ex-situ conservation

Ex-situ conservation is the conservation of species, breeds and varieties of animals and plants outside their natural habitats.

Ex-situ conservation is commonly carried out through the following methods:

1. Gene Banks
 2. Field Gene banks
 3. Botanical Garden
1. **Gene Banks** can constitute the following depending on the materials conserved and conservation techniques applied.
 - 1.1. **Seed Gene Bank:** It preserves dried seeds at very low temperature. Generally orthodox seeds with moisture content between 3-7 percent are preserved in freezers at -20°C .
 - 1.2. **Tissue Banks:** It conserves buds and meristematic tissues in nutrient medium with controlled light and temperature. This technique is used to preserve seedless plants and plants which reproduce asexually.
 - 1.3. **Cryo-banks:** The technique of preserving tissues, semen, embryo and recalcitrant seeds in liquid nitrogen at -196°C is known as Cryo-banking.
 2. **Field Gene Banks** are commonly used for conservation of plants which are difficult or impossible to conserve as seeds or are vegetatively propagated. In field genebanks, plant germplasm are conserved as live plants for continuous growth and require continuous maintenance.

3. **Botanical gardens** contain living collections of plants species to maintain a living store of genetic diversity for the purpose of conservation and research.

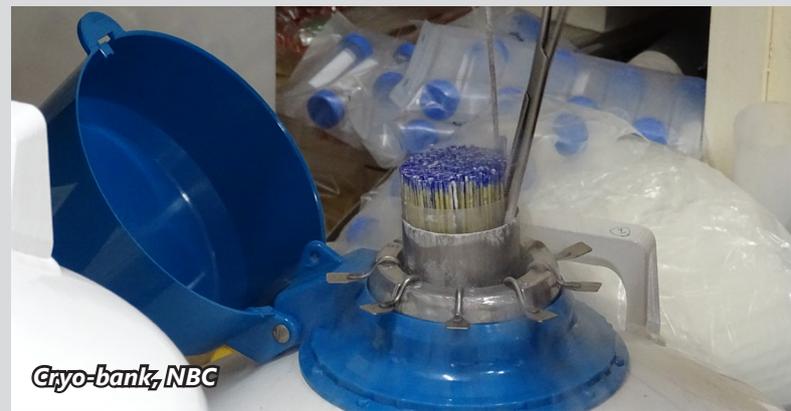
Ex-situ In-vivo Conservation

Conservation of breeds through maintenance of live animal populations not kept under normal management conditions and/or outside of the area in which they evolved or are normally found. Examples in the country are the Takin Reserve in Thimphu and the Nublang Nucleus Farm in Trashiyangphu, Wamrong.

In-situ Conservation/*On-Farm* Conservation

The conservation of plants and animals in their natural habitats is known as *in-situ* conservation. Some of the examples of *in-situ* conservation in the country are the Rhododendron garden in Thrumshingla National Park and the *Nublang* in Sombeykha, Haa.

On-farm conservation is used more in reference towards the *on-farm* management of traditional crop varieties.



Seed gene bank, NBC



National Nublang Breeding Farm, Trashiyangphu

What is organic farming? How do we start organic farming? What are its benefits?

Organic farming is a sustainable farming practice which sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. It combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.

It is easier to start organic farming with kitchen gardening and backyard poultry producing your vegetables, salads, herbs and food by recycling your home/farm wastes and then gradually expanding further to other crops and animals. Basic farm planning would be a key to the success of establishment of organic farm wherein the plans for organic soil nutrient management, cropping calendar, rearing of livestock, agro-forestry, pest and disease management, post harvest, marketing plans etc, can be prepared.

The benefits of organic farming are numerous which include the production of healthy, safe and tastier food, avoidance of environmental contamination with adverse

farm inputs, promotes farm biodiversity and provides insurance in case of failure of one crop, reduces the cost of production due to more use of on-farm inputs, higher profit margins due to reduced cost of production or premium prices, reduces the emission of green house gases and resilient to climate change.



Bio-pesticide extraction from Melia seed kernal

Source: National Organic Program, Smtokha

What is good poultry farm Bio-security?

With susceptible hosts and the right environmental conditions, transmissible pathogenic microorganisms spread and invade animals and humans, growing and reproducing to cause a disease. Transmissible diseases of poultry can be unpredictable and can have severe effects on poultry population, household food security and safety, and human health. Good poultry farm bio-security is simply doing practical things to reduce the chance of pathogenic micro-organisms entering poultry farm, establishing, and spreading to other farms hence reducing the incidence of disease outbreaks.

It is neither practical nor possible

to completely eliminate the spread of transmissible poultry disease. Good poultry farm bio-security reduces the incidence of disease and occurrence of outbreaks to acceptable levels. With the objective to reduce the incidence of poultry disease outbreaks in the country, BAFRA developed the following poultry farm bio-security check lists. Routine implementation of these basic bio-security measures would guarantee minimal disease incidences and healthy flock with higher returns.

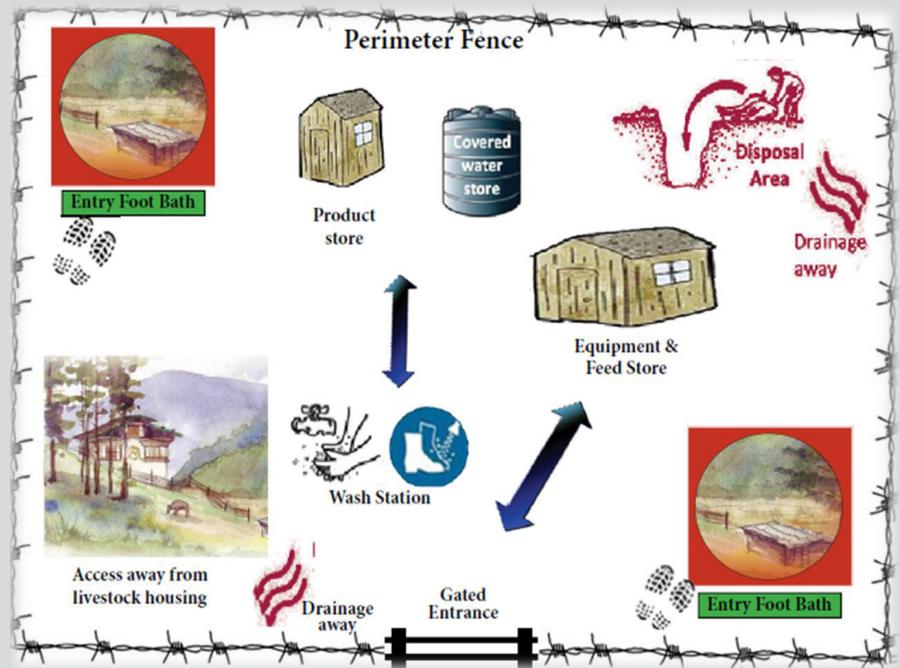
I. Farm Layout and Setup

1. Farm should have a perimeter fence with gated entrances to control unauthorized access

by people, stray animals and vehicles. The number of entrances should be as minimal as possible.

2. Farm entrances should have a sign board requesting visitors to abide by farm bio-security norms.
3. Access to the poultry sheds should be separate from residential home so that visitors to the home do not enter or pass near the poultry sheds.
4. Farm should have a washing facility (water, scrubbing brush, soap etc.) near each entrance to the farm for all people entering the farm to wash hands and footwear and to wash any equipment arriving on the farm.

5. Poultry sheds should be enclosed and have lockable doors to control unauthorised access.
6. Management and treatment of diseased poultry should be carried out in separate poultry shed.
7. Effluents from the farm should drain away from the poultry sheds and should not accumulate.
8. Farm should have a disposal pit away from the poultry sheds where dead birds are buried deep enough to prevent scavenging.



II. Visitors and Workers

1. The number of visitors and workers to the farm should be kept to a minimum.
2. Farm should have a book where farm bio-security rules are listed and where all visitors and workers should abide by the rules.
3. All vehicles should be parked off the farm. Delivery/ collection vehicles that need to enter the farm should be parked away from poultry sheds.
4. Poultry products from other farms should not be brought onto the farm.
5. Workers should avoid contact with other poultry farms and have good personal hygiene.
6. Every entrance to the poultry sheds should have a disinfectant foot bath immediately in front of the entrance. Footbaths should be replenished every day.

III. Pest Control

1. The area around the poultry sheds should be neat and tidy with no left carcasses, and no spilt feed.
2. Poultry sheds and store rooms should be wild bird proof.
3. Rodents should be prevented

VISITORS

PLEASE RESPECT FARM BIOSECURITY

Animals, plants, people, vehicles and equipment may carry pests and diseases.

Please contact the farm manager upon arrival and follow instructions to limit the risk of pest and disease entry.

4. Farm should cover any water storage to stop faecal contamination from wildlife or stray animals.

IV. Record Keeping

1. All poultry sheds should be inspected daily for sickness and deaths of poultry. Signs of disease or suspicion of any

2. disease should be reported to the nearest BAFRA Office or Livestock Extension Office concerned.
2. Farm should maintain a record of sickness and deaths of poultry.
3. Farm should maintain a record of source of feed, equipment and poultry.
4. Farm should maintain a record of vaccinations and treatments.



Farming Tips

Asparagus crown production

Source: RDC- Bajo

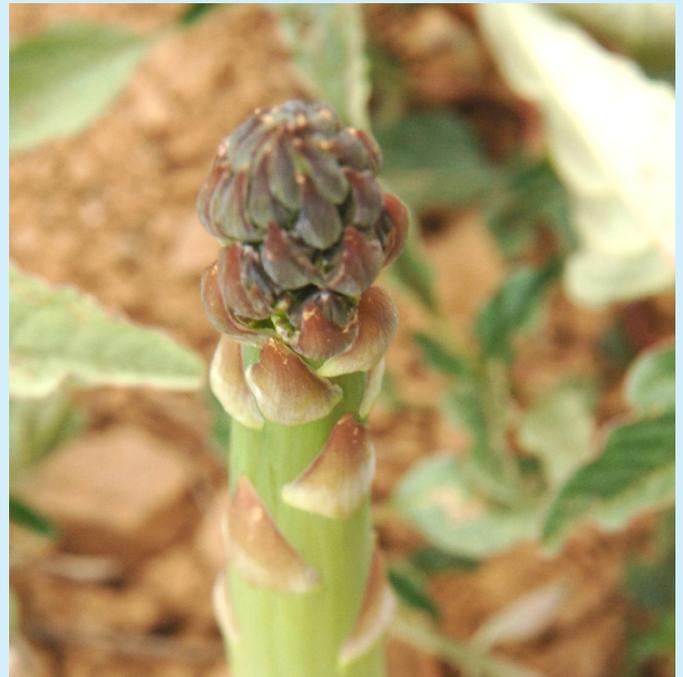
Asparagus (*Asparagus officinalis*) is an important commercial vegetable crop. This is a unique, early spring vegetable (a perennial of the lily family). This vegetable was originally valued more for its medicinal properties than for its culinary uses. Asparagus was thought to cure bee stings, toothaches, heart trouble, dropsy and many other ailments, and it was also believed to help maintain good eyesight.

It was considered to have significant medicinal value as a diuretic and was also highly prized as an aphrodisiac. Asparagus is high in vitamins and also contains significant amounts of iron.

There are two ways of acquiring asparagus crowns: Planting stock can be obtained from the National Seed Centre, Paro or farmers can produce their own crowns.

Procedure

- The sandy soil is necessary for optimum drainage, growth and for ease of digging.
- The land should not have and previous asparagus crop due to the risk of disease carry-over. It should also be weed free.
- A pH of 6-7 is preferred for maximum growth since a low pH can be detrimental to seed germination and seedling growth.
- The soil should have an adequate organic matter content to avoid soil crusting which hampers germination.



Seed soaking

- Asparagus seed is soaked for 3-4 days at 30-35°C before planting. This results in earlier emergence of up to one week.
- The optimum temperature for germination and emergence is 25-30°C. At a lower temperature of 15°C, it will take 3-4 weeks for the seedlings to emerge, and at 10°C, it will take 6 weeks. At lower soil temperatures seed soaking results in earlier emergence.
- If the seeds are planted in early to mid May when the soil is usually much cooler, the soaking treatment may result in an earlier emergence of one week.

- Research results have shown that the faster the seedling emerges after planting, the more vigorous it becomes.
- Asparagus seed should be planted 2.5-4 cm deep, to provide adequate moisture for germination.
- A higher crown yield per hectare is obtained if a bed system is used. The number of rows per bed ranges from 2-10, with inter-row spacing in the bed ranging from 10-30 cm, and spacing between beds of 45-70 cm. One hectare usually requires from 12-20 kilograms of seed depending on spacing and seed size.
- Each kg of seed sown usually produces enough useable crowns to plant one hectare of asparagus. The seed spacing within the rows ranges from 2.5-4 cm apart.

Maintenance

- The predetermined fertiliser rates required should be incorporated into the seedbed before seeding.
- One, two or more nitrogen applications throughout the season can be beneficial, especially when the plants are 10 cm high. This nitrogen side dressing in seed is especially important after heavy rains.
- In the drier growing seasons or in areas where rainfall is not sufficient, irrigation of the seedbed is very important for seed germination.



- Weeds should be kept in check throughout the season. Herbicides are important for economical weed control. Pre-emergence herbicide can be applied after sowing.
- Supplemental hoeing is usually necessary and cultivation is used sometimes with some row spacing.

Crown digging

- Asparagus crowns should be dug in spring, just prior to setting on the field, and before the beginning of bud growth. The crown digging operation is easier if the fern is chopped.
- The crowns should be dug carefully to avoid damage to the fleshy storage roots. Loss of storage roots results in a reduction in food reserves, necessary for crown growth after field setting.
- One-year-old crowns can be dug with much less root damage than 2-year old crowns.

Crown selection and sorting

Crowns should be sorted and graded critically:

- Depending on crown quality, from 10-50 percent of the poorer crowns dug may be discarded.
- The larger uniform crowns, which have a large number of plump buds and a strong root system, should be planted separately from the smaller uniform crowns.
- Crowns, which have long spindly roots and, pointed buds, regardless of crown size, should also be rejected. Large uniform crowns generally give a uniform asparagus planting
- Crowns should not be stored in a large mass or pile to prevent overheating and old growth due to poor air circulation.
- Extreme drying of the crowns should be avoided.
- Severe injury, or even complete loss, can occur if the crowns are allowed to freeze while being stored.

How to start Mushroom Cultivation

1. Principles of mushroom cultivation:
 - a) Creating a selective nutrient base for the mushroom
 - b) Introducing the mushroom of choice
 - c) Managing environment to favour mushroom growth and development
 - d) Ideal location for climate and marketing
2. The support to mushroom growers (Mushroom spawn and technical back up) can be obtained from the following agencies:
 - a) Western Region: National Mushroom Centre (NMC)
 - b) West Central Region: RDC Bajo
 - c) East Central Region: RDC Jakar
 - d) Eastern Region: RDC Wengkhar
 - e) Southern region: RDSC Bhur

However, for mushroom farms on commercial scale the support can be obtained directly from NMC.

3. All proposals for mushroom cultivation should route through the Dzongkhag Agriculture Sector.



Source: National Mushroom Centre, Semtokha

Important points to remember: Dairy Farming

- Develop required pasture/fodder resources on available land. Grow nutritious and high yielding varieties of forages. Preserve surplus forage as silage or hay.
- Connect water supply to the farm for drinking and cleaning.
- Construct infrastructure such as cattle shed, milk collection and processing unit in a phased manner based on budget availability.
- Buy cattle with more than 50 percent exotic blood level of breed such as Jersey and Holstein Friesian (HF), and dairy buffaloes breeds such as Murrah.
- Practice appropriate dairy cattle breeding scheme depending on resource available (such as out crossing, cross breeding, up-gradation, and use of good breeding bull or AI). Keep good animals born on farm to replace low yielder animals because they are uneconomical to keep and should be proportionately culled.
- Use labour saving devices such as milking machines, farm machinery where possible to cut down operation cost.
- Practice hygienic milk production: keeping healthy animals, clean surroundings, clean milking practices and clean utensils.
- Prevent disease outbreak in the herd, vaccinate new animal arriving in the herd against common diseases before entering the farm and regularly vaccinate later.
- Give regular preventive and curative treatment to all farm animals.
- Keep proper farm records of farm inputs such as feed, forage supplied to farm animals and outputs such as daily milk yield of individual cows, sale of milk and other farm products so that it can be periodically analysed to know investments and returns and will help in decision making.

Source: Department of Livestock