



The RNR family would like to wish everyone a very happy and prosperous **FIRE FEMALE BIRD YEAR 2017.**



May the **NEW YEAR** bring you health, happiness and wisdom.
Losar Trashi Delek!

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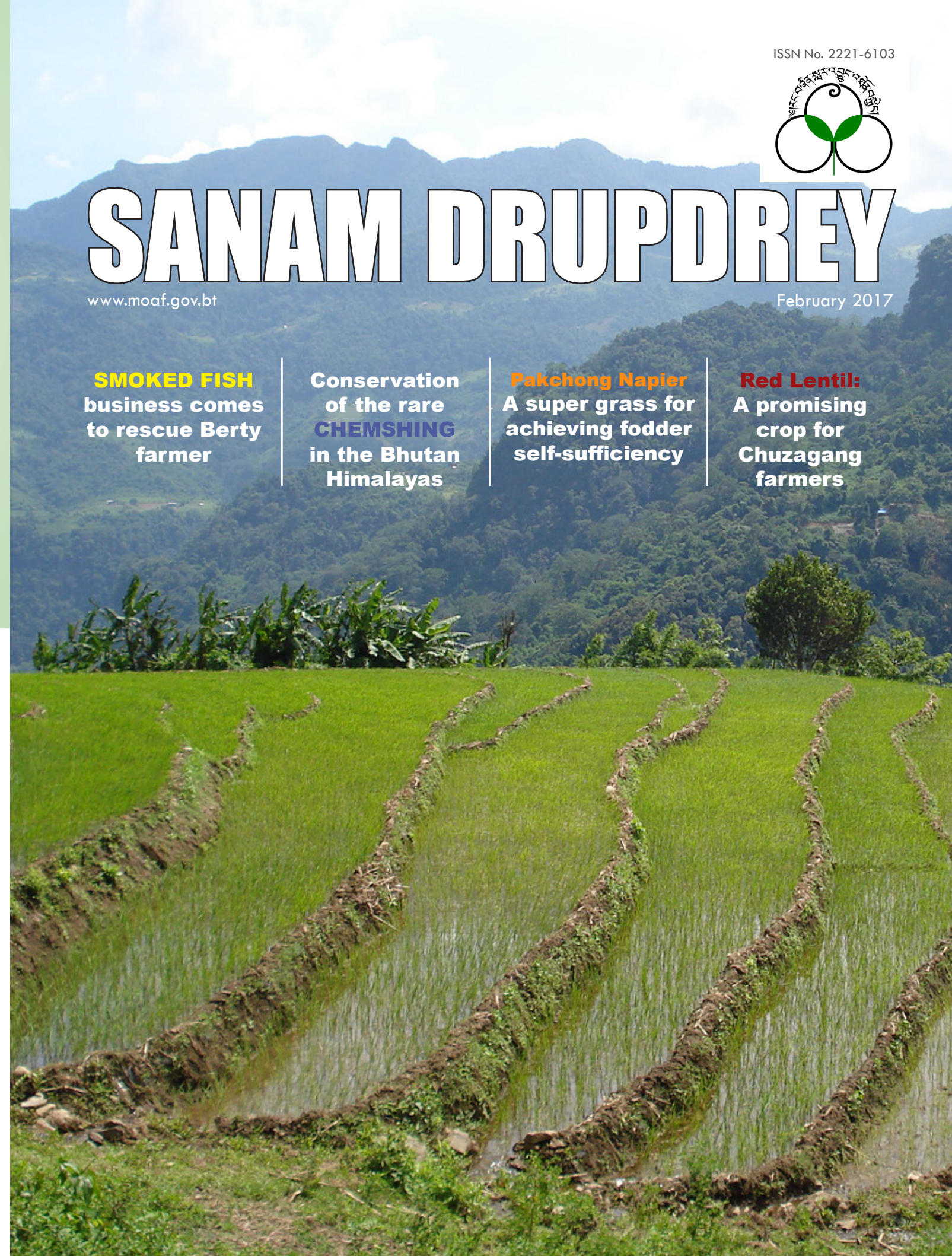
February 2017

SMOKED FISH
business comes
to rescue Berty
farmer

Conservation
of the rare
CHEMSHING
in the Bhutan
Himalayas

Pakchong Napier
A super grass for
achieving fodder
self-sufficiency

Red Lentil:
A promising
crop for
Chuzagang
farmers





*The RNR Family would like to dedicate this 7th Issue of Sanam Drupdrey to
HRH The Gyalsey, Jigme Namgyel Wangchuck whose First Birth Anniversary was celebrated
throughout the country on 5th February 2017.
We wish The Gyalsey great happiness, perfect health and a long life.*

KEEP FOOD SAFE

Read the label when buying,
preparing and storing food



Follow FIFO- First In First Out
Follow FEFO- First Expired
First Out



Cupboard foods- Store in cool
dry place, off the floor



When it doubt- Throw it Out
Do not rely on look, smell and
taste



Avoid bulged/puffed/
rusted canned products



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Dear friends,

This 7th Issue of *Sanam Drupdrey* is dedicated to HRH The Gyalsey, Jigme Namgyel Wangchuck whose First Birth Anniversary was just recently celebrated throughout the country on 5th February 2017. We wish The Gyalsey great happiness, perfect health and a long life.

As I look back at the year 2016, I see that this past year has been very fruitful for our Ministry of Agriculture and Forests (MoAF). Please allow me to reflect a little on some of what the MoAF has effectively carried out:

To reduce Human Wildlife Conflict, 150kms of electric-fence benefiting more than 1175 Households was erected. To improve rural connectivity and availability of irrigation water for agricultural development and poverty elevation about 818.48kms of Farm Roads and 4 major Irrigation Schemes of 16.30 km benefiting 775 households and covering a command area of 1929 acres have been constructed just in the past year or so. Due to huge Rural-Urban migration and the drive towards commercial farming, farm mechanisation has been a priority of the Agriculture Department. During this last year alone, hiring services of Agriculture Machinery Centre has covered 9750 acres

benefiting 9704 households. Besides this, 217 numbers of power tillers covering the whole country have been distributed.

As land management and rehabilitation is a priority, the Ministry has successfully brought about 303.65 acres of land under Sustainable Land Management. Apart from this, about 600 acres of land have been rehabilitated by recultivation and land development. Protection of cultivation for offseason crop production has been supported by promoting the establishment of 470 numbers of green houses. The focus has been placed on the research aspect for the development in agricultural sector, hence in 2015-16 year a total of 7 new crop varieties have been released, namely 2 Maize varieties, 1 Wheat variety, 2 Citrus variety, 1 Kiwi variety and 1 Cherry variety. All this initiatives has increased the overall agricultural production, thereby reducing our agricultural import and increasing export.

A successful completion of the nationwide Snow Leopard Survey was carried out by June 2016. Two national reports on, firstly, sign and prey base for Snow Leopard and secondly, camera trapping results of Snow Leopard were declared on the International Snow Leopard Day on 23rd October 2016. An assessment of all the protected areas in Bhutan was also completed successfully through a standard methodology developed for Bhutan known as Bhutan Management Effectives Tracking Tool Plus (Bhutan METT+). All the parks were initially assessed on their own followed by external evaluation.

The first ever State Of The Park Report was launched on 9th December 2016 by the Hon'ble Lyonchhoen. The report showcased the work of Bhutan's protected areas by highlighting the constitutional support for habitat conservation while emphasising the practical approach in actively engaging local people in managing Bhutan's pristine environment and fulfilling their needs simultaneously.

A detailed assessment within Nikkachhu, Kurichhu, Wangdigang-Dechugang watershed under Mandgechhu and lower Choekhar watershed under Chamkharchhu was effectively completed. For the Wangchhu basin, a series of consultation meetings

were carried out with the relevant stakeholders including the communities in Naro and Dagala geogs under Thimphu and identified problems/issues that degrades the watershed. The national stakeholder consultations were also carried out and committees were formed for Thimphu watershed. Under NAPA II project, the scoping study of Themnangbi-Jaibab watershed in Mongar and Barsa watershed in Chukha was completed. The Integrated River Basin Management Plan for Kholongchhu sub-basin which is inclusive of Bumdeling Ramsar site management plan was also developed. The PES framework and field guide to all the relevant stakeholders including Dzongkhags for promotion and upscaling of PES program in the country was fruitfully developed and distributed. Joint monitoring and verification in the three PES sites to enable the payment of PES fees by environmental services users to environmental services providers were facilitated and conducted. Stakeholder consultation meetings to identify degrading influences and their mitigation measures for Pelingtsho watershed/wetland management at Dechenling under Nganglam Dungkhag were conducted.

In 2016 alone, 40 community forests were established covering about 4151 hectares benefitting 1291 households.

In areas of strengthening biosecurity and food safety in the country, the construction of Plant and Animal Quarantine Stations at Nganglam and Phuentsholing were completed. The Biosecurity office at Dagana was setup. ISO 22000 (Food Quality and Safety Management System) certification of three Food Processing Industries in the country was completed.

In 2016 alone, 27 agriculture farmers groups, 12 livestock farmers groups and 6 cooperatives were registered. The Agriculture Market Infrastructure Inventory 2016 and Commodity Marketing through the FCBL auction yards was achieved. The RNR market price information mobile app

for Android and iOS was developed. There have been a number of linkages established between FGs/Coop linked with institutions, for example, 11 farmers groups' in the east have been linked with 6 schools to supply RNR produce and 1 cooperative has been linked with 2 schools in Zhemgang to supply vegetables. Supply of off-season fresh chilli from Kolkata – 38.55 MT- was facilitated, market promotion for certified organic potato of Rangzhin Sonam Detsen, Gasa resulted in 1735 kgs of potatoes being sold generating a revenue of Nu.67655/-. As a compensation for market failure due to demonetisation of some Indian currency, Nu.1,139,400/- price gap supports for potato farmers was provided.

Five turkey sheds were constructed and equipment installed in 2016. A pig nucleus farm at Yusipang was finished. Dairy cattle and breeding bulls were sourced and supplied all over the country. Farmers were trained on clean milk production and product diversification was done throughout the Kingdom. Yoghurt plants with incubation chambers were installed and cheese processing units were set up. Pigs were outsourced from Contract Pig Breeders.

A City Veterinary Hospital was opened at Phuentsholing, as it is a hotspot for animal diseases being a border town. Stunted fingerlings were produced at National Centre for Aquaculture, Gelephu and distributed to farmers. Climate smart interventions were made to mitigate greenhouse gas emissions from animal waste initiated at the National Jersey Breeding Centre at Samtse and the National Piggery Research Development Centre at Gelephu. The overall milk production in the country increased from 34807MT to 39844MT while 68.70Million eggs were produced. In the same period 1063 MT of chicken meat was produced. Similarly pork, fish and chevon production during the fiscal year was 462MT, 149MT and 166MT respectively. In order to achieve production targets, breed

improvement program for all species of livestock has been enhanced, livestock support services has been able to reduce the economically important disease outbreaks from 24 to 18 outbreaks, fodder availability and utilisation increased to 81%. Besides, semi-commercial and commercial farms were promoted to supplement livestock production to achieve greater self sufficiency. Concerted focus has been given to diversify livestock products through the establishment of processing plants and value addition.

The production and supply of vital inputs like day-old-chicks, piglets, heifers/cows, fingerlings, seeds and seedlings including animal feeds has been accelerated. The establishment of cold storage facilities and outlet chains serves as a driver for effective marketing network across Dzongkhags. Appropriate policy support and implementation guidelines to the extension were provided. Technical support and expertise to aspiring farmers with entrepreneurs towards livestock enterprise development and facilitate in availing soft loans (4% per annum) from the Rural Enterprise Development Corporation Ltd. was given. To promote green livestock farming practices and to adopt and mitigate climate change, over 7000 households (hh) have adopted stall feeding practices and 2726 hh have adopted and applied biogas technology for generation of alternate energy source thereby ensuring safe and sustainable use of dung/manure. Further, several mega farm projects such as fishery, poultry (chicken and turkey), piggery, dairy and livestock product value addition facilities have been initiated. Some of these projected are completed and other's projects are progressing very well. It is indeed working actively contribute to fulfill RGoB's aspiration to achieve greater food self-sufficiency in the country in the near future.

With this issue, we have successfully reached our 7th Annual Publication of the Ministry of Agriculture and Forests' very own magazine- *Sanam Drupdrey*.

Last but not the least, allow me to mention the launching events, we held on 5th February 2017- commemorating the auspicious occasion of the First Birth Anniversary of The Gyalsey: The Integrated Yak Conservation and Breeding Centre in Haa, Park Office for Jomotsangkha Wildlife Sanctuary in Samdrupjongkhar, Regional Centre of Tiger and Cats Research in Zhemgang,

Wildlife Rescue and Rehabilitation Centre in Sarpang, Centre for Conservation and Breeding of Bhutanese Mastiff (Bjop-khyi), National Mastiff Breeding Centre in Gasa; Salang Tendrel Ceremony for the National Native Poultry (Yubja) Conservation Centre in Lhuentse, National Forest Inventory Report, A Century of Orchid Records in Bhutan in Serbithang, 100th Farm Shop in Sakteng and Naming of the newly discovered Dragonfly species as Gyalsey Emerald Spreadwing in honour of HRH The Gyalsey

Remember, my friends, we are a country who is not just carbon neutral but also a carbon sink. This basically means that we are one of the few countries in the world that has negative carbon emissions. Which in turn means thanks mainly due to our country's emphasis on forest conservation. We have also been recognised as one of the top ten biodiversity hotspots in the world. This is mainly due to the wise foresight of our Monarchs to lead us to recognise the importance we should lay on the preservation of the rich flora and fauna of our tiny Kingdom.

With that, I would like to commend ICTD for coming out with another great issue yet again and ask you continue on and enjoy the magazine.

Trashi Delek !



Yeshey Dorji
MINISTER

Editorial

Singye Wangmo
Program Director
ICS

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Dear readers,

Another year gone by and we hope you have been looking forward to another captivating issue of *Sanam Drupdrey*. Our annual Magazine is unique from other publications in that it contains the best stories of the Bhutanese RNR Sector from throughout the year and across the country, some of the stories which you may have not read or heard about even a little.

Here you can read the success stories of our ingenious farmers of whom we are proud of. After all we are an agriculture based economy thus our Ministry of Agriculture and Forests with the main mandate of looking after the agriculture, livestock and forests' issues of our country may have the most crucial role to play.

Remember those Giant African Land Snails in Mongar? See how they were contained helping the agriculture sectors these parts. Read tips on cardamom which is now emerging as a big business in the warmer south of our country. Take a look at articles on maize, lichen, mustard, cordyceps, lentil and banana. You can also find tips on how to make your own home coffee from Chuzagang coffee beans and even how it made its way into a well-known Thimphu cafe.

The very successful project MAGIP completes while a new project CARLEP has been in place a little more than a year. Other forestry related articles include conservation of the rare Chemshing, a surveillance study of Schochum, rehabilitation of degraded community forestry land, potential of the sea buckthorn that grows in some areas of Bhutan such as Bumthang, Haa, Thimphu and Paro.

There are various Livestock articles such as on Mithuns, Piggery, Poultry, Yaks, Goats, Dairy and even Fishes. I do not wish to delve too much into all the articles in this magazine and will let you, dear reader, get on with finding out for yourself.

We hope that *Sanam Drupdrey* continues to help one appreciate what has been happening around our Kingdom in the fields of agriculture, livestock and forestry.

All I can now say is, "HAPPY READING!!"

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Zhemgang farmers adopt improvised traditional drying system for **CARDAMOM**

*Phuntsbo, Dzongkhag Agriculture Sector
Zhemgang*

The cardamom industry in the mid 1990's saw a total decline due to epidemic disease outbreak affecting the rural households' economy and their livelihoods at large. Its revival after a decade due to the sheer effort of farmers and Government interventions has aroused the growing interest for cardamom once again, nationwide.

The Zhemgang Dzongkhag Agriculture Sector as a part of its promotional activities provided the planting materials to farmers with supports from the Government and projects for the last three years.

In Trong geog alone, farmers were supported with 1,30,000 seedlings and its production started from 2015. During the first year of production, farmers lacked the technical know-how on harvesting and proper drying. To enhance their skills and knowledge on this, trainings were conducted in Bjoka and Ngangla geogs by cardamom growers from Surey in September

2015. It was funded by the Rural Livestock Project. Similar trainings were also held in Trong, Phangkhar and Nangkhor geogs using the local expertise. The local resource persons were sought to make the training effective and facilitate the farmer to farmer interaction and knowledge sharing.

The training demonstrated farmers on the *Bhati* system, an improved method of traditional dryer which is widely practiced by farmers of Sarpang, Samtse and Tsirang.

Prior to the training, the Zhemgang farmers used to follow the local method of an open air drying system. This used to take more than a week which dries less quantity and consumes huge amount of firewood. On the contrary, *Bhati* takes less time to dry huge quantity with less firewood. Due to this, this method is considered as cost effective and beneficial to poor rural farmers.

Field visits to demonstrate the harvesting method were also organised. Harvesting cardamom at the correct stage of maturity is essential to produce high quality capsules. The fruits should only be harvested once they are fully ripe and mature. A ripe capsule has black seeds inside while an immature capsule has white seeds. When a cardamom capsule is ripe, it can be easily removed from the plant without too much force.

Farmers earlier used to harvest cardamom using a knife with high risk of damaging and injuring the young emerging shoots and mother plants. So, the experienced farmers from Surey demonstrated the special harvesting tools using so called *Churi* which is safe and effective. Farmers learnt to harvest spikes from the elite clumps, separate the capsules from spikes and thinning out the

clustered shoots without damaging the emerging shoots and mother plants. For better production, farmers were advised to remove all old shoots without a tip and let appear new shoot.

The Dzongkhag Agriculture Officer acknowledged the local experts and participants for their effort in making the training productive. The training has come a long way in improving the farmers' knowledge and skills. Farmers now successfully utilise these practices during cardamom production and ensures proper post harvest management for better income.

In 2015-2016, farmers from Phangkhar, Nangkhor, Trong, Ngangla, Goshing, Shingkhar, Bardo and Bjoka from 488.65 acres of land produced 6132.4 kgs of cardamom worth Nu.45,64,300/-.





How to set up *Bhati* system and dry cardamom:

Step 1: Site selection and development

A site selection for *Bhati* construction needs to be done near the field sites with less stone, top gentle slope and more steeper below. Dug holes horizontally, little narrower from the bottom and little wider towards the centre in a circular form. Holes below the soil have to be about a man height to ensure the optimum heat. This form of *Bhati* helps to ease setting fire from the bottom and allows all smokes to exit from the centre.

Step 2: Placement of wooden blocks over the base

After the holes are complete, wooden blocks over the base needs to be placed to facilitate the construction of stone walls. Ensure that wooden blocks are strong and rigid or otherwise consider placing iron poles for its durability.

Step 3: Stone wall construction

Stone wall construction of about two feet height needs to be designed into square shape. The wall height also depends upon the quantities that we require to dry. The wall is enough to dry about 400-500kgs of fresh cardamom. To ensure stronger and durable structure, a wall size of about 50 cm wide should be maintained.

Step 4: Floor base preparation

At about one foot height, wooden poles should be placed as the base for placing bamboo slits. Further, bamboo mat that is designed to fit the drying chamber has to be placed over it.

Step 5: Roofing of *Bhati*

It is very crucial to ensure that *Bhati* is protected from rain for which safe roofing is important. In the village, roofing is usually done through



readily available local materials like banana leaves or plastic tarpolin. However, if farmers are resourceful and comfortable, they can go for durable materials like zinc sheets.

Step 6: Drying of cardamom

Drying is the most important part of the process as it affects the quality of the final product. It is important to dry the cardamom capsules

immediately after the harvest to ensure flavour. The process must be of short period to further avoid growing mould on the capsules and retain the bright green colour. The drying temperature should not be above 50°C.

Controlling and maintaining the optimum fire is the principal factor for proper drying and maintaining the quality and colour. Therefore, a person must be there throughout the forty eight hours of drying.

Step 7: Removal or reduction of fire

The sparkling sounds indicate the completion of drying time which means it is now time to remove the fire and avoid over drying. After fire removal, gently splash the water towards the centre to avoid fire accidents.

Step 8: Removal of head and tails

The dried cardamom should be rubbed thoroughly to remove all its heads and tails. Before rubbing it off, green banana leaves should be placed over the fire place underneath the drying chamber to collect those shattered seeds that had dropped down through the mat holes. According to local experts, those seeds are locally known as *Beeje* and can be sold sometime even at higher rates.

Step 9: Colour improvement

After removal of heads and tails, it should be moisturised with splashes of few water drops uniformly. After which, it is mounted up to cover with jute sacks and leave for half an hour. This will enhance its colour and quality and help to fetch better price. Finally, cardamoms are packed in the jute sacks and stored in a safe and ventilated room.

LAND TERRACING

-A way forward for Sustainable Agriculture

*Tshering Dorji, Kuenzang Nima,
Haka Drukpa, Chenga Tshering
and Karma Dema Dorji*

*National Soil Services Centre
Semtokha*

Land degradation is a global issue and poses a huge challenge in increasing sustainable agriculture, enhancing climate resilience and ensuring continuous ecosystem services. Land degradation is the reduction in the capacity of land to provide ecosystem goods and services. It is caused by multiple forces including extreme weather conditions and human activities that affect the soil quality and land utility negatively, thus, affecting food production, livelihoods and the ecosystem services.

Bhutan being a mountainous country with very fragile landscapes, it is bound to have land degradation problems. Unless appropriate measures are taken up, its limited land resources would continue to degrade and have a very adverse effect on the livelihoods of the people. This is largely because more than 65% of the country's population depend on agriculture as their main source of livelihoods and are vulnerable to land degradation and climate change impacts.

In order to combat the land issues, sustainable land management (SLM) is the way forward. SLM has multiple benefits as it not only mitigates land degradation and climate change impacts but also enhances the rural livelihoods through increased food security and good ecosystems.

Although there are many SLM technologies, physical land terracing (up to 30° slope) is found to be very effective in bringing vulnerable land with steep slopes under sustainable agriculture production. This can be done by reducing surface erosion and other forms of land degradations, retaining soil moisture and nutrients, easing workability, enabling farm mechanisation and providing more crops growing options to the farmers.

The Ministry of Agriculture and Forests is spearheading in bringing as many vulnerable agricultural land as possible under SLM practices to reduce land degradation and increase crop production in the country. Towards this, the Ministry instructed the National Soil Services



Centre to carry out land terracing at Samarzingkha and Dechenphu in Thimphu. It was aimed at bringing the fallow land under cultivation, compensate the paddy land lost to urbanisation, improve the aesthetic value of the proposed sites and serve as a demonstration site of land terracing.

Samarzingkha site was located at an altitude between 2500 to 2540masl with an estimated annual precipitation of less than 700mm. It was a government land with very scanty tree cover due to low precipitation and frequent forest fires causing acute moisture stress. Likewise, Dechenphu site which was left fallow for many years was located between 2630 to 2700masl.

Prior to land terracing, the Centre carried out a detailed feasibility study to assess its suitability. Based on the soil properties and other landscape attributes, both sites were found to be suitable for land terracing. Due to the past land degradation scars, the land terraces at Samarzingkha were not found to be suitable for irrigated paddy cultivation as the irrigation water could reactivate the past land degradation processes causing severe land degradation and affect the settlement below.

After the study, landform mapping was done at both sites with different slope gradients. Based on that, A peg was used to demarcate the terrace interval along the middle of the field. On either side of the peg, an 'A' frame was used to layout the contour lines across the field.

Terrace design

After laying out the contour lines, the fertile topsoil (top 20 cm depth) between the two contour lines, was removed and kept aside. Then bench terraces were constructed by small excavator or Spider machine following the layout. After this, the topsoil was put back on the terraces to retain its previous soil fertility status.

According to the technical specification, a newly terraced land should be left fallow for at least two to three years to enable the terrace risers to stabilise. However, this is usually not possible because farmers have limited land holding and wish to cultivate immediately. In such cases, farmers are advised to go for cereals and vegetables that do not require extensive irrigation.

A total of 3.11 acres of land was terraced at Samarzingkha in two



months and are planted with mustard, buckwheat and Adzuki beans. Similarly, about 12.7 acres of fallow dry land at Dechenphu was terraced in less than 4 months. An access road of about 1.5km was also constructed at the Dechenphu site to ensure proper access and input supply. About 2 acres of terraced land at Dechenphu was immediately brought under paddy cultivation given its very stable landscape. However, due to lack of proper plough plan and disturbed soils, the irrigation water readily infiltrated into the subsoil resulting in piping erosion. In few places, the unsettled terrace risers have collapsed forming small gullies. The remaining 10.7 acres of terraced land at Dechenphu is under wheat and vegetable cultivation.

Based on experience from both sites, some points should be considered while terracing such as for optimal terrace, a proper terrace layout design is necessary and fertile topsoil should be saved and put it back after terracing to maintain its former soil fertility status. After terracing, immediate cultivation is not recommended, it should be left fallow for at least 2 to 3 years. The upper threshold of 20 degree slope gradient is recommended for terracing using a machine and a proper drainage system should be in place to better manage the overland flow as well as the irrigation water.

Within a period of four months or so, a total of 15.8 acres of land, including both at Samarzingkha and Dechenphu was terraced. Since they were constructed following the

contour lines, they blended very well with the surrounding landscapes and greatly helped to improve their aesthetic values. Land terraces at both sites were found to be effective in reducing surface erosion, retaining soil moisture and nutrients increasing the working condition.

Thus, land terracing is very feasible in Bhutan given our limited arable land with steep slopes. Although the initial cost of land terracing might be little high, its benefits in bringing vulnerable agriculture land under sustainable agriculture production would be immense. Fortunately, the Ministry accords due importance to land development and for the 12th FYP, it is going to be one of the Ministry's main priorities.

The vision of the Ministry to increase national food security, alleviate poverty and achieve self-reliance may not be unachievable, if invested little more in developing the fragile agriculture land to enhance its productivity and resilience against climate change. The Ministry's noble initiative to offset the loss of paddy fields to urbanisation can also be achieved through terracing of agriculture land that are suitable for paddy. Although the Ministry has the required expertise to take up the land development activities, lack of sufficient budget undermines its implementation in a more effective manner. Therefore, an adequate budgetary support from the Government to scale-up the activities to combat land degradation, ensure sustainable agriculture and enhance rural livelihoods is crucial.





Bumthang farmers report SHOCHUM -A rice weed

Saha Bir Rai and Nidup Dorji
National Plant Protection Centre
Semtokha



One of the main challenges for rice growers in mid-altitude areas (1200-2500 masl) of Bhutan is the threat of an invasive weed called Shochum (*Potamogeton distinctus* A. Bennet). The weed, one of the severe types competes for nutrients with paddy plants and spreads rapidly from field to field if the containment measures are not put in place. This aquatic weed grows in winter through rhizomes buried in the soil and sprouts during the paddy season.

The shochum case was suspected in Bumthang where the paddy fields are very young as it had started the paddy cultivation only after 2004. To detect and delimit the Shochum spread and provide quarantine measures and advices to the affected farmers, a team from National Plant Protection Centre (NPPC) carried out a survey including the farmers' interview.

The survey was done in Choekor geog mainly in Jalikhar (south), Chamkhar and Wangduechhoeling (central) and Jambay Lhakhang (north) of the main Chamkhar valley following the standard detection and delimiting survey protocols of NPPC. For the farmers' survey, 10 representative farmers were selected using the purposive random sampling approach. With the help of the Dzongkhag Agriculture

Sector, four suspected sites were selected. The study was supported by the tools like Google Earth and ArcGIS and the data collected from the interviews were analysed using the MS Excel.

After the shochum was detected and delimited, the team interviewed farmers to get the more detailed information especially on their experiences about the weed. Later, farmers were individually made aware on various measures to prevent further spread of Shochum.

The team also identified the surveillance plots in Jalikhar, Chamkhar and Jambay Lhakhang.

The fields at Chamkhar and Jalikhar were provided with primary control measures with weedicide (Sunrice) @40-50 g/acre along with training for the conduct of a primary control. The team drew samples from Jalikhar to see the effectiveness of the management strategy undertaken (the primary weedicide control) over the years. They further had discussions with the Sector to develop a suitable Shochum management strategy for Bumthang.

The survey covered an area of more than 600 hectares including the non-paddy areas in the lower elevation of Choekor. Shochum was detected only in three locations/farms and

accordingly the weed was delimited. Other pests such as sheath blight, rice blast and weeds were also observed in the farmers' field. Out of the 4 suspected sites covering a stretch of more than 19 km, only the three sites, Jalikhar, Chamkhar and Jambay Lhakhang was found to be infested by Shochum. The weed rhizomes was seen to be still active underground even after abandoning the paddy cultivation for one year, suggesting that altering the cultivation practice do not necessarily eradicate the rhizomes immediately and effectively. The infestation by the weed was more or less localised in few pockets but stretched in the whole valley.

Nine out of 10 affected farmers interviewed have revealed that they share the machineries such as tractor and power tillers among each others. The data also stated that more than 60% of the farmers interviewed do not practice basic precautionary measures such as washing the machines and field equipment while taking from one farm to another.

Further, all the respondents shared that they either get the seeds from the Government or raise on their own. Some farmers conceded that the Shochum problem started after they imported the seedlings from Punakha, Wangdue and Trongsa due to difficulties in growing it locally. The Dzongkhag have now distributed green houses to farmers to help them grow paddy seedlings.

Since the practice of sharing the farm equipment seemed to be aiding the spread of Shochum in fields, it was recommended that farmers and the extension officers conduct the regular surveillance and monitoring of the weed spread. Farmers were also advised to completely uproot the plant and destroy. Throwing into the river was not advised for it may aid in its further spread from irrigation canals. It was also noticed that with the current unregulated movement of paddy seedlings from infested area, the risk of spreading weed to nearby paddy growing geog like Tang remains high. Therefore, an advocacy program to regulate the seedlings transport from Shochum infested areas needs to be conducted for farmers.

Further, the delimited areas including the surveillance plots must be monitored regularly. Both the chemical and non-chemical management approaches shall be applied to contain the weed in the delimited areas. An exposure visit for farmers in areas where shochum is being managed satisfactorily such as Paro may be worth organising. Also a research study is recommended to determine the actual survival capability of rhizomes in absence of flooded field condition.



Realigning Orchard development programs targeting 50 acres/Dzongkhag/year

*Lhap Dorji and Kinlay Tshering
ARDC Wengkhar*

In order to focus cash crop development in the regions, the Ministry of Agriculture and Forests sometime in 2014 decided to realign the ongoing orchard development in the Agriculture Research and Development Centres (ARDC) and Dzongkhags to target coverage of at least 50 acres/Dzongkhag/year. Accordingly, ARDC Wengkhar facilitated the same in the six Dzongkhags so that the development support programs of fruit crop in the region are realigned.

In order to achieve the new target, the available resources for fruit crop development in the Dzongkhags and the ARDCs were reviewed at the regional consultation meeting. Orchard development programs in the Dzongkhags and regions were reviewed to ensure that there is no duplication of efforts thereby equitably distributing the available resources to reach wider beneficiaries. The meeting found that there were several programs and sources of fund towards the fruit crop development.

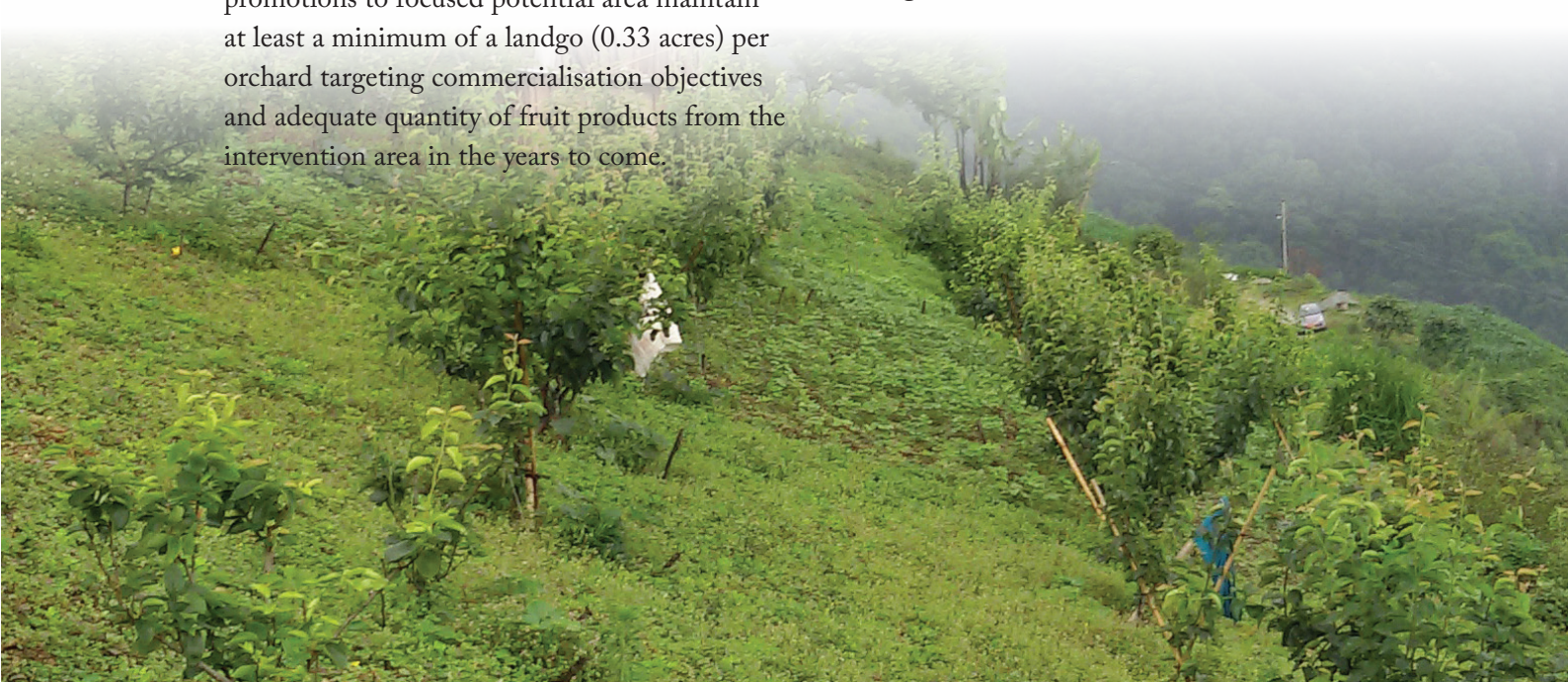
With the resources and plans in the region harmonised, the implementation of fruit crop development program follow a focused implementation approach. The conventional practice of distributing planting materials scattered across the geogs was replaced by promotions to focused potential area maintain at least a minimum of a landgo (0.33 acres) per orchard targeting commercialisation objectives and adequate quantity of fruit products from the intervention area in the years to come.

Coverage in the last two years (2014-15 and 2015-16)

Since the directives between 2014-2016, about 1,161 acres of land has been put under orchard development through the establishment of 6,422 orchards in the region using about 182,000 seedlings mainly sourced from the National Seed Centre, private nurseries and the outreach nursery of ARDC Wengkhar and sub-centres.

The implementation of the orchard development program with revised targets and approaches in the region not only enabled Dzongkhags and ARDC to achieve the targets but it has also been useful in convergence of programs and initiate complimentary effect on each other resulting on wider coverage in the region for fruit crop development. The process of harmonising the resources is now a regular feature in the annual regional meeting in the eastern region. The same approach can also be useful to streamline coordination of the overall development programs.

The expansion of fruit crop promotion in the region can be limited by land availability for orchard development. However, there are also instances of land remaining fallow which needs to be targeted in future interventions.





Up scaling Lime Solution to control Lichens in Apple orchard

.....
Tshelthrim Zangpo and Phuntso Loday
National Plant Protection Centre
Semtokha

Lichens are considered as a unique organism because they are a symbiotic relationship between two organisms, fungus and algae. In Bhutan, it usually appears in apple orchards surrounded by pine forests and it tends to grow more in poorly managed and declining orchards.

Foliose (leafy) and fruticose (shrubby) are common types of lichen found. They are considered a frustrating pests as vigorously growing lichens may cover up the branches and young shoots which may cause drying and reduce photosynthesis and fruiting.

A thick covering of lichens on a twig or branch may interfere with gas exchange of host tissues, causing decline or death of a tree. Lichen hyphae can penetrate bark causing extensive penetration of the rhizomes through the cork, cortex and cambium, as far as the living wood. Abundance of lichen can result in poor growing conditions for the fruit tree.



Although, no severe lichen cases have been reported in Bhutan, most of the apple orchard owners have this problem. They usually scrape off the lichen by using gunny sack after rainfall which is time consuming. Scraping sometimes damages the bark of the trees and dispose the surface to infestation by pest and diseases. However, this method provides no control of lichens as it regenerates. There have been complaints of lichen from Thimphu and Paro.

Therefore, as a lichen control remedy, the National Plant Protection Centre carried out a trial in December 2015 to evaluate the efficacy of lime and water solutions with different ratios. Fine commercial lime powder was used and mixed with different ratios of water such as 1kg lime: 30litre water (strongest), 1kg: 50litre water (medium) and 1kg lime: 70litre water (weakest). The scientific logic behind the trial was that lime solution would kill the lichens because of its burning effect.

Three apple orchards were selected for the trial at Bondey, Paro. Twenty heavily lichen infested trees from each orchard were selected and five trees from each orchard were selected using a 'W' sampling pattern for monitoring. The first orchard was sprayed with strongest, second medium and

third with the weakest solutions. The solution was sprayed with a power spray to ensure full coverage of the trees. Prior to the spraying, the orchards were monitored for lichens and easy removal. The parametres were monitored for consecutive three months.

The trial result showed that the medium solution was highly effective in killing and inhibiting the regeneration of lichens. It was apparent from the colour change of lichens from green to brown in compared to other two solutions. The strongest solution killed the lichens in the first month but they regenerated in the second month. The weakest one proved to have very limited control over lichens. Lichens were easy to remove after one month from the trees sprayed with medium and strong lime solutions, but remained hard to remove with the weakest solution.

For better results, the solution should be sprayed from December to February when the trees are dormant. Other management practices like timely pruning and application of tree spray oil should also be practiced to manage the lichen growth and prevent the infestation in the orchards. Considering the trial success, the Centre is now promoting this technology through farmers and extension training.

Maize Stover Silage

- An effective winter feed for cattle

*Thinley Rabten
Dzongkhag Livestock Sector
Samdrupjongkhar*

Dairy is one of the most preferred farming systems which play an important role in the rural livelihoods of Samdrupjongkhar.

The most challenging part in dairying is to meet enough roughage during the lean season that falls from December till March. During this time, farmers suffer and take lots of effort to overcome the feed shortages. Underfeeding the dairy cattle for longer duration will not only have adverse effect on animal health but will also have an implication in the next lactation and parturition process.



In order to overcome such problem, the conservation pasture remedies such as hay and silage are the most preferred methods till date. During the peak season, when the green pastures and fodders are in abundance, farmers' never conserve or bother to feed the cattle enough. Considering this trend, the Dzongkhag Livestock Sector introduced the plastic bag silage for dairy groups at Orong, Jangchuling and Wooling.

The objective was to achieve a desirable fermentation and maintain the high silage quality to store it for a longer period. Owing to subsistence integrated land use with limited land holding per household, the fodder cultivation separately is a huge burden and remains impossible for rural people. The scope was also to manage the crops integration with livestock rearing. Therefore, crop residue becomes the foremost important component for livestock sector.

Silage making is simple. Once the corn is harvested, the maize stover is immediately conserved to make silage. With the help of chuff cutters, the stover is cut into pieces and fills into the plastic bags. After this, a thorough



compacting is done either manually or with the help of vacuum cleaner. The compacted bag is ensiled tightly to avoid air to get inside. The silage bag weighs approximately 50-60kgs. They are stored at the shed either inside the house or in areas without the direct sunlight. After storing it for 2-3 weeks, it is ready to feed based as required; otherwise it can be stored for more than four months.

The plastic bag silage is a cost effective method which does not require specialised equipment. It can be done manually or with simple chuff cutters and need less labour. It can be easily stored in the good quality plastic bags and reused where spoilage is also rare. It occupies no space and loss of dry matter is negligible during its packaging.

It was found one of the most effective tools to boost milk for small scale dairy farmers with 3-6 milch cows. Making trench or silo pits at the rural households level was found ineffective and expensive.

In 2016, the Orong dairy group ensiled more than 20 MTs of maize stover. During the lean season, it was noticed that feeding maize stover silage significantly increases the milk production. Considering the several benefits, the Dzongkhag Livestock Sector is promoting this technology in other geogs as well. Farmers have also shown keen interest in the learning as they found it affordable and easy to process.



UNIVERSITY GRADUATE OPTS FOR DAIRY FARMING

*Chandra Ghalley
Dzongkhag Livestock Sector
Samtse*

Twenty five years old Surjei Dhungyel, a graduate who completed Bachelor of Life Science from Sherubtse College is a proud owner of a semi-commercial dairy farm in Penjorling village, Samtse.

Surjei had nurtured his keen interest on dairy farming since his childhood days. He was born and brought up in the farming family which falls under Tashicholing Dungkhag. As a fresh graduate, he did not hunt for other platforms after realising the stiff competition in the job market. His strong determination and passion for dairy enterprise dragged him back to his village where he has privilege to work independently for living and serve his aging parents.

To kick off his dream activities, Surjei availed Nu. 1.5 Million loan from the Bhutan Development Bank Limited and Nu. 0.3 Million from close friends and relatives. With a total budget of Nu. 1.8 Million, he developed farm structure, improved pasture, purchased eleven dairy cows and other equipment. He now has a shed to accommodate thirty cattle which is based on head to head housing design.

With sub-tropical pasture seeds and fencing materials support from the Dzongkhag Livestock Sector, Surjei converted about 20 acres of fallow lands into improved pasture and about 80% of the pasture land on lease from private individuals.

The pasture is now well established with adequate forage for his cattle. This was one of the activities, he has considered important.

At times, he have to tussle with elephants encroaching his well nurtured pasture as the giants not only harvested the pasture but also stamped on the standing fodder making it unpalatable for cows, yet he managed to harvest his share. According to him, without farm mechanisation facilities, manual cut and carry system is a daunting task in dairy farming especially when the herd size is big and has to race against time to meet their daily fodder requirement.

His cows are well managed and fed with enough forage from the pasture and Karma Feeds which he buys from Tashicholing. He also uses spent grain purchased from brewage factory in Pasakha to minimise his expenditure. He reserves them in an airtight polythene barrels to avoid spoilage and feeds his cattle as and when required. On an average, he spends about Nu. 60000/- for feeds.

Initial milk production started in June 2016 with five jersey cows producing about 30 litres of milk which was processed into butter and cheese and sold within the community. With another batch of locally purchased cows, his herd now produces about 105 litres on a daily basis. The highest producing cow provides 14 litres and least with 8



litres. The morning milk is sold as fresh milk and evening milk is churned into dairy products. He produces two kilograms of butter and thirty balls of cheese weighing approximately 150 grams



Surjei Dhungyel

each. He uses his van to cater milk to the residents along Belbotay-Sipsu Highway, Gola town and army and police colonies at Nu. 40/litre.

Surjei have no shortage of customers for his products because of its reasonable price, quality assurance and hygiene. His cottage cheese ball sells like hotcakes at Nu. 20/ball and butter at Nu 350/kg. His cheese is in high demand because of which advance bookings are also made. Since there is an ample demand for his dairy products, he feels sad that he is not able to meet them.

His farm is managed by his parents and four labours while he looks after the marketing and input arrangements. He spends Nu. 24000 /-on labour charges. According to him, it is difficult to find labours and school dropouts do not easily take up the manual work.

Surjei proudly shared that he makes a monthly profit of Nu. 42000/-, excluding the loan repayment amount which is a good income to run his family of five members. He has a plan to enhance his dairy production with better management plan and technical guidance from the Livestock Extension Office. He wants to work hard and prove that a graduate coming back home can make a big difference in the community. He is keen on showcasing his improved dairy husbandry as a model. He has ambitious plan to increase his farm size housing forty milch cows and diversify his dairy products in the future.

He is planning to avail government land on lease as private land have short lease period and with the increasing economic value of land, their renewal would be difficult. His other future plans include the construction of silo to overcome lean season fodder shortage and install biogas plant to replace use of LPG and produce organic fertiliser for sale. He also plans to mechanise his farm with simple time and labour effective device to curb the expenditure.

The technical staffs of RNR Tashicholing provide all the required backstopping on farm management including artificial insemination service and health care. Surjei hopes for continuous support to make his farm a model dairy farm in the Dungkhag.

In these contemporary planet, where every educated people are looking for better opportunities, youth like Surjei still believe that village is one place where we can live up to our dream. Surjei rightly believed that 'Nothing is impossible, if you believe in yourself'. Today, he has achieved his childhood dream of becoming a dairy farmer, all credit goes to his hard work and commitment. With such positivity, he can be a role model for many of our youths who considers farming as not so attractive opportunity.



Sea Buckthorn: A Potential Natural Resource

*Sonam Tashi and Lhab Tshering
Bumthang Forest Division*



Bhutan is rich in diverse natural resources with potential to contribute in achieving the sustainable socio-economic development and biodiversity conservation. One such resource is a tree named Sea Buckthorn, a thorny willow-like plant species native to Europe and Asia.

In Bhutan, three species of Sea Buckthorn such as *Hippophaesalicifolia*, *H. rhamnoides* and *H. tibetana* is found in the valleys of Bumthang, Paro, Haa, upper Punakha and Thimphu, mostly along the river and in the riparian vegetation.

The berry is a very rich source of vitamins and is called treasure of bio-activity substance for covering 190 bio-activity substances with unique medicinal properties. Some of the important functions of this berry oil includes treating inflammation, disinfecting bacteria, relieving pain and promoting tissue regeneration. It is also believed to have preventive affects against cardiovascular diseases, mucosa injuries, skin problems, cancer and immune support system.

Realising such benefits, in 2015, a company called the Bhutan Organic with fund from the Business

Opportunity and Information Centre, piloted a project in Bumthang to harvest buckthorn berry and process it into syrup. The project has six staff.

In Bumthang, people call it Tae and they traditionally used the squeezed berry juice as conditioner for dried turnip leaves. Apart from this, very little is known about its usage in Bumthang and in other parts of Bhutan. It is known in Dzongkha as Tare and in traditional medicine as Tarbu.

The project permitted the berry collection to local villagers who followed the conventional method of beating the branches gently till the berries fall down. They bought berries from villagers at Nu.60/kg. The berries was washed and processed in apple juice factory in Bumthang and Menjong Sorig Pharmaceutical as the company did not have their own processing plant.

The company produced 4000 litres of syrup and packaged in different quantities of bottle with a label, Sea Buckthorn: Tarbu Duetse Syrup. The syrup is expected to be beneficial for hair, skin, nails, general immunity and weight management

among others. At present, the company is able to market it only in local shops of Thimphu and Paro. They are exploring to market it in other areas as well.

Bhutan Organic has bravely ventured the economic aspects of Sea Buckthorn, despite it being very unpopular in Bhutanese market. In spite of numerous difficulties, the project partner shares their enjoyable success stories and feels motivated to give a taste of happiness.

According to records, in countries like Russia, Sweden, Finland, Hungary, Germany, Mongolia, and China, the berry is known as multipurpose fast growing species and a measure of biodiversity conservation. It is frequently used as medicines, food, fodder, fuel wood and soil conservation measure. Likewise, even Bhutan can use it for multiple purposes.

It has an extraordinary capacity to grow and survive under adverse conditions (-40 to 40°C) and has extensive subterranean rooting system with strong soil binding ability useful for soil stabilisation, river bank protection and water retention, which is aptly feasible for propagation in mountainous, landslide and flood prone country like Bhutan.

Similarly, using the plant for soil and biodiversity conservation will be of great avenues for forestry sector as not much is explored about the tree

other than the berry. For the pine encroached forests like Bumthang, growing Sea Buckthorn is a potential plant for ecological diversity.

The wonderful plant has high potential to be tapped with careful planning by integrating technologies and expertise in growing and collection of berries for sustainable production serving a good example of mountain perspective-oriented sustainable development. It thus qualifies as a unique option for the simultaneous management of several problems emanating from the fragility, marginality, inaccessibility and diversity characterising the mountainous country of ours.



SMOKED FISH

business comes to rescue Berty farmer

Arjun Gurung, RLDC-Zhemgang



Fish farming is gradually picking up in Berty, a locality in Zhemgang which falls under Mangdechu catchment basin. Fish farming was introduced in Berty to liberalise the fishing right, improve people's livelihood and encourage its sustainable farming.

In Berty, Pema Choden is one of the farmers seriously taking up the business. She owns two huge fish ponds and is planning to add one more. Fish farming is the main source of income for Pema and her family of two members. Besides her, there are four other households taking up fisheries.

Although, production is good enough, Zhemgang still being one of the remotest areas, market opportunity is very limited. A farmer like Pema was facing difficulty in selling her products due to less demand. Her problem got serious in July 2016 due to hot and humid weather, lack of readymade market and highly perishable nature of the fresh fish. Fish is considered to be one of

the most perishable foodstuffs that gets spoiled or become unsafe to consume after certain time period.

To help out Pema, a team from the Regional Livestock Development Centre, Zhemgang and Dzongkhag Livestock Sector come up with a solution to process and market the smoked fish as an alternative option.

The expertise from Birkha Bdr. Monger from Sisty village in Sarpang was sought. He was already in the smoked fish business which he started on his own effort, a year ago after realising the limited market for fresh fish and spoilage. Apart from nearby areas and other Dzongkhags, Thimphu is the main market for his smoked fish. He has already earned Nu. 90,000/- this season.

Pema, being the most affected one, was trained on processing the smoked dry fish for two days in July 2016. Smoking is one of the oldest preservation methods that combine the effects



of salting, drying and heating. It ensures unique taste and aromatic flavour during process because of which it is considered a delicacy. The Dzongkhag technical team arranged a drag net, constructed smoking chamber, smoked fresh fish and demonstrated it to other farmers. The packaged smoked fish was marketed in Tintibi and Zhemgang town, weighing 250 gms at Nu. 150/- initially and later it was increased to Nu. 200/-.



Following this, farmers tried the technology on their own, but failed to bring out the right colour and aroma. The third try done by farmers was a huge success in terms of quality, colour and taste. Ever since, both local and regional demand for the smoked fish has been on the rise. Public acceptance of smoked fish was excellent despite the lack of traditions and habits.

The training proved to be helpful for Pema. She shared that the profit margin is better and with such technology in place, she now need not worry about fish spoilage and market issues. She has been able to earn approximately Nu. 40,000/- from her new business and is now wish to sell smoked fish rather than fresh ones.

During surplus production, particularly in hot and humid areas, smoking is an effective alternative for fisheries. They are cost effective, have a longer shelf-life and easy to prepare, if the basic procedures are followed properly. Other highlights of smoked fish are that it kills and slows down the growth of bacteria, add flavour to

foods and prevents fats from developing a terrible taste.

Considering such benefits, it is high time that our fish farmers explore this smoked fish technology for marketing. Meanwhile, Sarpang is already planning to replicate this successful idea in the Dzongkhag to address their surplus production and market issues.

Ever wonder about preparing the smoked fish. Here are the tips:

Pre-processing steps

1. Harvest fish with drag nets
2. De-scale or remove the fish scales
3. Split the fish back bone
4. Remove guts, gills, kidney etc. completely because these are the areas where spoilage can take place. Follow gutting and cleaning before salting to reduce spoilage and improve the quality.
5. Salting-Fish to be immersed in strong brine for 15 minutes. The brine concentration is 70%. Ensure that the fish takes up 2-3% salt i.e. the optimum requirement for smoked fish
6. Use vinegar 3% to give a shiny/glossy appearance to the smoked fish skin. Fish to be dipped in the vinegar for 5 minutes before hanging it on to dry
7. Hanging-For efficient smoking, fish must be dry enough with no water on the surface. Split and salted fish is suspended by the tail and needs to be kept in stretched out position for uniform exposure of all parts to smoke

Smoking process

Drying is done directly in the closed smoke chamber by burning woods without producing smoke. Hard wood species in form of chips, shavings or sawdust is preferred for smoking. Smoking is a mild process where temperature is not raised enough to let fish flesh cook properly. During the first stage of smoking, increased loss due to tearing of the fish from the speats/hooks

under their own weight happens. Therefore, extreme care has to be taken not to disturb the chamber when smoking. It can take a whole night to achieve required level of drying, smoke flavour and colour.

Post-Processing steps

The fresh fish loses more than 64% of its weight during drying and another 5% during evaporation. After smoking, the warm fish is left to be cold. If it is packed warm, moisture will condense and get deposit inside the packet creating premature mould growth. Smoked fish can be frozen and stored in a cold place to minimise spoilage.



Tissue Culture of Banana

An efficient technology to make available high quality disease free banana seedlings

Banana (*Musa* spp.) belonging to the family Musaceae is one of the world's most important subsistence crops. It is widely grown in the tropics and sub-tropic regions of the world. In Bhutan, the major production areas are low altitude and mid altitude regions. The demand for the seedlings has been increasing realising the importance of the crop for good source of income year round. In spite of suitable climatic condition and agro-ecological zones in the low and mid altitude belts, the major challenge in its cultivation was the availability of adequate quantity of quality planting material.

Until 2014, only a small proportion, few hundreds of the banana seedling demand was being met through normal sucker production from the National Seed Centre (NSC) farm and farmers field. In the absence of a reliable source of good quality seedlings, many growers opt to collect suckers from their own field and multiply. Because of the facts, Bhutan do not have banana cultivation on a commercial scale like in the neighbouring Indian states West Bengal and Assam.

Also, seedlings obtained through normal sucker multiplication yields low mainly due to viral

diseases as well as spread of bacterial and fungal diseases. Hence, the requirement of an efficient technology to make available high quality disease free banana seedlings to the farmers to improve production and income was felt to be of utmost importance.

What is tissue culture?

Plant tissue culture is collection of techniques used to maintain or grow plant cells, tissues or organs under sterile and in-vitro conditions on a nutrient culture medium of known composition to produce many new plants from each clone of original mother plant, over a very short period of time.

Introduction of tissue culture

If the country is to advance in agriculture, it has to adopt technologies that give advantage to farmers in the provision of planting materials that are free of disease, mature fast, have better yield and are safe for human consumption. One of the potential technologies that can be adopted is tissue culture as it is easily adoptive to existing planting materials that are indigenous and abundant. NSC has been supplying few hundreds of banana seedlings through natural sucker regeneration from limited mother block at its regional farm, Bhur.

In an attempt to meet the growing banana seedlings demand and upon the directives from the Ministry, NSC has tissue culturing method to producing quality banana towards the end of 2014. Prior to the program, as the start up, staff from the tissue culture laboratory and NSC farms were imparted hands on training on in-vitro propagation of banana at Bio-technology laboratory, Bangladesh for duration of two weeks to build up their capacity in tissue culture funded by the World Bank.

Advantages of using tissue culture planting material

- True to the type of mother plant under well management
- Pest and disease free seedlings
- Uniform growth, increases yield
- Early maturity of crop-maximum land use is possible in low land holding country like Bhutan
- Round the year planting possible as seedlings are made available throughout the year
- No staggered harvesting
- 95-98% plants bear bunches
- New varieties can be introduced and multiplied in a short duration

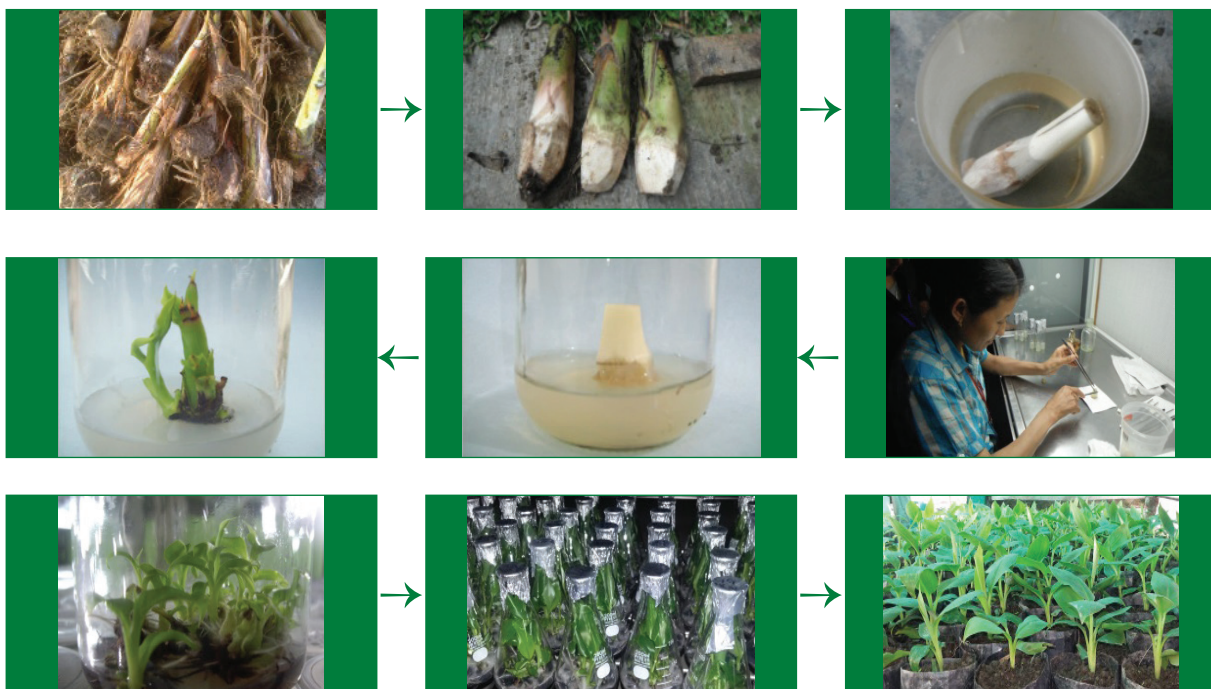
Materials required

Banana suckers, nutrient agar medium, autoclave, conical flask, forceps, dissecting instrument, distilled water, surgical gloves, ethanol, fungicides (mancozeb), detergent (Tween 20), Bleach (sodium hypochlorite-chlorox)

Methodology

To initiate the tissue culture of banana seedlings, following is the procedure:

- Collect healthy disease free 3-4 months old sword suckers for obtaining shoot-tips for inoculation
- Shoot tips obtained are processed and cut into 2-3cm length and disinfected with 60% bleach, detergent, ethanol, distilled water and cultures are prepared under sterile condition in laminar flow chamber
- As per the target of production, shoots are multiplied in conical flask at an average multiplication rate of 1:3 till desired quantities are met
- After adequate numbers of plants are met, they are placed on rooting medium for root initiation for 30-45 days
- Primary hardening is carried out in Bhur farm for about 2-3 weeks in small cups which will be further transferred to poly-tubes for secondary hardening under moist and humid condition for 3-4months and finally supplied for planting in the field after attaining the minimum quality standard



Procedures for tissue culture of Banana

About four weeks old suckers were collected for 3 released varieties from Bhur and Chuzagang, Gelephu. These suckers were transported and excised at Tissue Culture Laboratory, NSC. They were peeled off to the size of 4cm at the base and 5cm long consisting of single shoot tip. These explants were surface sterilised for 15 minutes with 50% commercial bleach (Sodium Hypochlorite) to which few drops of Tween-20 were added.

After complete washing with sterile water, explants were trimmed to final size of 3-5mm in the laminar flow cabinet. These explants were cultured on MS medium containing 5.0mg/l BAP and incubated at $25\pm 2^{\circ}\text{C}$ and 16 hours photo-period. Sub-culturing was done after every four weeks. Number of shoots was counted after every subculture.

The rate of multiplication was calculated as the ratio of shoot number at the end of subculture to the initial number of shoots. After mass sub-culture, the shoots were shifted to rooting medium. Rooting medium was half strength MS containing 1.0 mg/l IBA. Profuse rooting was observed within two weeks. The plants were carefully removed from the conical flask and medium from roots are washed to avoid microbial contamination, plants were transplanted to pots having mixture of top soil, saw dust and FYM in 1:1:1 ratio. These plants were kept under polythene shade house to maintain the humidity for four weeks and then transferred into poly tubes for secondary

hardening in green house. The first batch of 150 suckers comprising of 3 varieties were collected in June 2014 from NSC, Bhur and Chuzagang and were propagated through tissue culture at Paro. The result was not successful due to contamination. As it was the first attempt using the tissue culture technique for banana plant, numerous sources for contamination were suspected for instance methods of sucker collection, prolonged storage of suckers after collection, disinfection procedure followed, preparation of explants and in-vitro propagation initiation procedure.

The second attempt for banana tissue culture was started in January 2015 with two varieties. The result was successful as the necessary precautions were strictly followed to avoid contamination. Following this, micro propagation was also tried for Dhusrey (local variety), Chinichampa (local) and Grand Naine (popular international variety).

From the experiment, NSC has now gained capacity to produce enough banana seedlings through tissue culture. In 2015-2016, more than 9000 seedlings were supplied to the farmers and for 2016-2017, NSC is producing more than 30,000 seedlings as per the demand from farmers and other clients. With the success, NSC is now trying to tissue culture other important high demand fruit plants like avocado, kiwi and cardamom.

Second batch of banana suckers propagated in-vitro

Variety	Total suckers collected (Nos.)	Date of culture initiation	Total explants cultured (Nos.)	Successful plants (Nos.)	Contaminated plants (Nos.)
Ghew Kola	50	30/01/2015	50	41	9
Jagi	50	30/01/2015	50	20	30

TANG GEOG

REVIVES YAK REARING PRACTICE

Pema Wangda, NRCAN, Bumthang

Yak rearing in the past used to be one of the important activities for the Naruth community in Tang, Bumthang for sustaining their livelihood. Due to limited opportunities for age old farming, people gradually found it less attractive and as a result, the yak farming started declining. With the advances in agriculture development and livestock breed improvement program to increase production, yak rearing disappeared completely from Tang geog by 2004. There was a steady shift from yak rearing to dairy farming as it offered more benefits in terms of livestock management and income.

In order to revive the farming tradition, the National Research Centre for Animal Nutrition (NRCAN) initiated a three year project, titled 'Securing Rangeland Soil Carbon through Community Yak Herding' with a budget about Nu.8.20 Million from the Bhutan Trust Fund.

The project based on a community model identified a yak rearing group in Naruth to carry forward the revival of yak farming with eight founding members. To start with, eighty-five yaks were procured from Haa, Wangdue, Bumthang,

Paro and Thimphu at an average cost of Nu. 30,000/-per animal. Good quality breeding bulls and good quality female yaks were procured to ensure the improved breed in the coming years.

Besides, the project restored about 400 acres of rangelands through fencing, development of improved pasture as supplementary fodder resources and slashing of unpalatable shrubs and forbs. The area was left unused and exposed to various land degradation issues such as soil erosion, landslides and encroaching by unpalatable shrubs and forbs, after the yak farming ended in Tang.

To support further, capacity building on sustainable rangeland management practices along with practical sessions on pasture development, removal of bushes and shrubs, formulation of compact feed blocks was held for the community members.

Lack of adequate feed and fodder resources during winter season was the major bottleneck for Tang herders. To address the issue, improved pasture development with 30 acres of Cocksfoot, Italian rye and tall fescue grass species was carried



out. The pasture development will not only restore the degraded rangeland but also enhance the availability of fodder resources for yaks and increase the carbon sequestration capacity of rangelands.

The project further established the nucleus yak herd in Tang and stocked with optimal herd size of 85 yaks sourced from the country's different locations. They produce an average of 700ml of milk per yak per day and have 23 milking calves. The optimal stocking was maintained to ensure less green house gas emissions in environment and reduce the rangeland degradation.

According to reports, yak farming in Bhutan have challenges such as inequitable access to basic social amenities, shrinking grazing grounds, shortage of household labour, low productivity from yaks, unhygienic yak product processing practices, lack of facilities and technical capacity in yak breeding.

The project had few issues during the initial stages of the community yak farm establishment such as yak mortality while transporting from far flung areas, their difficulties in adjusting to the new environment and hiring the experienced herders.

Although, the project has come an end successfully in June 2016, to ensure the yak farming sustainability, the community bye-laws have been endorsed. The plans are underway to sustain the farming through the incorporation of eco-tourism activities such as home stay in the yak herd, production and marketing of niche organic yak products and sale of superior quality breeding bulls to the other yak rearing Dzongkhags. The processing of hygienic yak milk products is being also emphasised for better market opportunities.

Since the community yak farm is the first of its kind in the country, the Department of Livestock will provide the necessary technical assistance. The farm is also expected to receive Government fund for few more years.

Meanwhile, with the revival of yak farming, the semi-nomadic lifestyle in Tang is back on track bringing both economic and environmental benefits to the community. As of December 2016, around 95 yaks were seen wandering the green meadows of Tang. According to the Livestock Statistics 2015, Bumthang has 3621 nos. of yak and a total of 38222 nos. in the country.



Making Technology Transfer work:

Case studies of the Food Processing Sector in Bhutan

Ugyen Phuntscho, National Biodiversity Centre and Dr. Ronnie Vernooy, Bioversity International, Rome

Article 13.2 (b) of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) states that “Contracting Parties undertake to provide and/or facilitate access to technologies for the conservation, characterisation, evaluation and use of plant genetic resources for food and agriculture which are under the Multilateral System”. The ITPGRFA anticipates that transfer of technologies could be carried out through a variety of mechanisms including crop-based thematic groups, research and development partnerships and commercial joint ventures.

In order to deepen the knowledge about actual and potential technology transfer as applied to plant genetic resources for food and agriculture, a series of case studies on food processing technologies used in Bhutan was conducted. Food processing technologies that actually fall within what is described in article 13.2(b) of the ITPGRFA was selected. The vital importance of these technologies for economic development which is highly dependent on agriculture and the options that can be developed to add value to local agricultural products was also considered. The study aimed as well to shed some light on Bhutan’s food processing technology needs and its capacities to transfer such technologies.

Three case studies

Based on the food processing sector in the country, three case studies combining the criteria of type and origin of technology, food processing processes and technology used were selected. The case studies are on Bhutan Agro Industries Limited, a government supported commercial company processing local fruits into multiple products; the Agriculture Research and Development Centre at Wengkhar in terms of maize flakes and the National Post Harvest Centre, one of the country’s technology development centres in terms of potato chips.

Bhutan Agro Industries Limited, Serbithang

Established in 1999, this company was set up by the RGoB to support farmers through the purchase of their high value, surplus horticultural crops. The company has a Board of Governors chaired by the Director of the Department of Agricultural Marketing and Cooperatives. The company purchases fruit through a system of contract farming with Bhutanese farmers. When supply is low due to seasonality, the company seeks other sources in order to maintain its year-round operational company.

The company was also established to provide employment. At the moment of the study, the staff included about 130 people. It aims to develop and spread knowhow about the processing of horticultural crops. It takes care of the distribution of all the products through a nation-wide network of retailers. Having established this network is seen by the company as one of the major factors contributing to its effective operations.

Retailers are close to consumers and constantly informing the company about consumer demands. The company has a number of experiences in product development. It purchases all the technology and related knowhow that is needed



abroad from other countries such as China, India and Italy. Staff regularly attends international events organised by the food processing sector, such as food fairs. In addition, the company sends staff for training to India and Thailand.

Agriculture Research and Development Centre, Wengkhar

The main purpose of the research and development centre in Bhutan is to do research on crop management and improvement. After rice, work on maize was initiated, the country's second most important crop. More recently, research has expanded into a wide variety of crops and trees of importance. According to the key informant, the idea to work on maize and maize flakes was born during the surplus production period at the beginning of the 1990s when many farmer households produced a surplus of 50-100kgs.

Farmers used a traditional practice of frying using a firewood and then pounding of maize kernels to make maize flakes using a wooden pounder and a hollowed stone. To improve the practice, the Agriculture Machinery Centre developed a pounding machine and began to supply it for free, first in Punakha and then elsewhere. Over the years, Bhutanese researchers developed 12 new products from sweet maize flakes to crispy maize flakes to chilli maize flakes. Some technologies are yet to be unraveled.

National Post Harvest Centre, Paro

The National Post Harvest Centre is responsible for all post-production processes related to agricultural crops including handling, value addition and storage. The centre's work on potatoes is in collaboration with the Bhutan Potato Development Program and focuses on the technical side and covers research and extension. The work on the improvement of adding value to potatoes includes the production of better and more diversified potato chips, but also looking into the production of starch and the fermentation of potatoes to produce alcohol. The experience with potato chips serves as an example for other crops and products that the centre is trying to develop, such as dried fruits and vegetables. For example, the centre designed a vegetable dryer that is now being used throughout the country. Many challenges remain, however.

The case studies offer some useful insights about the complexities and challenges of technology transfer and development in the Bhutanese context. All three cases suggest that the food processing sector in the country could greatly benefit from additional international cooperation and support in terms of technical knowhow and skill development, the provision of equipment, methodological guidance and perhaps facilitation in the development of public-private partnerships. ITPGRFA could be a useful platform for Bhutan to enter into contact with countries that have more experience in the food processing field.



Conflict Management in Community Based Natural Resource Management

*Gem Tshering
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Conflict management (CM) is the practice of recognising and dealing with disputes in a rationale, balanced and effective way. CM implemented within a community forest management groups (CFMGs) usually involves effective communication, problem resolving abilities and poor negotiating skills to restore and settle problems at the community level.

While managing the renewable natural resources, conflicts and disputes arise from various factors and are not something that can be avoided as learned from the study. The short-term adverse impact of conflicts can range from a temporary reduction in the efficiency of resource management to the complete collapse of initiatives or abandonment of community forests (CF).

At present, such conflicts are not so common, however, there has been one such extreme case of conflict over natural resource management which had even escalated into physical violence in Gadhen community forests over a dispute of CF boundary and the Chuzagang geog. A study was conducted in 15 CFMGs and four non-wood

forest products (NWFPs) groups representing 52% and 57% respectively. Ninety females and 131 males participated in the group discussion. Focused group discussion was administered to collect primary data.

Some strategies were referred to avoid the conflict as an obstacle to sustainability within community based natural resource projects in the South Pacific. This is to see if it can be adopted to our situation in Bhutan. Some relevant examples of the outputs of the conflict management strategies were also suggested.

The CF boundary disputes will be settled when the boundary pillars will be erected in accordance to the GPS coordinates in Risumgang and Pakheygang CFs. In case of Gadhen CF in Umling, surveyors from the National Land Commission must be deployed to authenticate and fix the actual boundary. The dispute over absence from labour contribution in plantation work was the highest followed by dispute over letting cattle lose in the plantation area and non-payment of annual membership fees.

Strategies for Conflict management

The strategy for CM in the CFMGs centres are the by-laws prepared and is found to be the most practicable for managing a particular conflict. The following strategies were referred to manage conflicts for the natural resource management:

Force: One of the key strategies promoted is force which means law enforcement. The by-laws incorporated in the CF management plans are adopted in the field and executed by CFMG chairman, secretary and executive committee members. Penalties were levied for letting cattle lose in the new plantation and absentee from labour contribution.

In some cases, the annual membership fees were not able to collect due to missing members from village. This created precedence and other members were reluctant to pay the fees as well. In one case, the CFMG chairman himself had let his horse graze in the plantation area. Later, he was fined as per the by-laws. In general, the cases are compounded and settled amongst the CFMG members.

Accommodation: There are occasions when one party in a conflict values a strong and continuing relationship with one or more of the other parties above the attainment of its own specific goals. Some of the CFMG and NWFP groups have accommodated and added the interested members who have not joined in the group initially.

Consensus: Consensus-building explicitly sets out to achieve a win-win outcome. This is administered to settle conflicts arising from CF management. In most of the groups, it seeks to develop dialogues amongst CFMG executive members and GFEOs while allotment of any timber resources from CFs. This is a way forward based on consensus which contributes mutual benefits for all the CFMG members. This strategy is also applied in the field.

Recommendation

1. Timely monitoring and evaluation of CFs
2. Penalise the offenders strictly as per the by-laws
3. Department to review handing over CF marking and passing hammers to respective CFMGs
4. Capacity building for CF accountants on books and record keeping
5. Inclusion of water sources nearby the CF areas as water resource
6. Department to review stone boulder and sand to be included as CFMGs user right resources
7. Requirement of office for CFMGs with construction materials support from Department and labour contribution for construction from community.
8. Revision of bylaws and make it simple and applicable

Analysing the conflicts which occurred within the CFMGs revealed that, the CF executive members collectively get involved in building consensus and finally settle the disputes at the community level. This provides protection and creation of social capital. The consensual approach to conflict management can build social capital and thereby reduce conflicts as obstacles to sustainable resource management and utilisation. For example, the requirement to fill up a form from geog for timber sanction from Gaselo CF led to loss of trust and may create conflict. This needs to be negotiated and remove the form to make the process shorter.

It is felt that, CM training must be conducted for the foresters and CFMG chairmen to build co-operation in relation to effective conflicts resolution. The model for dispute resolution needs to be initiated on consensus-building. Unfortunately, different cultural values instigate disputes within communities as witnessed in some CFs. An acceptable process of dialogue for dispute settlement is required. Recent experiences in some groups revealed difficulty in settlement of conflicts by the chairman and executive members. However, in general the conflicts were settled successfully within the group members.



BACKYARD DAIRY

A Boon for Rural Households in Samdrupjongkhar

.....
Thinley Rabten
Dzongkhag Livestock Sector
Samdupjongkhar

Dairy farming has shown exemplary development as enterprise in a significant way enhancing the rural household's income. It was an alternative source of income for farmers in the earlier days but over the years, this has grown as one of the important farming businesses. This indicates that farmers are opting this over the other farming activities owing to its immediate benefits.

The case is similar with farmers in Samdrupjongkhar, dairy farming has now become the most profitable business in Dzongkhag with seven dynamic dairy groups involved in the fresh milk business among others.

One of the policy framework of focused approaches, a self-help group concept has brought limelight in the rural development through dairy commodity marketing prospects. The production of fresh milk linking all the smallholders dairy farmers in the villages has further proved to be effective for better marketing system.

With more in the pipeline, the milk production is expected to grow significantly to 5000 litre/day. As of now, the groups market 2500-3000

litres of milk daily to the market. The highest production by an individual ranges from 25-30 litre/day and minimum from 4-5 litre/day. In terms of income, they earn an average of Nu. 3000-4000/- minimum and Nu. 25000-30000 maximum every month benefiting more than 600 rural households.

Through this farming, dairy groups from Orong, Wooling, Janchukling, Gomdar, Deothang and Dungmanma have been able to procure milk marketing vehicles (Bolero pickups) with the help of a loan from the Bhutan Development Bank Limited which they repaid within a year. The groups have also employed more than 15 people for book keeping services.

Today, the overall Dzongkhag milk production is 2403 MT (APA, 2015). Out of it, more than 704.6 MT of fresh milk are produced by the dairy groups. Besides, the local market outlet as an alternative marketing channels, the Dzongkhag Livestock Sector has explored outlet at nearby Indian towns. In 2015, the fresh milk export was recorded at 345 MTs of worth Nu. 1,381.4 Million to Assam, India. The milk price is fixed at



Nu. 40/litre both for local and outside market.

The groups were supported with improved sheds, cattle subsidy, free fodder seedlings, dairy equipment and milk collection centres through the Government and MAGIP funds. The shed with stall feeding system has not only improved the household's living standard through installation of biogas plant but have also improved the forest re-growth as cattle grazing was reduced. This has further helped to reduce the use of poles by villagers for fencing the agricultural fields.

For smooth functioning, the groups follow the respective by-laws which can be amended as per the genuine requirements during the group's annual general assembly. This helps to promote village based rural development

institution to empower farmers in decision making and function them sustainably as self-help groups.

Although, the opportunities are immense being located next to the Indian market, challenges still lies in terms of ensuring the high milk quality, market skills, service delivery, hygienic market outlet and in maintaining the cold chain facilities from farmers field till the market. Establishing the links from one household to another bringing whole community remain a foremost challenge in rural settings.

As such, a mass awareness to disseminate dairy value chain system to rural farmers is crucial.

If farmers are able to adopt the new approaches to ensure quality and hygiene, it will strengthen their capacity to achieve and explore more with the local products. It will further not only enhance their income at household levels but also guarantees the household food-security, employment and improved livelihood.

Meanwhile, for the hard work and concerted efforts, the Dzongkhag farmers put in making the dairy business, the most successful venture in the east, they have received the National Recognition for the Best Dairy Group and Best Dairy Farmer during the National Day 2014. This recognition has empowered all the rural farmers across the country.



CORDYCEPS Marketing System



-A gradual transformation
then and now

Dorji Wangchuk, DAMC

The collection of Cordyceps (*Ophio-Cordyceps sinensis*) for commercial purpose was legalised in 2004. Since then, the marketing of cordyceps was facilitated by Ministry of Agriculture and Forests (MoAF) and has been sold through auction until 2010. The government facilitated this auction mainly due to the fact that majority of the collectors were illiterate and was not able to market it themselves.

The facilitation of cordyceps marketing went through many changes over the years based on the experiences and challenges faced.

a. Auction by MoAF (2004-2010)

The auction was organised by the Department of Agricultural Marketing and Cooperatives (DAMC) jointly with the Department of Forests and Park Services (DoFPS) and local government officials. Prior to auctioning, lots were segregated by quality based on physical damage, colour, size, shape and displayed accordingly. After the auction, the sale was awarded to the highest bidder and the transaction took place with the fulfillment of all documentation process.

b. Direct buying and selling (2011)

From 2011, it was decided that, direct buying and selling without government involvement be tried because of the costs incurred for facilitating auction. The cordyceps traders and bidders too felt that business should be liberalised without

government intervention. Under this mode, the DAMC announced the starting of the marketing period, after which buyers and sellers met and did their business accordingly.

Unfortunately, the DoFPS found it difficult to get and maintain proper records of the transactions leading to one of the lowest realisation of royalty that particular year. Many collectors also felt that auction is better since the system is transparent and more competitive and they got better prices.

c. Auction by FCBL

Based on the preceding year's experience, the government reverted back to the auction system but with the Food Corporation of Bhutan Limited (FCBL) as the service provider, mainly considering their experience in auctioning of other RNR produce. The FCBL charged 0.65% of the final bid value for their service while the royalty amount remained same.

Though the system worked, most of the local government leaders felt they could provide this service. The advantage is that they can retain the service charge within their administration to be used for development work.

d. Auction by local government administration

Prior to the auction, the DAMC conducted trainings for the local leaders on auctioning process, issuance of transaction documents and

developed guidelines for cordyceps marketing.

Since 2013, there has not been a major change on the mode of marketing, though minor changes were made constantly based upon the growing experiences. One major change was to permit the collectors to sell their ware at which ever auctioning location they preferred since they were of the opinion that in some auction locations, where there were a limited number of bidders, they colluded to keep prices low.

Processes involved in current system

a. Collection

Currently, three members from any household in the cordyceps collection geog are issued with collection permits. The collection period is usually restricted for one month keeping sustainability in mind. The respective forestry officials are present for the entire harvesting period conducting regular patrolling functions. Apart from ensuring proper harvesting methods, they in coordination with the respective local government officials ensure that the harvesting sites are not littered. Once the collection period ends, the designated

forestry officials weighs and counts the cordyceps collected and issues “Certificate of Origin” (CO) authenticating the legality of each collection.

b. Marketing

After the collection, the DAMC in consultation with geog administration and other stakeholders decides the venue and dates for auction are informed through radio and print media. Interested bidders registers with the Department in advance. The auctioning process stretches over a month and usually starts from west and ends in the eastern region.

The collectors need to produce CO during auction following which their product is registered for auction. The forestry officials make sure that the quantity reflected in CO matches with the quantity declared at auction, though small variations are permitted as a result of weight loss.

The collectors then have the option to



either participate in auctions or sell directly. If they participate in the auction, the cordyceps are categorised into different grades by a committee comprising of officials from BAFRA, DAMC, geog administration and exporters.

Goods are auctioned based on their grades, but after auction, the collectors are given the option, whether they want to sell at the offered price or explore alternative markets. If they decide to sell, then the buyer pays the price and other related charges such as royalty and service charge. In the event, if the collector decides otherwise, they are still liable to pay the royalty and service charge. They are issued with the relevant documents accordingly. They can either explore other auction locations or sell to others once they have the documents.

The collectors wishing to export directly can export only the quantity reflected in the CO. During export, BAFRA officials strictly examine quantity reflected and other related documents.

3. The value of CO

One of the main objectives of legalising collection and sale of cordyceps is the enhancement of socio-economic conditions of the people residing in mountainous border areas without much access to technology and modern amenities. However, over the years, there has been growing concern with regard to increased number of players in the value chain. Although, the role of middlemen is vital like in any other value chains, there is concern that the increasing number of players may decrease the income for the actual collectors- thereby defeating the whole purpose of legalisation.

There are reports that influential middlemen buy cordyceps right at the collection site or exchange with other goods at a minimum

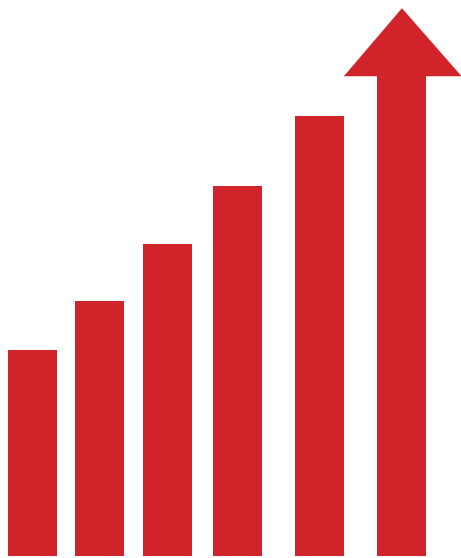
price and later, these middlemen participate in auction or export directly.

The government initiatives are focused toward keeping the cordyceps value chain as simple as possible and for this strict implementation of the CO regime is very critical. This will ensure the cordyceps collected is declared at the auction and not elsewhere. Realising this, in 2016, an executive order from the Ministry was dispatched to all the respective field and park offices for strict implementation of CO which is a major challenge due to staff shortage.

The success of this current marketing mode in meeting the noble Royal Government objectives is heavily dependent on one single document and this is risky. Therefore other modes of marketing needs to be studied in the future.

With increasing literacy of the people residing in cordyceps collection areas, the Royal Government hopes that the collectors will be in a position to export their own produce to the final markets deriving maximum benefit in the future, but till that time, the current marketing mode has to be followed. Nonetheless, changes and improvements have to be incorporated as we move forward, to ensure that the cordyceps industry becomes sustainable and flourish, benefiting our people living in the most difficult parts of the country.





Improving Goat Husbandry practices in Bhutan

Sonam Jamtsho, National Goat Nucleus Farm, Samrang

In Bhutan, goats are reared mostly in the southern Dzongkhags for meat, manure and commercial and religious purposes. It is considered as an important activity to improve household nutrition and generate income.

It was noticed that local breeds that farmers have been rearing was of inferior quality with poor growth rate. Therefore to improve the breeds, the National Highland Research and Development Centre-Jakar started a program at its sub-centre, Bhur in 2007 to breed and select elite stock for crossbreeding. In 2010, exotic goat breeds imported from India were supplied to the farmers of Dovan in Sarpang and Goshi in Dagana. Similar breeds were also supplied to Singye and Gakiling geogs in 2013.

The National Goat Nucleus Farm (NGNF) was established in July 2014 to supply breeding bucks, upgrade the local breeds and produce niche products like goat cheese. The farm is expected to cater to any needs pertaining to the country's goat industry. It will also function as a training location for scientific goat farming, maintaining and producing top quality breeds and distribute offspring to multiplier farms for propagation and distribution to farmers.

Till date, the unit has supplied 125 improved breeding bucks to the interested farmers. At present, NGNF is rearing four goat breeds

such as Beetal, Sirohi, Jamunapari and Boer at Samrang.

According to farmers, goats are cheaper to maintain, easily available and have a friendly nature. One of its highlights is the quick economic returns which they used to buy household items and meet school expenditure. It also provides them the social security as it can be sold as and when there is urgent need for cash.

Goats in the past were considered to be harmful for environment due to its tendency to nibble at foliage. Keeping this in mind, farmers are now being encouraged to adopt scientific ways of goat management which would include proper feeding and nutrition for the goats, housing requirements and disease management among others. They are advised to enclosed goat sheds and adopt cut and carry forage feeding system. This will help to increase the productivity of the pasture land and support more number of animals.

With such management practice, goat farming in the country is expected to be enhanced creating immense contribution to the rural economy.

As per the Livestock Statistics 2015, there are 41983 nos. of goats in the country with the highest nos. of 13237 in Samtse. It also states that the chevon meat production was 165928kgs with 79472kgs of highest production from Samtse.

Breed Characteristics



Local Goat (Black Bengal)

Origin: Bezoar type of wild goat. Its population is concentrated in Samtse, Chukha, Dagana, Tsirang and Sarpang

Live body weight: 17-25kgs

Kidding rate: 1.5 kids/litre



Beetal

Origin: Punjab, India

Live body weight: Doe 45-55kgs, Buck 70-80 kgs

Milk yield: 1.4-2.5 litre/day

Length of lactation: 170-210 days

Kidding rate: 1.4 kids/litre



Sirohi

Origin: Rajasthan, India

Live body weight: Doe 23-25kgs, Buck 50-52kgs

Milk yield: 0.5-0.6 litre/day

Length of lactation: 120 days

Kidding rate: 1.4 kids/litre



Jamunapari

Origin: Uttar Pradesh, India

Live body weight: Doe: 45-60kgs, Buck: 80-90kgs

Kidding rate: 1.4 kids/litre

Milk yield: 1.4-2.0 litre/day

Length of lactation: 160-210 days



Boer

Origin: South Africa

Live body weight: 75-80kgs mature, Bucks and Doe: 45-50kgs

Kidding rate: 1.7 kids/litre

Milk yield: 1-1.5litre/day

Length of lactation: 150-180 days

Improving reproductive efficiency of non-cycling cattle through estrous synchronisation

*Dr. Lham Tshering, Dr. N. B. Tamang, Dr. M. P. Timsina, D. B. Rai, Dr. Dorji
Department of Livestock*

Estrous synchronisation is a technique applied to address the reproductive waste management in cattle. It helps improve the fertility and reproductive efficiency of non-cycling cows and heifers. For its success, heifer or postpartum cow requires a high level of management. However, several factors complicate this process in the postpartum cows. It is found to be the most successful in heifers due to a lack of interference from extraneous factors. This technique facilitates timely insemination of animals and help reducing the reproductive waste.

In Bhutan for estrous synchronisation, mostly two hormonal devices viz: Controlled Internal Drug Release (CIDR-B) and Progesterone Impregnated Intra-Vaginal (TRIU-B) are used in non-cycling animals with or without the combination of Prostaglandin (PGF2 alpha) and Gonadotrophin Releasing Hormone (GnRH) as per the ovarian status of the animals.

To understand the response rate of both hormonal devices, preparations used in non-cycling cows and heifers and for conception and pregnancy rates, estrous synchronisation was organised in various Dzongkhags jointly with the Dzongkhag Livestock Sectors.

Ideally, this techno is carried out in a well managed cattle farms. But considering the most reproductive disorders in cattle, it was decided to use it in the problematic cows and heifers. In total, 812 animals were identified with fertility problems from seven Dzongkhags of Paro, Mongar, Punakha, Sarpang, Dagana and Wangdue. Out of that, 653 were treated with CIDR-B and 159 with TRIU-B. The standard protocols were followed to ensure proper response of hormonal treatments such as intra-vaginal insertion of the hormonal devices, its

removal on day seven, accordingly observation of synchronised animals for estrus within 24 to 48 hours and insemination of animals exhibiting the estrus signs with administration of GnRH hormone.

Animals inseminated were observed for conception and pregnancy diagnosis was conducted. The result showed that the response rate through application of TRIU-B is better than CIDR-B in both cows and heifers. The average conception rate using CIDR-B and TRIU-B was found to be 45.4% and 43.6% respectively. It showed that more animals got conceived using CIDR-B than using TRIU-B. It has to be noted that TRIU-B cannot be readily used in younger animals with a smaller body size. However, the findings whether these hormonal devices are significantly different in terms of its efficacy have to be statically validated.

The study concluded that TRIU-B is slightly better in response rate while CIDR-B is better for conception rate. When compared, both treatments do not appear to be very different. Hence while using the particular hormone in the field; either of the drugs available can be used based on its cost effectiveness and other added advantage.

It also indicated that both hormones have great potential to improve reproductive efficiency of animals for increasing AI performance and enhance cattle productivity. Hence, a concerted effort be made through fertility campaigns and estrus synchronisation on a regular basis to manage reproductive waste and production loss. Further, in-depth study on application of estrous synchronisation protocol with bigger sample size from different cattle breeds needs to be undertaken to validate the current findings.

Upscaling Mushroom Services in the region:

A case of multiple supports resulting in complementary effects

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ARDC Wengkhar*

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Trashigang*



The potential for mushroom cultivation in the eastern region has not been explored mainly due to the lack of mushroom spawn as it was available only in Thimphu. Given this limitation, the National Mushroom Centre (NMC) and the Agriculture Research and Development Centre (ARDC) Wengkhar in 2010 with support from the South South Cooperation between Bhutan, Benin and Costa Rica established the Mushroom Spawn Production Unit (MSPU) in Khangma at a cost of more than Nu. 2Million. The unit with some basic equipment and two mushroom technicians began its operation under the technical supervision of NMC and administratively under ARDC Wengkhar.

In order to expand mushroom services in the east, the centre began exploring support from various agencies since no single agency had the complete package of required support. In 2014, through the technical assistance of the then Horticulture Research and Development Project (HRDP), a mushroom expert was field to advise the unit and to make recommendation for improvements. The

project also supported the unit in putting an air conditioning system and fresh spawn introduced from Japan.

However, the major recommendation in terms of structures, equipment, containers and capacity development was possible only with support from the Market Access and Growth Intensification Project (MAGIP). The project provided a total fund of Nu. 1.832Million which was used for proper insulation, soaking tank and equipment such as air compressors, auto spawn injectors, autoclave, sawdust machine and heat resistant plastic containers for spawn production.

In addition, MAGIP supported the farmers training through ARDC Wengkhar. More than 160 farmers (82 men and 72 women) were trained on mushroom cultivation following the hands on practice approach.

With the help of various supports, the unit started the spawn production of two major mushrooms promoted in the country i.e. Shiitake and Oyster. Between 2011 and 2016, a total of

14,775 bottles of Shiitake and 6,215 bottles of Oyster spawns have been cultured by the unit. The unit consistently maintained an increasing trend except for a drop in its production of Oyster spawn in 2014 which was due to some spawn infections that were later corrected and regained. The spawn production of both mushrooms has now been doubled since 2012.

Between 2012 and 2015, the unit produced a total of 8,900 bottles of Shiitake and 5,877 bottles of Oyster spawns. Using these spawn, a total of 71,322 billets of Shiitake and 16,769 bags of Oyster mushrooms were inoculated benefitting more than 800 farmers.

Apart from expanding services to farmers, the unit has also been able to expand technical assistance to other agencies such as the Rural Development Training Centre in Zhemgang which now organise the training program for Khangma farmers.

The unit was also able to extend services to the farm to school approach jointly initiated by the Ministry of Education and the Ministry of Agriculture and Forests in promoting mushroom particularly in the central and boarding schools. Between 2013 and 2015, the mushroom

cultivation reached five schools namely, Khaling Higher Secondary School, Duntse Central School, Gomdar Central School, Yadi Central School and Brekha Community Primary school. This helped to educate students on mushroom cultivation techniques which were further enhanced with the hands on training in the schools.

The unit is preparing to upscale mushroom by producing quality spawn and establishing the production unit with farmers following an approach of hands on practice where in growers are trained to establish their mushroom production units.

The expansion of mushroom services and its promotion in the east especially through a completely new set up is fully dependent on support programs. The unit was supported through various programs which complimented each other ultimately enabling the unit realise its primary functions of spawn production and mushroom promotion in the region. The unit is now planning to upscale mushroom following either a “focused village approach” in which several farmers in a village take up cultivation to produce in bulk or individual entrepreneurs on a commercial scale.



Piggery thrives well in Southern Dzongkhags

Pema Sherab, NPiRDC, Gelephu

For those who wish to improve their living standard immediately, piggery farming is the best way out.



are major challenges. To address the issue, since 2013, the National Piggery Research and Development Centre (NPiRDC) in Gelephu had been decentralising the piglet production to the interested Contract Piglet Breeders (CPBs). The CPBs are supplementing the piglet supply to the fattening operators through guarantee buyback system of piglets which will continue till the end of the 11th FYP.

With the close collaboration from the Regional Livestock Development Centres and Dzongkhags, the NPiRDC through the PSSP has established 62 CPBs (5-30 breeding sows) between 2013-2015. The support included 60% i.e. free construction materials from government and 40% i.e. labour charges from the

beneficiaries.

The Department of Livestock has identified southern Dzongkhags such as Sarpang, Tsirang, Dagana, Chukha and Samtse as potential areas for piggery development where many semi-commercial farming is being promoted through piggery stimulus support packages (PSSP) with permanent shed construction and price support for piglet production.

Despite having a huge piggery potential in the south, the inadequate piglet production and supply from the government breeding farms

From 2014-2015 onwards, the NPiRDC also supported the fattening farm establishment. So far out of 14 farms, 10 semi-commercial farms having 450 fatteners are operating in Sarpang and Gelephu.

In order to strengthen the farmer's institution, a Sarpang Yarkey Piggery Cooperative (SYPC) was formed with 47 members to coordinate piglet and pork production and marketing. Since then, the domestic pork production has been increasing

through the markets at Gelephu and Sarpang. However, with 2016 Sarpang flood, the SYPC Head office and meat sale outlet has been washed away disrupting the pork marketing functions of the group.

Gelephu market is catering the pork business not only for the consumers of Sarpang but also to the east-central region by importing from Assam during domestic pork shortages. Till 2015, the pork price at Gelephu was at the whims of Datgari meat suppliers.

In 2016, for the first time in the country's history, the pork supply to Gelephu market was dominated by domestic pork producers, who were the members of SYPC. As of August 2016, the domestic pork supply to Gelephu market hit at 40.763 MT while the import was 28.685 MT. It showed that Gelephu market on an average handles 8.681 MT of pork monthly for its consumers. With such trends, the NPiRDC is hopeful to provide hygienic domestic pork at an affordable price.

Piggery tremendously helps in creating employment opportunities for youths and enhances the income level of farmers. For instance, under the guarantee piglet buyback system, from January-October 2016, the CPBs have supplied 1755 nos. of piglets to NPiRDC at the rate of Nu. 3500/piglet earning them Nu. 6,142,500/-. Likewise, the fattening operators of Sarpang have earned an income of Nu. 6,522,080/- selling 40.763 MT of pork at a wholesale rate Nu. 160/kg.

As per the records, at least six farmers now owned vehicles after venturing into piggery business, which is a clear indication of the improved living standard. With the right kind of incentives and leadership, it would not be difficult for the Department of Livestock to achieve pork self-sufficiency in the country.



Conservation of the rare **CHEMSHING** in the Bhutan Himalayas

*Conifer Forest Research Sub-Centre
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Integrating natural rarity with artificial propagation techniques

Chemshing (*Ziziphus budhensis*), a newly identified *Ziziphus* species belonging to the Rhamnaceae family is a tree of religious, economic and conservation significance.

The tree has a very limited distribution and found only in a small pocket of central Nepal and western Bhutan. It is highly revered in Buddhism as its round stony seeds are used to make rosary beads to enchant prayers.

According to Lama Kunga Dupshang of the Awalokeshwor monastery in Timal, Nepal, the seeds of the plant were sown by Guru Rinpoche after subduing a demon

and meditating in a cave in Timal village (seen as Yarinaaaa in Guru's prayer Barched lamsel). Guru blessed the villagers that someday this will bring prosperity to them. Accordingly, there are reports that the farmers in Timal are earning millions of rupees from sale of the beads. According to the UWICE researchers, who visited Timal to explore the tree's ecological requirements and nursery techniques, the species lack basic scientific studies such as taxonomic and ecological information which makes conservation and propagation efforts difficult.

In Bhutan, only three types of the species have been recorded from Shaba, Paro. The researchers while interacting with the elderly

people of Paro found that one of the very old trees that grow currently was brought from Nepal. Legend has it that the famous Iron Chain Builder (Dupthop Chazop) during his pilgrimage to Nepal (Belbu or Boudhanath temple) brought this famous Chemshing as his walking stick. Upon his arrival in Paro, he planted the walking stick on the present site to subdue the spirit that dwells on this particular hill, a hill that resembles a giant turtle. This very old tree gave way to the current few populations. That must also be the very reason why there are no other Chemshing found in the whole country.

Field observations have revealed that natural regeneration from this particular tree is absent and propagation through artificial means is met with little success owing to which there are not many plants developed for this species. Regeneration through seeds is hampered due to very hard seed stone which contains an embryo that is very short lived unlike other *Ziziphus* species. The germination of the seeds also requires controlled temperature and moisture conditions which are only possible in the laboratory conditions. Considering the Bhutanese people's religious sentiments towards this tree and concerns on the aging of the parent tree, studies to propagate and multiply this species were genuinely felt in order to conserve Chemshing. Research on the species was therefore initiated in 2007.

The Sub-Centre through various seed treatment studies were successful in obtaining several seedlings which will enable the conservation of this rare species in Bhutan. Their study was published in the Indian Journal of Plant Sciences in 2015. Having generated the information on seed treatment and propagation techniques, the centre has now plans to propagate the species and promote its conservation through active rural participation in growing the species so as to synergise the conservation efforts with rural income generation.





Tshendu, Dzongkhag Livestock Sector, Sarpang

POULTRY DEVELOPMENT

serving as a viable source of income in Sarpang

Poultry rearing has existed as age old farming practices providing nutritional food and additional income for the farmers. In the past, farmers used to rear in small quantity with traditional housing, local breeds and low cost management practices due to lack of poultry technology, expertise and insufficient resources among others.

Poultry farming is a cost effective and eco-friendly but risk oriented business. It provides immediate profit as compared to other livestock businesses but if proper care and management practices are not put in place, there is high risk of disease outbreak which can lead to collapse of whole business.

The series of extension awareness and interventions, policies and farmer to farmer training approaches has brought lot of changes in the community. Further, the exposure to the developed nations, study tour, field visits and television has helped change the people's mind set, their living standard and dietary system.

Today, farmers are taking up intensive poultry farming from semi-commercial to mega-commercial farming. More farmers are coming forward to undertake this business and the proposal are being accepted after fulfillment of certain criteria to assure standardised level in the community.

The Dzongkhag Livestock Sector has supported the interested farmers through shed construction materials and subsidised poultry equipment besides the regular extension services such as vaccines and medicines. The National Poultry Development Centre also supported them with shed construction materials, subsidised day-old-chicks, equipment and capacity development. Due to such subsidised facilities, the Dzongkhag has established more than 100 semi and commercial poultry farms producing annually 10080000 nos. of eggs worth of Nu.705,60000/-.

The Dzongkhag farmers have successfully registered the Sarpang Layer Cooperative (SLC), which was initially started in 2000 as farmer's group and later become a cooperative. SLC have 97 active members from five geogs Shompangkha, Dekiling, Gakiling, Samtenling and Gelephu.

It was formed to produce fresh table eggs and reduce import, generate income, build up dynamic farmers group, use optimum resources, build capacity, offer reasonable price to consumers, mitigate rupee crunch, create job opportunities, achieve egg self-sufficiency and improve farmers' living standard.

SLC produces 1000-1300 cartons of table eggs weekly. Each carton contains 210 eggs which makes the group's weekly income of Nu.20,28000/-.

The eggs are collected into two categories of big and small sizes and fetches Nu. 1510/- and Nu.1200/- respectively for each carton. They are collected weekly from the farmers and brought to the sale counter. The eggs are sold directly from counter to the brokers based in Thimphu and other Dzongkhags. SLC have also opened sale outlets in Gelephu and Sarpang. The transportation cost during eggs collection is calculated from the profit margin of Nu. 50/- which also covers the members payment and counter's monthly rent.

The Cooperative functions under the board of members comprises Chairman, Secretary and Treasurer. They are the highest decision makers for emergency cases in terms of price, market and demand-supply situation. SLC is registered with the Department of Agricultural Marketing and Cooperatives with number COOP/18 dated 30/10/2012. It is constituted with the Cooperative Act 2009 with Cooperative Rules and Regulations of Bhutan 2010.

The Dzongkhag is performing very well with poultry business through egg production yet more farms needs to be introduced to reach the optimum market for supply-demand and consumers benefits. The increased market production will help consumers to buy at a reasonable price and everyone to have equal product access which will lead to prosperous life and improve health and living standard fulfilling the aspirations and noble mission of the country's Gross National Happiness.



Pakchong Napier

- A super grass for achieving fodder self-sufficiency

Dhan Bdr. Tamang, RLDC, Zhemgang

A new hybrid grass called, Pakchong Napier is gaining popularity among dairy farmers in Bhutan. Why? Because it is so nutritious, very fast growing and high-yielding. It is also palatable and claimed to contain 16-18 % crude protein.

Pakchong's average grass growth is about 1 metre/month and the maximum in about two months is 10 feet tall. The fodder can yield about 200 tonnes/acre in a year, which is enough to feed 20 dairy cows for 12 months. According to records, the crop initially planted can last for around seven years, prior to replanting with new crops and can be harvested once a quarter. The stalks are cut close to the ground, and in no time, new shoots or ratoon will come out.

The super grass was developed by Dr. Krailas Kiyothong of Thailand by crossing Pennisetum purpureum (Elephant grass) and Pennisetum glaucum (Pearl Millet). He has named it as 'Pakchong' after the name of his research place.

In Bhutan, the National Research Development Centre for Animal Nutrition launched this grass in 2013. Later, the Regional Livestock Development Centre, Zhemgang introduced it in sub-tropical areas under east-central region to achieve fodder self-sufficiency.

The fodder is best suitable under wet tropical or sub-tropical climate with a minimum annual rainfall of 1200mm. The soil texture best suitable is acidic red loam or mildly saline soil. It also has excellent resistance to excessive rains and water-logging during rainy season.



To do a comparative study and evaluate the effect of cutting interval on forage yield, nutrient quality and morphology, Pakchong was distributed to all four regions. For further multiplication, it was propagated at Pasakha and Phuentsholing for west, Kikhorthang for west-central, Tingtibi, Bhur and Darjethang for east-central and Lingmethang for east.

In addition, Nimshong in Trongsa, Nangkor, Trong and Ngala geogs in Zhemgang and Singye, Dekiling, Chuzagang, Umling and Sompangkha geogs in Sarpang have been supplied this grass from the germplasm banks established in Sarpang and Tintibi. A daylong demonstration program on its performance and plantation technique in comparison to the existing variety was organised

for farmers to help them with better choice. Free fodder slips were also distributed to the interested ones.

Besides, the fodder has other uses as well. If there is excess harvest, it can be use to make silage. The shredded leaves and stalks can be used as organic fertiliser by mixing the same with cattle manure. It can be also fed to hogs, chickens, ducks, plant eating fish, horses, rabbits and for feeding earthworms in vermiculture.

With such species, the fodder shortages are expected to be reduced gradually. The super grass will help farmers to increase green fodder production and contribute towards the enhancement of milk production for better income.

Number of farmers at different locations and acreage developed

Sl. No.	Location	No. of farmers	Acreage	No. of slips
1	Singye	20	2.5	25000
2	Panbang and Rebati	64	2.5	25000
3	Tsanglajong	17		
4	Tama	32	5.0	50000
5	Buli	26		
6	Trong and Dangkhar	35	2.5	25000
7	Dekiling	23	2	10000
8	Nimshong	20		
	Total	237	14.5	135000



Community **AI** Technician:

Striving to reach AI services closer to farmers' doorsteps

*Dr. Dr. Lham Tshering,
Dr. N. B. Tamang,
Dr. M. P. Timsina,
D. B. Rai and Dr. Dorji
Department of Livestock*

Artificial insemination (AI) is the most efficient and proven reproductive technology accepted by the scientific community for breed improvement and enhancement of livestock productivity. Promotion of AI technology to introduce quality genetic material into cattle populations has several advantages compared to other short term measures like induction of live animals.

Currently, there are over 106 AI Out-Reach Stations (AIORS) covering 20 Dzongkhags of the country. Most of them are manned by one AI technician or technical staff who has to cater AI services, attend clinical cases and out calls, carry out feed and fodder development activities and participate in official meetings and trainings organised by various offices. It is therefore, not possible for the AI technicians to provide uninterrupted services to the local communities.

Thus, to take the AI technology closer to farmers doorsteps and expedite cattle genetic improvement, the concept of Community Based AI Technician (CAIT) was initiated by the National Dairy Research Centre, Yusipang in 2010.

The CAIT aims to ease the shortage of field AI technicians in providing the regular AI services, involving local community participation in cattle breed improvement and generating employment opportunities for early school leavers and educated farmers. The Centre jointly with the

Regional Livestock Development Centres and Dzongkhags identify, train and deploy CAITs in the dairy potential areas to accelerate the breed improvement and address unemployment issues. This initiative is also expected to contribute to the Government's effort in mitigating the rural-urban migration.

Till date, the Centre has trained and deployed 45 CAITs in six batches, 20 from Thimphu, Paro, Chukha and Samtse in west, 5 from Tsirang and Dagana in west central, 13 from Mongar, Trashigang, Pemagatshel and Samdrupjongkhar in east and 7 from Bumthang, Trongsa and Zhemgang in east-central. The western region has the highest uptake of CAITs which is an advantage for its farming communities.

For availing AI services from CAITs, to remeunerate them, each community draws an internal agreement between the CAITs and community beneficiaries in the presence of extension officer and local leaders. The Centre provides inputs such as Liquid Nitrogen (LN2), frozen semen, AI gun, gloves and sheath to conduct AI in the field.

According to the assessment of CAITs services to dairy farming community, their performances are very impressive looking at the complexity of the technology and precision required for its success. A total of 946 AI was performed by CAITs till date.

Owing to flaws in timely recording of the progeny born in the field, the average success rate in three regions was only 23.20 % which ideally should have been much higher. One of the reasons for low AI success rate was that the CAITs were offered very nominal fee for their services. Besides, poor incentives from the Government to motivate and encourage CAITs uptake was another key factor leading to compromise the quality of AI services along with poor follow up on progeny born records in the field.

The introduction of CAIT is a noble initiative undertaken by the Centre for better delivery of services. The feedbacks from CAITs on the relevance of training and their services to the community is very positive as they were able to

perform AI services on their own. Most of the trained CAITs are successfully employed in the field.

The CAITs services have greatly benefitted the dairy community with timely AI services which directly enhanced the breed improvement programme. For better uptake of CAITs and obtain higher AI success rate in the field, there is a need to come up with proper incentive mechanisms from the Government to complement the existing fees of the beneficiaries. In addition, the regular monitoring of the performances from each CAIT and timely technical backstopping and upgradation of their skill has to be given due impetus by the Department and Dzongkhags.





Goodbye MAGIP Welcome CARLEP

Tashi Wangdi, CARLEP, Wengkhbar

Bhutan has received a total of US\$52.9 Million over the past 36 years from the International Fund for Agricultural Development (IFAD) for investment in seven projects and programmes in the country. Five of them were solely dedicated to the six eastern Dzongkhags of Trashigang, Mongar, Pemagatshel, Samdrupjongkhar, Lhuentse and Trashiyangtse where rural poverty is found to be the most acute. They were implemented to reduce poverty and improve food security in the rural areas.

One of the successfully completed projects is the Market Access and Growth Intensification Project (MAGIP) which was implemented from 2011 till June 2016 with final closing in December 2016.

The project improved the productivity of subsistence farming systems in communities with no road access, intensified the production of cash crops and dairy products and enhanced the smallholders' access to markets, in communities with road access. The total project cost was USD 13.5 Million including the IFAD loan of USD 8.49 Million and grant of USD 2.0 Million, the Royal Government of Bhutan contribution of USD 1.99 Million, beneficiaries contribution of USD 0.86 Million and a grant from SNV of USD 0.171 Million for technical assistance and capacity building.

Some of the important progress during 2012-13 financial year includes the formation of 114 vegetable groups and school linking program, supply of 32 power tillers, improvement of 34 kms farm roads, construction of 10 kms of new irrigation channels, setting up of 14 one stop farmer shops (OSFS) and linking the food corporation of Bhutan to these OSFS and farmer groups.

MAGIP and past IFAD supported projects have brought about significant development in the project areas. They mainly focussed on increased agricultural and livestock production, enabling farmers, mostly smallholders, to adopt improved practices for better living standards. The projects also enhanced income through better road access and market making the diverse and numerous impacts.

Over the past three decades or so, the projects have enabled farmers to add various physical and household assets and equitable access to inputs and infrastructures including the irrigation and farm roads. It also improved food security with intensified production of vegetables, cereals (Paddy and Maize), dairy and poultry products. It further helped to acquire knowledge and skills in production, farm management and better social capital through various grassroots organisations.

As MAGIP is bid goodbye, Commercial Agriculture and Resilient Livelihoods Enhancement Programme (CARLEP) also funded by IFAD is welcomed. CARLEP was launched on 11 December 2015 for seven years (2015-2022). The total project cost is USD 31.5 Million including the IFAD loan of USD 8.25 Million and grant of USD 1.05 Million, a grant from the Adaptation for Smallholder Agriculture Programme of USD 5.0 Million, a contribution from beneficiaries of about USD 0.6 Million, USD 5.7 Million from the Royal Government of Bhutan and USD 4.8 Million from the Food Corporation of Bhutan Limited (FCBL).

With the overall goal of sustainably increasing smallholders' income and reduce rural poverty, the CARLEP aims to facilitate the transformation of a subsistence-based rural agricultural economy

into a sustainable value chain and market driven productive sector by promoting climate smart approaches in agriculture and strengthening capacities of communities and local institutions. It builds on the solid agricultural and rural development foundations laid down by the prior projects. It however makes a basic shift in its investment style by adopting value chain approach and climate resilient farming practices.

CARLEP is managed by the Office of Programme Management based at Wengkhar in Mongar. The key implementing partners are FCBL, Regional Agricultural Marketing and Cooperatives Office, Agriculture Research and Development Centre, Wengkhar; Regional Livestock Development Centre, Kanglung and six eastern Dzongkhags.



SAVINGS AND CREDIT CO-OPERATIVES:

An alternative source of financing for farmers

Dawa Tshering, Department of Agricultural Marketing and Cooperatives

What is a Savings and Credit Co-operatives (SCC)?

It is like any other co-operative formed voluntarily by a group of people with a common purpose. The members pool their savings together and provide loans to any member requiring a loan at very reasonable interest rates.

A corollary benefit of such a group is that it educates members on the prudent investment and use of their money which will raise their income level and uplift them socially and economically. Like any other co-operative, the members of the group own, control and run their organisation on their own.

Why SCCs?

SCCs are member owned and managed based on the co-operative principles where every member has equal say. Getting access to finance to enhance their livelihood, e.g. buying a cow, or investing in a business. Starting a grocery shop is a major challenge for the marginalised rural community in Bhutan. Because there are no banks in the vicinity or they do not have the necessary collaterals, or because the interest rates are too high, most rural folks cannot avail loans from formal financial institutes. In such situations, SCCs become a boon.

Besides lending, SCCs also provide savings services to its members. Availability of such services inculcates a habit of saving among the members. Any excess cash that they do not require immediately, say, after they sell their farm produce, if deposited with SCC will not only ensure safety of their cash but also generate additional revenue through interest income over time.

Since they are local and normally have low administrative costs, they have the potential to provide faster and cheaper loan as compared to commercial banks.

History of SCCs in Bhutan

In 2013, the Department of Agricultural Marketing and Cooperatives (DAMC) established a working partnership with the Association of Asian Confederation of Credit Unions (ACCU) and received fund support to form and strengthen five credit cooperatives in Bhutan. In January 2015, a memorandum of understanding for a two year project on credit cooperative development in Bhutan was signed.

The Respect, Ownership, Reliable, Union and Member (RORUM) registered as the first ever SCC in Bhutan, was spearheaded by 21 women street vendors and today, RORUM has 87 full-time members. RORUM has till date disbursed Nu. 0.46M as loan to its members to start and expand small businesses, to meet the education expenses of their children and for other emergency needs and has a balance of Nu. 0.27M in the bank. They started with a meager amount of Nu. 2,500 injected as the seed capital.

Dompola Savings Group in Punakha was an informal group providing such a service to its 15 members, way before RORUM started, since 2002. One of the beneficiaries, Namgay Bidha, got a loan Nu. 0.1M that she desperately needed at that time to send her children to school. She says she repays the loan in small amounts through the sale of vegetables and dairy produce on a regular basis.

To start a small vegetable business in Khuruthang town, Kinley Penjor took a loan of Nu. 50,000/-



Dompola Savings Group with marketing officials in Punakha

and later an additional loan to expand his business. He is running a successful agri-business in Punakha.

Initially, Dompola Savings Group required their members to save Nu. 60/month but now, has increased to Nu. 100/month. The group has disbursed Nu. 1.250M loan and has savings of Nu. 1.5M.

Furthermore, the DAMC has already identified three more groups looking to register as a SCC.

Way forward

This is not to say that saving co-operatives are smooth sailing all the way. There are several inherent challenges in forming and running a SCC in Bhutan:

- The concept of such savings group is new in Bhutan and to get members interested in such a scheme is a challenge. This mainly emanates from the difficulty in trusting other people with one's money.
- Generally, Bhutanese people do seem to be independent and do not seem to see the merits of working in a group. Such innate characteristics cannot be changed overnight and does take time.
- While being guided by the Co-operative Act, the Rules and Regulations, there are no separate regulations governing SCCs and this may lead to conflicts among members in the future if due diligence is not taken during the formulation of the by-laws.

- Because of the low number of members and low financial capacity of households, it would be a challenge to grow SCCs into large profitable co-operatives.

Nonetheless, the benefits of SCC to its members and the local community is well known and if the merits are to be reaped and extended to the larger section of the population, some strategic interventions have to be made by the government:

- Proper rules and regulations governing SCCs needs to be in place
- Advocacy on the merits of working in groups and savings with SCCs have to be made, along with strengthening the capacity of the group members particularly the office bearers
- Hand-holding and constant supervision of the group by the government is imperative particularly at the initial stages.

Globally, SCCs have been identified as the vehicle for delivery of financial services with demonstrated successes in aiding the rural poor access rural finance.

Data from the 2015 Statistical Report of the World Council of Credit Unions shows that there are 60,500 credit unions in 109 countries around the world. Collectively, they serve 223M members with US\$1.8 trillion worth of assets.

Considering the many benefits of such groups and co-operatives, the DAMC accords top priority in the establishment of groups that have the potential to sustain and grow in years to come.

Highlights of 2016



Farm Shop for Laya

January 8, Laya: A farm shop was inaugurated in Laya which will serve as a market outlet for the RNR products, provide buyback guarantee and facilitate access to farm inputs and basic food items to the highlanders.

The shop will sell items such as rice, soap, sugar and salt among others. On the opening day, the shop sold around Nu.6280/- worth of items. Besides, the shop will help the community to have access to the farm inputs. Including this, there are 37 farm shops till date.



Kuchi Diana Irrigation Scheme

January 16, Samtse: A 7.2 km long, Kuchi Diana Irrigation scheme was inaugurated at Yoeseltse geog. It will benefit more than 300 households of Yoeseltse and Sang Ngagcholing geogs and irrigate more than 950 acres of land.

It is one of the largest schemes constructed in Bhutan with the total budget of Nu. 63.22 Million from the Government of India under Project Tied Assistance. Its construction started in March 2015 and completed in October 2016.



New BAFRA Office for Dagana

January 16, Dagana: A new BAFRA Office was inaugurated in Dagana. It was constructed with the RGoB budget of Nu. 4.4 Million.

With the new two storied office and added facilities in place, the BAFRA officials are confident in discharging their responsibilities efficiently. BAFRA now has 10 such offices and 7 Plant and Animal Quarantine Stations in the country's major entry points.

Till date, BAFRA has established its field offices in 20 Dzongkhags, 8 Dungkhags and branch offices in major towns including National Food Testing Laboratory in Yusipang.

Highlights of 2016



B-Coop shop for Gelephu

January 19, Sarpang: Bhutan Cooperative (B-Coop) shop was established at Gelephu by the Southern Ginger Cultivation and Cottage Industry (SGCCI) group based at Samteling geog. The shop will strengthen the marketing of local products through cooperative marketing, assist the cooperatives and farmers groups to market their products and make local products readily available to the consumers with standard quality. It will also showcase the proper packaging and create a niche market by developing and promoting potential geographical indicator products. So far, three B-Coop shops have been established.



Integrated Horticulture Promotion Project

February 4, Wangdue: The Integrated Horticulture Promotion Project (IHPP) was launched at the Agriculture Research and Development Centre, Bajo to commemorate the 30th anniversary of the diplomatic relations between Bhutan and Japan.

The project will cover Wangdue, Punakha, Tsirang and Dagana. It will work towards developing the appropriate technologies for promoting horticulture farming, strengthening the fruits/vegetable seeds/seedling production system, private nurseries, training and extension system.

It signifies the continued commitment of the Japanese Government to support the development of agriculture in Bhutan.



Farmers Hostel inaugurated in Lingmethang

February 8, Mongar: A training hostel for farmers and staff was inaugurated at Lingmethang. A two storied building with furniture, kitchen, washrooms and training equipment was constructed with a MAGIP fund of Nu. 7.13 Million.

The hostel will benefit farmers coming for training and study tours helping them with free accommodation among others. The local administration and other regional offices can also have access to the hostel but with payment of user fees. With such facilities in place, Lingmethang is expected to see an increase in training programs.

Highlights of 2016



Bhutan hosted 26th session of APCAS

February 15-19, Thimphu: Delegates from 20 member states of Asia Pacific Commission on Agricultural Statistics (APCAS) met to review the region's preparedness in achieving the UN Sustainable Development Goals by 2030.

They deliberated on the challenges of meeting the information needs of the agriculture sector to better monitor and respond to patterns of hunger, food insecurity and malnutrition while highlighting new methodologies and initiatives.

APCAS is a statutory body of FAO mandated to review the state of food and agricultural statistics in the Asia and the Pacific region and advise member countries.



Taki-Sakura Cherry Tree planted

March 4, Thimphu: To mark the 30th anniversary of diplomatic relations between Bhutan and Japan, three ceremonial Taki-Sakura Cherry (Weeping Cherry/Waterfall Cherry) tree seedlings were planted at Floriculture and Amenity Landscaping Centre in Dechencholing.

The tree is considered as one of the three national treasures of Japan. A total of 12 seedlings were donated by the people of Miharu town, Japan. Bhutan earlier received the ten saplings of cherry in February 2013 and was planted at Ludrong Memorial Garden. The bilateral relation between Bhutan and Japan was established in 1986.



Tendrel Plantation to Celebrate the Royal Birth

March 6, Thimphu: To celebrate the Birth of His Royal Highness, The Gyalsey, 108,000 seedlings was planted in all 20 Dzongkhags and 205 geogs. A seedling each was planted by every household in the country which was distributed by the Department of Forests and Park Services.

Besides this, a ceremonial plantation of 2000 seedlings was also carried out by Dzongkhags with prayers for long life and happiness of The Gyalsey. The plantation of 108,000 seedlings is a record for maximum tree seedlings planted in a day in Bhutan.

Highlights of 2016



World Forestry Day

March 22, Wangdue: The World Forestry Day with a theme 'How do forest contribute to our water needs' was celebrated at Samtengang Central School. To mark the occasion, the Department of Forests and Park Services launched the Integrated Watershed Management Plan for Baychhu Watershed. The plan document is developed in an integrated and collaborative manner involving all relevant entities at the watershed level. The approach will be gradually scaled up to cover other degraded watersheds in the country based on environmentally sustainable, economically efficient, and socio-culturally equitable and acceptable code of practices.



Fourth Annual Rhododendron Festival

April 15-17, Lampelri: The fourth annual Rhododendron Festival was held at the Royal Botanical Park with a theme, 'Bio-cultural Diversity' exhibiting the park's biodiversity and variety of park resident's culture.' It showcased 29 of the 46 Rhododendrons found in Bhutan. Some 200 community members from Chang, Dagala, Kawang and Toeb geogs together with Hongtsho Primary School and Dechentsemo Central School participated in the festival. Some of its highlights included rhododendron garden walk and exhibition, local culture and cuisines, arts and crafts, traditional games and guided walks through the park's nature trail.



Bhutan signs Paris Agreement on Climate Change

April 22, New York: Bhutan signed the Paris Agreement for Climate Change. The signing was done at the UN Headquarter during the High-Level Signing Ceremony on the Paris Agreement for Climate Change convened by the UN Secretary-General. The Ambassador Kunzang C. Namgyel, Bhutan Permanent Representative to the UN signed the Agreement on behalf of the Kingdom of Bhutan. In all, 175 nations signed the Paris Agreement, making the signing ceremony the largest number of countries ever to sign a multilateral agreement on the day it opened for signature.

Highlights of 2016



Vermi-compost launched at Bimtar

April 27, Samtse: A vermi-composting technology was launched at Bimtar, Norbugang geog to showcase the process of composting organic waste. It was established on Sarad Gurung's farm which will act as a demonstration unit in the Dzongkhag. The application of compost to the soil will help increase soil fertility and increase yields as this compost is readily absorbed by the. It can be used in all agricultural crops. Farmers are encouraged to replicate such technology as it not only benefits yields but it also helps income generation and provides employment opportunities.



National Livestock Workshop

May 9-10, Thimphu: Around seventy livestock officials attended the 'National Livestock Workshop' with a theme, "Taking stocks of the progress and gearing towards the future". A booklet called, Livestock Information 2015 was also launched on the day. The workshop discussed the achievements, budget utilisation and challenges from Dzongkhags, Commodity Centres, Animal Health Services and Projects. A way forward for the Livestock Department was also developed. Following the workshop, a meeting was held at the Livestock conference hall to re-deliberate and develop the action plans.



Climate Change quiz for Mongar farmers

May 16, Mongar: Thirty-two farmers from 17 geogs participated in a climate change quiz competition at Wengkar. It was aimed at creating awareness on the basic but useful information related to climate change. Competing a basic four rounds of quiz questionnaires relating to soil, forest, water and agriculture a, Narang geog turned out to be the winner followed by Khenkhar and Drepong geogs in the second and third positions respectively. The winners were awarded with cash prizes and others with participation prizes. Similar program was also held in Zhemgang.

Highlights of 2016



MoAF Website Ranked First Again

May 17, Thimphu: The Ministry of Agriculture and Forests' website retained its title as the Best Website in the third National Website competition. The Ministry's website provides regular updates of news, events and other announcements of the RNR Sector at large. The websites were assessed on categories like usability and reliability, content and aesthetics, security and privacy, electronic and mail services, citizen participation, and features like subscription and email notification among others. The competition was initiated based on the Hon'ble Prime Minister's directive to encourage agencies to use their websites efficiently.



LoU signed for better Food and Agriculture Products

May 19, Thimphu: A Letter of Understanding (LoU) was signed between Bhutan Agriculture and Food Regulatory Authority (BAFRA) and DNV GL Business Assurance International, the prominent International Certification Body.

The LoU will help to strengthen the professional capacity of BAFRA through knowledge sharing, training, assessments, certifications and developments in its core domains of Bio-security and Food Safety to safeguard the farming system and protect consumers' health. This further would essentially help promote the Bhutanese Food Business Operators for implementation of ISO 22000:2005-Food Safety Management System.



Paddy Plantation below Dechenphu

May 28, Thimphu: The Ministry of Agriculture and Forests initiated a paddy plantation on 3 acres of area below Dechenphu Monastery. Around 100 volunteers led by the Hon'ble Lyonpo, Yeshey Dorji took active part in the plantation.

The area till date was left fallow due to wildlife issues and lack of support. Following the plantation, the area has been bordered by around 600 metres of electric fencing. Such initiative is aimed to recover the paddy field lost for urban development in the past while also helping towards achieving the food self-sufficiency.

Highlights of 2016



Calf Rally Exhibition

June 1, Trashigang: The Dzongkhag Livestock Sector, Trashigang organised a Calf Rally Exhibition at Pam village. The show was categorised into different sex and age groups of male and female calves aged 0-1 years and 1-2 years. The program was to encourage farmers to adopt rearing improved Jersey progeny cow through contact heifer and breeding production program, stall feeding practice to enhance clean milk production and stimulate farmers to run-through scientific management of dairy farming. During the exhibition, the winners were awarded cash prizes ranging from Nu.4000-10000/-.



Bhutanese Women set Tree Planting Record

June 2, Lhuentse: Hundred Bhutanese women created history by planting a record number of 49,718 tree saplings within an hour in Takila coinciding with the Social Forestry Day and Coronation Day of the Fourth Druk Gyalpo. The previous record set last year by 100 Bhutanese men at Kuenselphodrang, Thimphu, was 49,672 tree seedlings, 46 tree seedlings lesser than the women. The almost 13-acre hill needed each volunteer to plant 500 saplings in an hour. They were divided into 10 groups. From 50,000 saplings planted, 282 saplings were disqualified.



Second Royal Bhutan Flower Exhibition

June 4-10, Paro: To commemorate the Birth Anniversary of Her Majesty The Gyaltsuen, the second Royal Bhutan Flower Exhibition was held at the Ugyen Pelri Palace. Spread across 20 acres of space, the exhibition showcased thousands of flowers, vegetables, trees, models of historic structures and many more. The new attraction at the second exhibition was the bonsai displays of Thai and Japanese styles. An open talk series by several Bhutanese and international experts and plant enthusiasts was also organised.

Highlights of 2016



Cow in Tsirang gives birth to triplets

July 12, Tsirang: A cow belonging to Hari Prasad of Dzamlingthang village gave birth to three calves. Among three, two were male and one was female. The cow was artificially inseminated in October 2015 with the help of the Geog Extension Officer. It was in its 3rd lactation period including the present one. The Dzongkhag Livestock Sector believes that it is a great success of artificial insemination and the case could be the first of its kind in Bhutan. All three calves are healthy.



EU Technical Cooperation Project

July 21, Thimphu: The Ministry of Agriculture and Forests and the EU Delegation for Bhutan launched the operational programme estimate for Technical Cooperation Project in Support of the RNR Sector (EUTCP) financed by EU.

EUTCP is a Nu.340 Million project for technical trainings both within Bhutan and abroad. Over a period of about 2 years, approximately about 1000 officials under the Ministry will be benefited. The capacity building includes areas such as crop production, horticulture, animal husbandry, forest management and climate change resilient production technologies.



Second Annual Mushroom Festival

August 15-16, Thimphu: The second annual Mushroom Festival was held in Geney geog to celebrate the Royal Birth of HRH The Gyalsey and the 30 years of diplomatic relationship between JICA and Bhutan. It was also aimed to help preserve and promote the culture and tradition as well as to improve the livelihood of the Geney community. The festival had different mushrooms on sale, food stalls and cultural programs. The awareness programs on mushroom nutrition and poisoning were also held. Mushroom is the major source of cash income for the Geney farmers.

Highlights of 2016



Experts discussed Zoonotic Influenza

August 29-31, Paro: Sixty-nine participants from Bangladesh, Bhutan, Cambodia, India, Indonesia, Japan, DPR Korea, Lao PDR, Mongolia, Myanmar, Nepal, Thailand and Vietnam gathered for the Asia-Pacific Workshop on zoonotic influenza. They discussed issues and way forward for better surveillance, prevention and control of zoonotic influenza through One Health Approach.

The influenza, if it becomes pandemic, is risky to both human and animal health. One Health is increasingly recognised as a cost-effective way to deal with emerging diseases at the human-animal-ecosystems interface.



Bhutan joins AFoCO Agreement

September 13: The Ministry for Agriculture and Forests and the National Environment Commission signed the agreement on Asian Forestry Cooperation Organisation (AFoCO) in Seoul, Republic of Korea (ROK).

The AFoCO Agreement was adopted in September 2015. Though the Asian Region is laden with vast forest resources and home to vast species of flora and fauna, the globalisation and technological development is becoming an increasing threat to these natural resources and species. The ROK has taken a daunting step to promote and endorse a sustainable development in the Asian region through AFoCO.



Gangtey-Phobji declared as the third Ramsar Site of Bhutan

September 22, Wangdue: Gangtey-Phobji wetlands area in Wangdue has been included in the List of Wetlands of International Importance (the Ramsar List). This brings the total Ramsar site in the country to three. The other two sites are Bumdeling in Trashiyangtse and Khotakha in Wangdue.

The inclusion of the new site in the Ramsar list is the Department of Forests and Park Services' effort to conserve and promote the sustainable use of the important wetlands area that is home to the vulnerable Black-necked Cranes (*Grus nigricollis*).

Highlights of 2016



The first of Organic Certification

October 10, Thimphu: The Bhutan Agriculture and Food Regulatory Authority (BAFRA) certified 'Rangshin Sonam Detschen' a farmers group of Khatoed geog, Gasa as Organic Group. BAFRA inspected and assessed around 25 acres of farm land owned by 50 members, who have jointly applied for organic certification for potato and garlic. They were assessed in accordance with the Bhutan Organic Certification System (BOCS) Guidelines 2013. This is the first case of organic certification and the certificate will be valid for one year. It will be renewed if the minimum requirements are met.



World Food Day celebrated at Laya

October 16, Gasa: The World Food Day was celebrated at Laya. It is observed every year to mark the foundation day of FAO. It aims to heighten public awareness and educate people on the efforts made by FAO on the world food problems and to strengthen solidarity in the struggle against hunger, malnutrition and poverty. To ensure food and nutrition security and poverty alleviation, WFD this year celebrated a theme "Climate is changing Food and Agriculture must too." As a part of the celebration, various prizes under different categories were distributed.



First Royal Highland Festival at Laya

October 16-18, Gasa: His Majesty The King attended the first Royal Highland Festival in Langthang which is located at an altitude of 4000 masl. It was aimed to promote the tradition and culture of the highlanders and bring them together to exchange values, knowledge and skills. More than 100 farmers from Bumthang, Gasa, Haa, Lhuentse, Paro, Thimphu, Trongsa, Trashigang, Trashiyangtse, and Wangdue exhibited various livestock products which were unique to their culture, tradition and ethnicity. Broadly three thematic areas of highlander's livelihood, culture and livestock technologies were covered among others.

Highlights of 2016



Bhutan is home to 96 Snow Leopards

October 23, Thimphu: There are at least 96 Snow Leopards roaming within the alpine regions of our country within the altitude range from 3920m to 6930m.

There are at least 31 in Jigme Dorji National Park, 17 in Wangchuck Centennial National Park, 9 in Jigme Khesar Strict Nature Reserve and 6 in Paro Division with few more individuals in other areas, revealed a nationwide survey carried out by a team of national professionals from Department of Forests and Park Services. The findings were revealed during the celebration of fourth International Snow Leopard Day.



Animal Nutrition Lab and Horse Ring in Bumthang

October 26, Bumthang: The new Animal Nutrition Lab at the National Research and Development Centre for Animal Nutrition will play the pivotal role in delivering effective laboratory services through analysing and testing all types of livestock feeds in the country. It was constructed with a budget of Nu. 6 Million from the Government of India (GoI).

Further, a horse ring to train horse for riding and tame for easy handling was inaugurated at the National Horse Farm, Nasphyll. The GoI provided Nu. 0.9 Million to construct the ring.



Agriculture Conference 2016

November 7-10, Thimphu: The Agriculture Conference 2016 highlighted the need to improve agriculture programmes implementation efficiently.

Various presentations were made focusing on program implementation arrangements whereby they discussed the planned 11th FYP targets, resources, challenges and ways forward for commercialisation and intensification of field and horticultural crops, agriculture infrastructure, research and support services.

The conference provided a platform for the agriculture officials to reflect their achievements for the past three years of the planned period. This further helped them to align their plans and activities to achieve the target set for the 11th FYP.

Highlights of 2016



Dagana Territorial Division

November 8, Dagana: The Dagana Territorial Division was inaugurated at Dagapela by the Chief Forestry Officer.

Dagana has two Ranges and two Beat Offices under Tsirang and Sarpang Divisions respectively. The establishment of Territorial Division was the result of the OD exercise carried out in the country. With inception of the new Division, it is hoped that the delivery of public services would be much efficient and shortened.

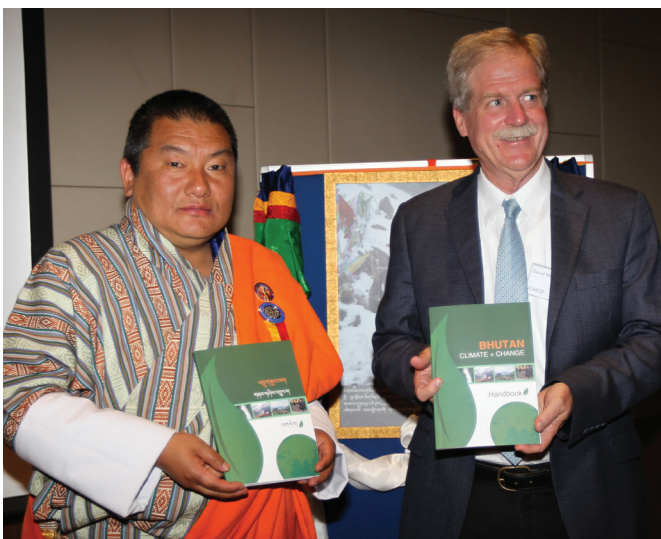
Dagana covers an area of about 1389 kms, with elevation ranging from 300 to 3800masl. It has 14 geogs with a total population of about 25,070.



New Divisional Forest Office for Pemagatshel

November 17, Pemagatshel: A new Pemagatshel Divisional Forest Office was inaugurated at Nangkhor under Shumar geog. On the day, Trashi Khadar was also offered to the new Chief Forestry Officer.

The office will benefit the people in receiving the timely and efficient forestry services. At present, Pemagatshel has two Range Offices, one each at Pemagatshel and Ngangla; three Beat Offices, one each at Dungmaed, Yurung and Nanong, and two Checkposts at Kherogompa and Nganglam. Prior to the inauguration, religious smoke offering and prayer for the well being of all was performed.



Handbook on 'Bhutan Climate + Change'

November 20, Thimphu: A handbook called 'Bhutan Climate + Change' was launched covering the basics on climate science, impacts, risk, mitigation measures and concerns related to Climate Change (CC) in Bhutan. It will serve as a guide for officials and others who wish to understand the CC in Bhutan.

At the community level, the handbook will help decision makers take the key steps required to plan for CC adaption and determine what strategic actions need to be taken. ICIMOD and Bhutan Media and Communication Institute jointly published the handbook.

Highlights of 2016



Bhutan State of Parks Report 2016

December 9, Thimphu: To commemorate the 10th Anniversary of the glorious reign of His Majesty The King, the Ministry of Agriculture and Forests launched a report, 'Bhutan State of Parks 2016'. A key highlight of the report was the use of the globally-accepted Bhutan Management Effectiveness Tracking Tool. It highlights the conservation value and management performance of the protected areas of Bhutan. The Department of Forests and Park Services will now measure all protected areas every five years, to track progress of conservation management and enable adaptive management prescriptions.



BIMSTEC Expert Group meets for the 5th time

December 28-29, Thimphu: Experts from Bangladesh, India, Myanmar, Sri Lanka, Thailand and Nepal attended the fifth meeting of the Bay of Bengal Initiative for Multi-sectoral Technical and Economic Cooperation (BIMSTEC) Expert Group on Agricultural Cooperation. They discussed on intensifying agricultural cooperation among the member states as a follow up to the commitment made by the BIMSTEC leaders at Goa in 2016. The BIMSTEC countries are primarily agrarian economies with a good share of GDP from agriculture, the key driver of economy in the region to address the challenges of food security.



MoU signed between BBP and FMCL

December 30, Thimphu: A Memorandum of Understanding (MoU) was signed between the Bhutan Biogas Project (BBP) and the Farm Machinery Corporation Limited (FMCL), Paro, a State Owned Enterprise. Under this MoU, FMCL will manufacture and fabricate biogas appliances and accessories which can be manufactured by FMCL while accessories and appliances which cannot be manufactured by FMCL will be imported from abroad for supply to the beneficiaries up to the concerned Geog Livestock Extension Centres as per their requisition.

RECOGNITION

Two Bhutanese receive Nature Conservation Award in Hawaii



Two Bhutanese officials were recognised by the global community for their exemplary contribution to nature conservation in Bhutan during the 6th World Conservation Congress held in Hawaii in September 2016. The two awardees were Rebecca Pradhan from the Royal Society for Protection of Nature and Sonam Wangchuk from the Wildlife Conservation Division.

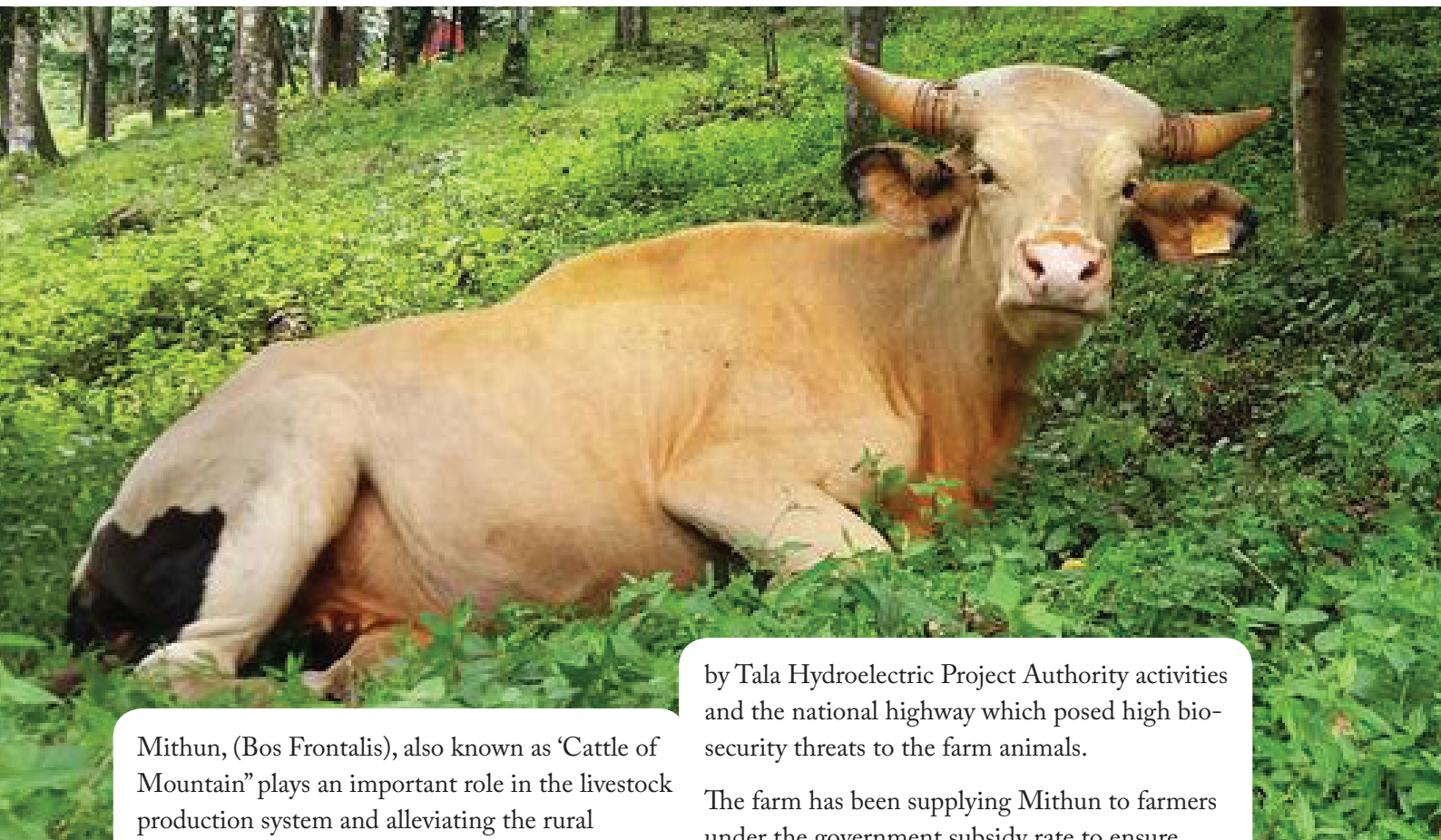
Rebecca Pradhan was bestowed the “Hotspot Heroes” by Critical Ecosystem Partnership Fund for her lifelong self motivated expertise and dedication in the conservation of the critically endangered White Bellied Heron in Bhutan.

Sonam Wangchuk was conferred the Fred M. Packard International Parks Merit award for his long years of outstanding service to wildlife conservation and protected areas management in Bhutan.



Mithun, a Nob (Jewel) for Bhutanese farmers

Ugyen Dorji, Pema Wangdi Sherpa,
Phuntsbo Wangdi and Tenzin Dorji
Regional Mithun Breeding Centre
Zhemgang



Mithun, (*Bos Frontalis*), also known as ‘Cattle of Mountain’ plays an important role in the livestock production system and alleviating the rural livelihoods. It is an indigenous species producing good quality progenies that enhances the farmer’s economic potential.

In Bhutan, farmers consider the Mithun as a Nob (Jewel) as it highlights the age old practice of farming community. People prostrate when they see it for the first time. According to the records, the first generation of Mithun is very important such as Jatsha (male) for draught purposes and Jatsham (female) for milk which contains high percentage of butter and fat.

In order to preserve this breed, a Mithun Farm was established in 1977 at Wangkha, Chukha with a mandate to produce, procure and distribute purebred Mithun bulls to the farmers of 14 Dzongkhags of west, central and east central regions. It was shifted to Wangdigang, Zhemgang in 2006 due to the encroachment of pasture lands

by Tala Hydroelectric Project Authority activities and the national highway which posed high bio-security threats to the farm animals.

The farm has been supplying Mithun to farmers under the government subsidy rate to ensure its preservation and maximise population and progenies. They also supplies young Mithun bulls to run as a nucleus Mithun mother farm. Since 2007 till date, the farm has supplied 137 numbers of Mithun to various Dzongkhags mainly for breeding purposes. This shows that the number of Mithun in the country is increasing gradually and indicates that our farmers have full faith and respect for this breed.

Mithun require a specific natural habitat with sufficient dense wood forests, gentle slopes and water sources away from human settlement. Keeping this in view, the farm covers an area of 1628 acres with abundant forages for free ranching of the animals. The efforts have been made to develop improved pasture through proper land management practices and planting fodder trees.

The rearing process for Mithun is likely to be based upon proper care and attention from the owner. Its economic potential cannot be measured by simply looking at their performance. They should not be compared with other breeds of animals in improved or intensive management. They should be examined respecting their purpose of selection and be valued on their own environmental conditions.

Mithuns are reared under free-grazing forest areas with additional housing and feeding facilities constructed using locally available materials. Occasionally, the female Mithuns are brought back to the shed prior to parturition for safety and hygienic reason during calving. They are sent back to the forests post partum for free grazing.

Mithuns are also trained to come to the shed at a particular time every day by providing little bit of concentrate feed and common salt which help us to supervise and provide medication to the animals. Individuals are provided an opportunity to look after the individual animal regularly to ensure discrepancy or disorder. The supervision of individual animals, additional feeding, watering and medication are done in the evening.

When abundant fodders are available, the salt and mineral mixture are fed to the animals to avoid mineral deficiency. During the fodder lean season, additional concentrate feed fortified with salt and mineral are provided to maintain their optimum performances. The drinking water for Mithun

should be abundant within the grazing area. The actual drinking water requirement for Mithun is approximately 9% during winter and 12% during summer of their body weight.

Similar to cattle, Mithun is a poly-estrus animal. The healthy adult female Mithun show repeated estrus cycles at an interval of 19 to 24 days unless it is pregnant. Mithun breeds throughout the year and no definite breeding season has been observed. The length of gestation period, service period and calving interval in Mithun varies from 270 to 290 days, 50 to 100 days and 350 to 400 days respectively.

Mithun bulls become mature to breed at 3 to 4 years of age. They are supplied to the clients at the age of 1-2 years for easy handling and adaptation to new environmental conditions.

In many other countries, Mithuns are reared for the meat purposes followed by milk and leather. Its meat is considered to be more tender and superior over the meat of any other species.

The Nob is seen in all the Dzongkhags having abundant forages and away from the human settlement. However, with the increasing human settlements and gradual denudation of free range areas, this breed may need further intervention to balance its proper management and conservation for the future. The Livestock Statistics 2015 states that Bhutan has 742 nos. of Mithun with the highest nos. of 128 in Samdrupjongkhar.



CHUZAGANG COFFEE:

From Beans to Brewing

Tashi Dawa, Chuzagang geog, Sarpang

Overcoming the earlier perceptive to consider coffee beans as an ornamental plant with red berries rather than extract acting home coffee, Chuzagang in Sarpang now has more than 1000 coffee plants of which half of them are bearing fruits. The variety in Chuzagang is Robusta coffee plant, which is originally from Belgian Congo of Africa.

The story of how coffee came into existence in Chuzagang is known to all through our earlier issue of *Sanam Drupdrey*. Now, with few more years of additional experience, we would like to share how we can produce home coffee or rather, how we produced home coffee in Chuzagang.

Some basic tips

Coffee berries are picked when they ripen to a bright deep red colour, though there are a few cultivars that ripen to a deep yellow colour. The coffee or 'green bean' lies within the fruit and is surrounded by the parchment membrane, pulp or mucilage and outer skin. So, it

involves removing the skin and pulp, and should be carried out as soon as possible after harvesting, certainly within 24 hours.

It is necessary to remove all green unripe and black overripe dry berries before pulping as these will reduce the coffee quality. The best home method for pulping is to squeeze each individual berry by hand. We can also soak the coffee beans in a plastic bucket and cover it. Fermentation may be complete in 24 hours depending on the surrounding temperature. If the coffee beans come clean and gritty then it is fine.

Coffee beans must be dried before the parchment can be removed and beans roasted. The simplest method of drying is sun. Later, the parchment on the coffee bean



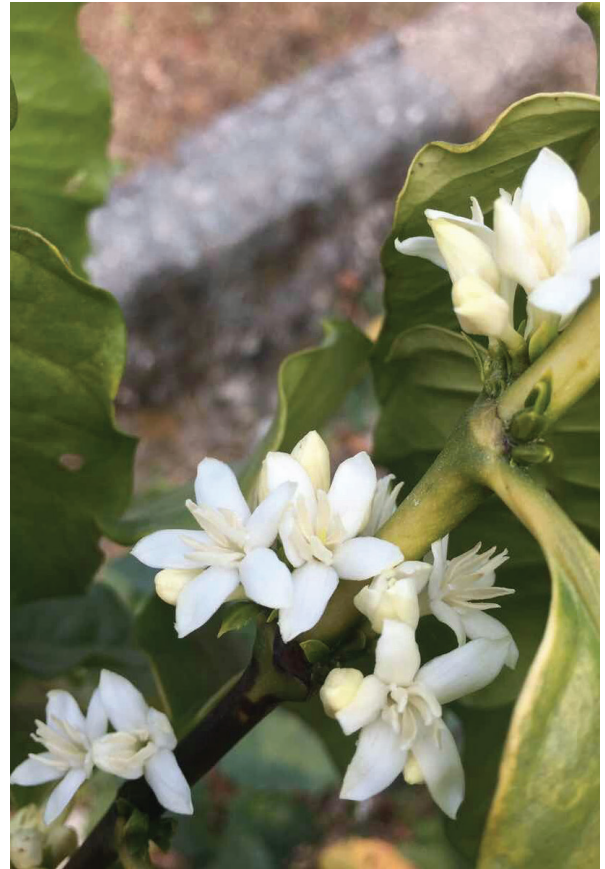
will dry to a pale straw colour and be brittle to touch. At this stage, test the beans dryness by removing the parchment by hand. If dry, the bean inside should be grayish blue in colour, hard and likely to break when bitten, if soft and chewy continue the drying process. The parchment comes off easy when rubbed between hands.

So, before roasting, remove the thin tough parchment layer from the beans simply by rubbing on wire mesh tray with bare hands or some sizeable plank. We can do it in a local pestle and motor (Lhew). We can also do it by partial roasting and later rubbing with bare hands or gloves on.

The green coffee beans must be roasted to develop the typical coffee aroma and flavour. After the coffee has been roasted for a short time, the colour will change to a yellowish brown which gradually deepens in colour as they cook. The colour and flavour of the beans will be influenced by the length of roasting, for example, light brown beans (a light roast) will have a weaker flavour than brown/black beans (a dark roast). The extent to which you will roast the beans depends upon individual flavour preferences. Over-roasting gives a burnt flavour. Adequately roasted beans should crack easily between the fingers. Once roasted, remove the beans from the oven, spread thinly and cool as quickly as possible with a fan, or the beans will continue to cook from their own heat.

Generally, literature states that whole bean coffee flavour are at its peak between seven and fourteen days after roasting, but some beans are best left even longer, up to 21 days. Green coffee beans can be kept fresh for 1-3 years, depending upon storage conditions.

Coffee roasting was tried on gas stoves at low flame in normal utensils. The production was



remarkable. It was also tried on open fire ovens and larger woks, in which we Bhutanese usually roast food grains for flour making.

The cooled coffee beans may then be ground to the desired extent. This is determined by the type of brewing extraction to be used. The finer the grind the greater the extraction of the flavour when the coffee is brewed. For example, literature defines: Espresso-very fine, Percolator-fine, Filter coffee-fine to medium and Pot infusion-medium to coarse.

However, the best quality brew is obtained when using freshly ground beans. It is recommended to store roasted beans in an air tight container in the refrigerator and grind the required amount just before use. Enjoying coffee made from freshly roasted beans is one of the major driving factors



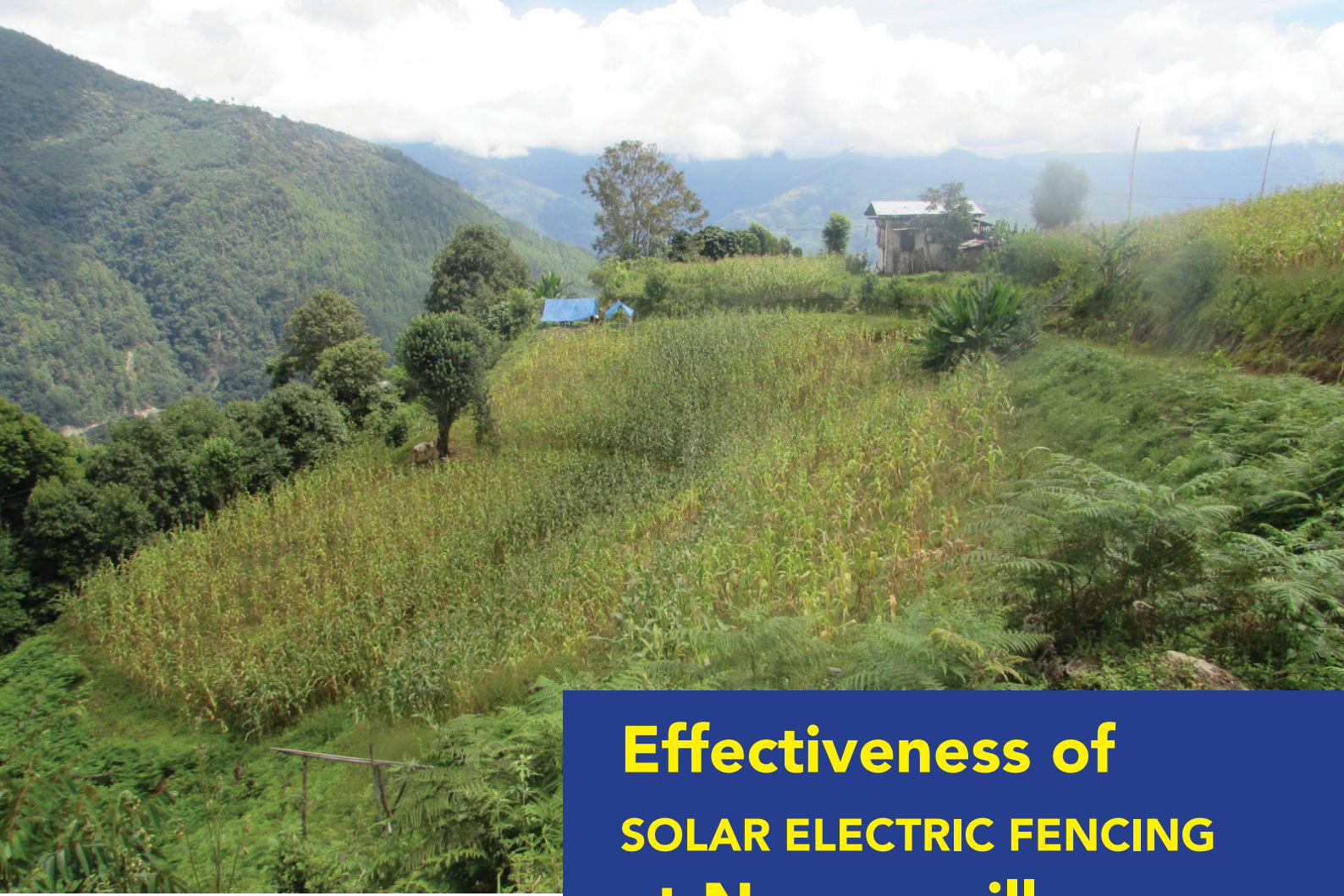
in the popularity of home roasting. The attractions are four-fold: enjoying fresh and flavourful coffee, experimenting with various beans and roasting methods, perfecting the roasting process and saving money.

In Chuzagang, the coffee beans were ground in normal table grinder which produced quite good product. Later, an electrical mini flour mill was available at the Regional Agricultural Marketing and Cooperatives, Bhur. We procured that and tried coffee making. And it was successful. Now, we are into the final step of labeling and packaging for the market. We can market as fresh green beans as well as fresh coffee suiting to the customers' choice.

Note that, at first, most farmers expected the coffee to taste like the commercial ones. Later, they were convinced that this is the true natural coffee in rural home.

In November 2016, in collaboration with the National Organic Program, a four kgs of green coffee beans were sent to Thimphu which was later tried at the Ambient Cafe. The result was remarkable. The true taste of rural coffee has finally found its way into the cups.

The Dzongkhag Agriculture Sector is still in the process of bringing out the rural coffee into the market to boost farmers' income in the south. Although there is limited production as of now, the necessary support is required to encourage coffee growers who is affected particularly by yearly loss of the beautiful cherries to birds and nature.



Effectiveness of SOLAR ELECTRIC FENCING at Nangar village

Jangchuk Gyeltshen, Central Park Range, Lingmethang

Nangar village is located in the midst of forest and it is one of the villages under Tsamang geog, Mongar which often faces problem of wild animals raiding their crops. Wild pigs, monkeys and porcupines are the wild animals which takes the share of their hard works. These had led to the cause of human-wildlife conflicts in the village. In order to combat against this problem, Phrumsengla National Park and the Wildlife Conservation Division provided a 4.3km long solar electric fencing to eight households which was completed in February 2016.

After the completion of fencing, Nangar Solar Electric Fencing Group was formed, bylaws framed and handed over its management to the Nangar community in July 2016. In order to assess the effectiveness of the fencing, the efficacy study was conducted by the Central Park Range Office, Lingmethang. The outcome of the study is expected to disseminate information on success and future challenge of solar electric fencing in the park.

During study, one member each from the eight households were randomly selected and interviewed using prescribed questionnaires to obtain information on before and after the installation of the fencing. GPS and Google Maps were used to locate the study site.

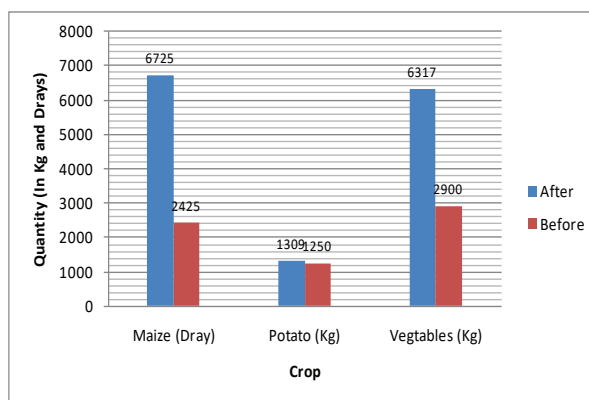
Results and discussions

1. Increased in cultivation of land for growing maize

Maize, potato and vegetables were the crops grown by the farmers. After installation of solar electric fencing, there was an increase of 0.50 decimal of land for growing maize, increased in growing vegetables to 0.8 acres. Prior to its installation, the farmers have grown maize only in 19.50 acres of land. There was decrease in potato cultivation after the installation of fencing since potato is not a priority cash crop for them.

2. Increased in crop yield

The installation of fencing saw increased in crop yield due to expansion of land brought under cultivation and the effectiveness of the fencing wherein farmers have not lost their crops to the wild animals. Maize yield increased from 2425 dreys to 6725 dreys, potatoes from 1250kgs to 1309kgs. Even the growing of vegetables was increased from 2900kgs to 6317kgs.



Crop yield before and after the installation of fencing

3. Increased in income generation

When calculated in monetary form, it is estimated that there is an increased in income generation of 73% after the fencing installation of eight households. The income from maize before installation was estimated to be Nu.2, 42500/- and after installation is Nu.6, 72500/-. The average annual income generation from the sale of maize for each respondent is estimated at Nu.30312.5/- and for potato at Nu.15625/-. After the fencing installation, the farmers were able to earn more income from the off farm activities like contract work and working as labour for others.

4. Drastic reduction in crop raiding by the wild animals

Wild pig is rated as top most wild animals that raided crops before the solar electric fencing followed by monkey and porcupine. After the fencing, there were no incidences of crop damage by wild pig instead six respondents have reported monkey entering into the field by climbing on the wooden poles and some enters from below the GI wire. They made attempt only once and did not return afterwards.

5. Reduction in crop damage by cattle

Crop raiding by the cattle was reported to have reduced due to the installation of fencing. The cattle were not even dared to go near to the fence due to fear of electric shock.

6. Reduced in hardship for guarding agricultural crops

Before the installation of fencing, farmers were engaged in guarding the crops both at day and night. They have to remain awake throughout the night to keep away wild animals from their agricultural fields. They have to waste resources like firewood, torch batteries and most precious the time. Now, the farmers need not have to guard and their time is spent economically.

7. Reduction in collection of local materials for fencing

Large bamboo, wooden poles and live fencing were the local materials used before the installation of solar electric fencing. Live fencing includes *Jatropha* sp. and *Brugmansia* sp. In a year, 200 numbers of large bamboo, 200 numbers of wooden poles and 70 numbers of live fencing were used for fencing their agricultural fields. Households 1, 2, 6 and 7 did not use any local materials for fencing since all their fields are located in the middle.

8. Prevailing crop guarding practices

It was observed that different respondents were involved in different guarding practices. Burning fire and cutting bushes around the agricultural fields were intended to avoid crop damage by the porcupine and wild pigs where as guarding during the day and placing of dummy tiger were practiced to prevent raiding of crops by the monkey. Guarding at night and setting of traps were practiced to keep away wild pigs.

Solar electric fencing for Nangar has immensely benefited the community in preventing their crop depredation by the wild animals. Their livelihoods have been improved and is expected to improve further through earning income from the sale of crops and working on the off farm activities. It is believed that in future the community would earn more and their food self sufficiency would be ensured. Human-wildlife conflicts are also expected to reduce. If the solar electric fencing is provided to the rest of villages in Tsamang, then we would see that there would be further reduction in human-wildlife conflicts and simultaneously increased in food self-sufficiency and income generation.





GALS containment program- *A Success Story*

Dzongkhag Agriculture Sector, Mongar

The outbreak of the Giant African Land Snail (GALS) was first seen in and around Gyalposhing in Mongar in 2006 which was left unbothered. As a result, in 2010, its population increased frighteningly. They were seen spread all over town and residents in Gyalposhing. The roads were flooded with snails especially during rainy season creating unhealthy surrounding to the pedestrians and vehicles. It was an endemic nuisance to the people. It entered kitchens, scavenged on kitchen gardens and waste. It was an epidemic kind of things appearing during the dusk and early hours of the day.

Perceiving the pest risk, the National Plant Protection Centre jointly with the Gyalposhing local communities, Gyalposhing High Secondary and Primary Schools, RNR sectors and Agriculture Research and Development Centre, Wengkhar carried out awareness campaigns. They collected and destroyed the snails to reduce and eradicate it. Chemical like herbicides were also sprayed as part of control measures to avoid infestation to agriculture and forest areas, and

cause human health and environmental hazards. The campaign helped to minimise its population for a couple of years. In 2011 and 2012, GALS did not increase due to unfavourable weather conditions and effect of mass handpicking and destruction in 2010.

However, the situation changed in 2013, the two years gap have offered ample opportunity to multiply and exploded its population beyond unbearable as it lays 400 to 1000 eggs in one year as per the literature. People could not even walk along the road and plying vehicles crushed on its way. The drains were packed and garbage pits were found full of snail feeding, creeping into the house and sheltering hanging on Melia trees around.

Since the GALS population significantly increased and realising the alarming impact, the Department of Agriculture (DoA) provided a budget to conduct mass campaign involving the people of Gyalposhing and Lingmethang, Schools, Kurichhu Hydro-Power Corporation,

BAFRA, RNR sectors and Hospital. Prior to the campaign, local communities were briefed on snails' biology, habitats, foraging habits and risk.

The two days mass campaign had collected and destroyed almost 8000 kgs of snails by dumping and salting in the pit. The shrubs and bushes were cleared and sprayed with herbicides to destroy its habitat and detach the food webs.

Since then the DoA entrusted the responsibility to the Dzongkhag Agriculture Sector to continue the GALS containment programs. A national stakeholder workshop was also convened to develop strategies to contain and eradicate the GALS which decided to go with hand picking and dumping basically of snails. The workshop also decided to deploy collectors and inform volunteers that Nu. 30/kg is paid to the collectors. The setting up the regulatory or quarantine check points at strategic location to control the spread of GALS to non infested area was another important strategies agreed among the stakeholders.

Containment and Eradication Method

The most common and practical method to contain and eradicate snails is handpicking and destroying them by burying deep into the pit, slashing and spraying Glyphosate to clear off the weeds-bushes to destroy snails breeding, hiding and feeding habitats.

GALS starts appearing in May and continue till November. They are active during rainy or wet days, thus collections needs to be planned when snail are active.

Towards this, the sectors and the Gyalposhing Throm Thuemey informed every individual about the burying of snails but how to go about was a problem. The details of collectors and amount collected had to be maintained for payment for which some youths were deployed on muster roll basis. For example, to determine the collection quantity, the weights have to be taken and recorded so that payment is made accordingly. The youths went door-to-door to weigh the snails and transport them to the dump site. The vehicles were hired for transportation of snails.



The workers were provided mask, gum boots, gloves and rain coats as part of the safety measures. Although the instruction was to pay Nu.30/kg but to ensure the continuity of the containment program till it is eradicated, Nu.25/kg was paid for collection. As a part of the religious measures, laying of Tsa Chhu Bumteer was also performed.

The sector also incorporated some budget in the Climate Change Adaptation Program (CCAP) in 2014-2015 annual plan as there was no confirmed fund against the GALS containment program.

Outcome of Containment Program

With fund from CCAP, the sector and community managed to collect approximately 30 MT of snails for destruction. The achievement was great and the places become clean except in few areas. The GALS population around town drastically reduced. The GALS become like Yartsa Goenbub in Gyalposhing to the pickers.

However, due to uncertain budget, the containment program have remained in hold in 2015-2016 which might lead to increase in GALS population and efforts put in for past two years would have no output.

Problems and Issues

The most labourious part of the handpicking method was to search snail eggs or juvenile snails that are buried in the vegetation or grass cover.

GALS hide under stones, rubbish and vegetation cover and it is difficult to locate them easily during day. The ones underground or hiding are difficult to hand pick which increases the risk of multiplying its population. Lack of fund support is a restriction for the program to accomplish the objectives.

The GALS containment program at Gyalposhing will go a long way and huge investment will incur while referring to outside country's experience. Continuity of the program is felt important in such kind of eradication program, therefore, it is important that the DoA and NPPC revisit the strategies and come up with other effective measures.

The main lesson learnt from the program is that one or two years of hand picking and destroying the snails is inadequate to eradicate them. An intensive thorough hand picking is necessary to ensure that snails are eliminated from the infested areas so that it is not spread and build up its population.





Mongar Farmers contribute to Electric Fencing bringing better results

A case of electric fencing in Mongar, Depong, Chali and Tsakaling geogs

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Introduction

With the popularisation of fabricated electric fencing, farmers request for the technology under development support fund is increasing. Although the promotion of electric fence technology is on a cost sharing mechanism in which the programs provide energisers, charge controllers, insulators, wires and other accessories which is imported and farmers contribute labour, local materials and carry out periodic maintenance. The increasing request from farmers has put enormous pressure on the development support programs.

The cost on development support estimated at about Nu. 35,000 per km vis a vis increasing request is not only unsustainable to fulfill all requests. Since cost sharing mechanisms are prioritised for community based establishments

to encourages them establish fence and manage jointly to cut down cost. However, there are also chances of arising problems such as communal disputes and poor post establishment interventions. Land area coverage, location of field either at the periphery or in the middle also affects in equitable contribution of labour and maintenance cost. Thus many fences end up damaged, left without care despite positive impact on protecting crops and contributing to livelihood security.

Therefore, in view of the limited funds and to meet the increasing request for electric fence, the Agriculture Research and Development Centre (ARDC), Wengkhar explored the possibility of increasing the farmers contribution.



Implementation Approach

The centre in 2015 in addition to continued works was assigned coordination of electric fencing works in four geogs of Drepong, Mongar, Chali and Tsakaling. With limited funding supports and having to promote in several places, the centre proposed for increasing farmers' contribution in electric fencing.

The local leaders i.e. Gups of the our geogs were called in for consultation where in firstly available resources to fund equipment and materials was explored. While some geogs such as Drepong had kept some allocations under the geog development grant (GDG), most did not have adequate and reliable source of fund. The centre had some allocations for purchasing energisers with support from the Market Access and Growth Intensification Project (MAGIP). However, in any case these resources were not sufficient to cover the sites. The centre and the geogs began consulting communities requesting for electric fence to increase their contributions so that available resources are effectively utilised.

The consultation meetings began with an awareness program on the importance and benefits of electric fencing, guide to fence establishment, costs and the benefits and advantages of beneficiaries taking ownership over fencing and the time it would take for development support programs to have adequate funding if all materials were to be provided free.

A video developed by the National Plant

Protection Centre (NPPC) on electric fencing was also shown to reinforce and encourage them to take up the fencing technology. In order for equitable distribution of available resources, the consultations decided that all individual requests, isolated sites for fencing be funded fully by beneficiaries except for technical assistance in estimation and establishment to be provided by the centre and the geog extension. It was also decided that the available funds from GDG and MAGIP be used for supporting at least energisers and some top up for imported materials. For those beneficiaries of at least more than four having land adjoining each other were considered suitable for shared fencing. This seemed to be the way forward and agreeable to most and thus began sorting out the requests. Some farmers came forward and agreed to the proposal.

The interested households who came forward to self-fund their fencing were given attention and provided hands on training on installation of electric fencing including safety measures, monitoring and maintenance of the fence. The technical assistance in surveys and estimation works began on a first come first serve basis. Gradually more and more farmers came forward. The centre facilitated procurement of energisers, charge controllers and solar panels from the suppliers identified by NPPC. Other materials such as wires, insulators, earthing materials and nails were procured by farmers from hardware shops based on the estimates prepared by the centre.

Outcome and Lessons Learnt

The cost sharing mechanism was implemented in groups or community willing to fence jointly. These were mostly farmers whose fields are in one location suitable for joint fencing and self-funding was applied for individual household or those farmers whose land is located in isolation. A total of 101 households managed to fence a total of 20.3 kms of electric fence covering an area about 323 acres in three geogs. Of the total cost of Nu. 761,655.41, about 90% of the cost was borne by the beneficiaries while 10% was the contribution from the development support funds.

Electric fencing through increased financing from beneficiary farmers though with much difficulty has brought immediate benefits to the community. A sample survey conducted at a later stage after fencing showed that apart from protecting the crops, there is an indication of reverting fallow land into cultivation. Production has increased mainly from protection as well as through double cropping which was not followed earlier. Farmers reported that their annual income from maize increased by almost 80% mainly through double cropping and crop loss to wild animal damages has reduced by almost 90%.

Appropriate consultation and sensitisation on the benefits of electric fencing helped in convincing farmers. Immediate attention towards those coming forward encouraged others to follow. Moreover, it has been observed that self-funding initiative instills sense of ownership and fosters

mutual trust amongst the members. Further, fencing installed through self-funding mechanism is more likely to be sustainable as farmers took better care.

Attempting for self-funding or increasing the beneficiary contribution in electric fencing should only be tried in communities which are fairly known to be better off socially and economically. This can be either indicated by their social well being or simply through their access to market and commercial farming activities.

All the identified four geogs were communities engaged in semi commercial farming activities with most of them supplying farm produces to the local market in Mongar. Thus the above approaches may not result equally in other communities which are socio-economically not well off, for which development support still continues to be a major factor in promotion of electric fence to reduce crop loss to wild animals.

Hence, the cost sharing mechanism with an average unit cost of Nu. 24,000/- certainly have an advantage in terms of reducing cost as compared to self-funding mechanism with an average unit cost of Nu. 37,000/km. However, the cost savings in cost sharing mechanism is often negated by disadvantages of poor post establishment management in groups as compared to more sustained fencing carried out individually. Additionally, scattered settlements, small land holdings, location of land and communal disputes are other major obstacles in prompting electric fencing through community based approaches.



New high yielding MUSTARD varieties introduced

Deki Lhamo, Agriculture Research and Development Centre, Yusipang


Among the oilseed crops cultivated in the country, Mustard (*Brassica campestris*) is the most predominantly cultivated. It is grown as a second crop after potato at higher elevations and after maize and rice in the mid and low altitudes. Farmers generally consider mustard as a secondary crop and hence do not give adequate attention.

The crop is cultivated during dry winter season on marginal soil and thrives on residual nutrients applied to the main crop. The current national average yield is 300 kgs/acre. The overall target of the National Oilseed Commodity Program in the 11th FYP is to increase the domestic edible oil self-sufficiency from 6% to 9 % by 2018. In absolute terms, the production of mustard will have to increase from 1332 MT to 2000 MT by 2018.

Considering the importance of country's edible oil requirement, the key strategy adopted by the Department of Agriculture is to achieve the target through promotion and introduction of high yielding varieties from the regional countries. Therefore, BARI Sharisha 14 and 15 from Bangladesh Agriculture Research Institute (BARI) and Lumley Tori 1 from Nepal Agricultural Research Council (NARC) were introduced in the country through the national oilseeds program. The program focus to supplement the household oil self-sufficiency, target potential growing pockets, address the seed supply and technology gap and utilise the existing oil expellers.

The varieties from Bangladesh were tested in lower elevation (300-1400masl) both in dry and wet land, while Lumley Tori 1 was tested in high





and mid elevation (1500-2600masl) after maize under dry land condition. They will be considered for release if they adapt well in our environment. The native local mustard variety was also promoted for high altitude region like Gasa.

The varieties were assessed through field day, participatory variety selection, crop cut, and informal interviews with the growers. Both varieties Lumley were tested for two consecutive cropping seasons and farmers are convinced with the performance of the new varieties. Farmers have widely preferred these varieties for grain size (bold) and its grain colour (Yellow) of BARI Sharisha 14 and 15. The result of oil recovery test conducted at the Agriculture Machinery Centre (AMC), Paro using farm managed 6 bolt expeller showed little above 30% in all the varieties.

Seed production of these introduced varieties and crop promotional program at the identified sites have encouraged some of the farmers to revive mustard cultivation. With the introduction of these new varieties, farmers have now options other than the old M27 variety. Farmers were positive with the adaptation of the new variety and are encouraged to upscale mustard cultivation. However, the farmers also expressed their concern of not having oil expellers at suitable location. Nu.18/- is charged to process a kg of mustard which was raised as a constraint in mustard cultivation. Given the future prospects of expanding mustard cultivation, support of oil expeller was seen to be fundamental.

It was noticed that easy availability of cheap and non-pungent oils in the market is the key reason for the general decline in farmers interest to cultivate mustard. Farmers generally consider this as a secondary crop to the main crops. In addition non-availability of high yielding varieties, lack of oil expellers are also hindrance to oilseed production.

As per the updated records, AMC has supplied 234 oil expellers, covering 93 geogs in 20 Dzongkhags. There are three different types of oil expellers with varying oil expelling capacities. Location and spread of the oil expellers need strategic placement since distance to oil expellers is a concern for the farmers. Importantly, socio-economic factors such as the non-availability of labour, crop ravages and low returns has greatly impacted mustard cultivation thus created the dependency on imported oils.

Across the region, the new varieties are successfully being evaluated and in general the performance of the new varieties from Bangladesh and Nepal seems promising. Farmers are adapting the new varieties and appear encouraged to upscale mustard cultivation. However, cardamom cultivation in dry land is a major threat for up scaling mustard in potential areas. In addition, recently introduced super cereal Quinoa is likely to compete for dry land.



Mongar farmers make use of Fallow Wetland

Dzongkhag Agriculture Sector, Mongar



The wetland normally is understood as a land area that is saturated with water either permanently or seasonally or land consisting of marshes or swamps but in our context it is terraced land especially used for cultivation of paddy, a staple food. The development of wetlands for agricultural production has been considered important for rice based production system. Since the start up of the development plan, the Government had been supporting the farmers in various forms of tools and cash till 1980s, thus there is large acreage of wetland across the country.

However, most of the once productive wetland is being conquered and left fallow due to lack of reliable water source and urbanisation. This has threatened the rice production to provide sustainable food security in the country besides domestic production meeting 40% of the total rice demand and imports more than 50% from India. The national rice demand is growing by 3.7% which is faster than the rice production (MoAF/IFPRI 2010) and shall be difficult to feed the present population growth rate of 1.9%.

With losing of fertile land to urbanisation and yearly increase of fallow land impacts the food sovereignty along with losing of preferred local paddy diversity.

Likewise, Mongar has many acres of wetland being left fallow although many other crops can be grown quite productively on wetland. On reviewing the issue, there are unending list of problems reported by the land owners such as lack of reliable water source, poor irrigation system, land fragmentation, absentee land owner, crop predation by wild animals and farm labour shortages.

Several attempts at the Dzongkhag level have been made to bring back those fallow productive lands to farming with support from allied agencies but success depends on the commitment of farmers. It is up to them to keep going as saying goes, “You can take horse to the river but you cannot force it”, so we are helpless and our effort of coordination earns no credit. Some even reported that farming is not as profitable as that of off farm activities in terms of earning income which is in fact true. We courageously explained to them that off farm activities shall not be as sustainable as agriculture farming.

The strategies that are more friendly and beneficial do well at facilitating to move things forward. The initiatives and push system does work in some places like Drepong where we were able to revert 50 acres at two locations Drepong and Okang which were left fallow for almost nine years.



Towards this, the Dzongkhag Agriculture Sector and the geog administration decided to endeavour into construction of a 2km long irrigation channel though there is no perennial water source but it is well fed by monsoon rainfall.

The fund from the Global Climate Change Alliance project was earmarked for the scheme. The construction was executed through contract and it is of both closed and open system depending on the topography of the land. The water user association was also formed to foster the ownership among the users and maintain the water source and protect it from vandalism. The group were educated and briefed on the National Irrigation Policy 2011, the Water Act of Bhutan 2011 and the Water Rules and Regulation 2014.

With the irrigation channel, the seeds and technical support in place, farmers have reverted 50 acres of fallow wetland in 2015-2016 in Drepong involving 44 households. The government policy of food self-sufficiency and land acts were other distinctive and motivating factors in successfully bringing land into farming.

With 50 acres of land into production, it is expected to produce approximately 50MT of rice to national food basket keeping in mind the minimal productivity of 1MT/acre despite the fact in productivity variation due to unfavourable weather condition and pest outbreaks. However, it will be ensured that farmers continue

the cultivation unless there are unavoidable circumstances.

Meanwhile, it is a different story in case of Wengkharpas in Mongar. Several attempts have been made from the Dzongkhag and the Agriculture Research and Development Centre, Wengkharr to bring the fallow wetland into cultivation through irrigation channel construction, input support, free farm machinery prop up and other necessary supports. The success is back to square one and we were left powerless. Farmer held no accounts and responsibility to continue farming and do not value the initiatives and the policy.

There are concerns that most preferred local paddy cultivars such as Asu, Tashigang, Ngera and Balingmin Bara in the villages would disappear one day.

Since the shortage of water is one of the main reasons for not being able to cultivate paddy in these villages, they feel it is high time that the Government should explore alternatives to make water available to the farming communities. The one promising intervention or the technology would be constructing reservoirs and dams to trap small perennial stream compromising the flora and fauna downstream for the time being. The monsoon rain is also uncertain for the farmers to undertake paddy farming.



Tashi Gyalmo, RDC-OA, Yusipang

TENSUNG AMSU PHENDEY TSHOGPA GEARS INTO VEGETABLE PRODUCTION

The Tensung Amsu Phendey Tshogpa (TAPT) is an association of the wives of the army personnel. With the sole motive of engaging the women in high income generating activities like the cultivation of high altitude vegetables, medicinal and aromatic plants, the group geared into the initial phase of the mini-piloted project with technical assistance from the Research and Development Centre for Organic Agriculture (RDC-OA).

The project in its initial phase intended to cover around 270 families, majority consisting of women and over a thousand children and dependents. It was also initiated to address social issues like domestic violence, absence of enabling home environment for children, financial constraints and the dilution of family values that are caused by financial pressures on income earners.

Based on the request from the TAPT, a team from RDC-OA visited the Royal Bhutan Army Camp in Damthang, Haa in March 2016 to provide them technical backstopping.

Damthang is situated at an elevation of 3035 masl. Yaks grazing over the patchy dry pastures in the vicinity are common sight. The peaks

enclosing the valley remained clad in blankets of snow even in March. The place embraced us with a welcoming note of chillness and serenity.

A theoretical presentation on the basics of vegetable cultivation was done which was attended by around 130 women and a few male. It highlighted nursery raising (under poly-tunnels to enable early nursery raising under extreme cold conditions and the ensuing crop hitting the market much earlier as well as under normal conditions), the critical operations required by specific vegetable crops, apt management practices of tomato cultivation emphasising on pruning and staking requirements through pictorial presentation and videos.

A presentation was also made on simple post harvest management of vegetables including the simple technique of drying and preserving the surplus produce, if any, to be consumed during the lean season. They were made to understand a simple technique required prior to drying called blanching. This simply involves immersing the sliced vegetables in hot boiling water added with a pinch of salt for a minute or two. This technique is known to have desirable influence in bringing an abrupt seizure to the enzymatic activity

which would otherwise deteriorate the quality of produce as well as help in colour retention. The subsequent discussion and question answer session was made even livelier and practical with the presence of representative from the Dzongkhag Agriculture Sector.

With financial support from the Department of Agriculture, the Dzongkhag also rendered their service in installing four green houses at the camp. Considering the huge expenses incurred for such protective structures, our next attempt was the practical demonstration focusing on the proper usage of green houses. We also advocated on the additional advantage that they will reap provided such structures were put to optimum use.

To augment their level of understanding and enhance the practical applicability, the team demonstrated and guided the nursery sowing of many varieties of vegetables. The four groups (Dekhas) which they had been divided into were given training individually in view of higher level of comprehension and greater participation. The groups owned a green house each and for a greater degree of performance, they were made to compete amongst themselves in production and subsequent sale of the produce.

Except for tomatoes, which did not yield fruits of optimum size, all other vegetables performed extremely well. However, the centre will be looking into some of the drawbacks in the coming year. Their hard work was also counteracted by trespassing of cattle and wild boars which reaped quite a considerable portion of their vegetables planted outside, though in wooden fence enclosures. So we suggested them to request for the installation of electric fencing through the Dzongkhag.



The colony housing more than 1000 inhabitants now have more and easy access to fresh and varieties of healthy and organic vegetables produced by themselves. Despite their first attempt in large scale vegetable cultivation as well as damage inflicted by animals, the groups in unison were able to produce and supply vegetables worth Nu. 40,100/- to their mess.

However meager the income generated and trivial the tale of success may seem, there is still a string of encouragement to hold upon. The entangled note of challenges and setbacks to be slackened off with the gradual flow of time. The figure would have assumed linear ascend had it not been damaged by cattle and wild animals and the slightly elevated price margin in par to market price.

This is gratifying since it is in a way engaging the Tensung Womens' Group in a healthy practice. This also means the dwellers there can get quick and easy access to varieties of vegetables as well as enhance the per-capita consumption of vegetables which is far below the global recommended intake of 250-300g vegetable/person/day.

The camp having been situated far from the town as well as having quite a huge number of inhabitants, it is likely that the dwellers there of might lag far behind in the intake of nutrition loaded vegetables. Therefore, our aim in achieving

self-sufficiency in vegetable production at such isolated and clustered settlements was found to be on the positive side in the very first attempt. Though not a tale of grand success, it is the first step leaped for thousands more to ascend with the gradual flow of time.


The activity was not in the list of the planned activities, which would have imposed a crippling effect on its implementation for the activity wasn't budgeted. Nevertheless, with a little bit of adjustment and the limited available resources, and the provision of vegetable seeds from the Dzongkhag in addition to ours, we were in a position to impact the group in a positive way.

RDC-OA wish that similar approach and interventions could be replicated in other such places, especially army, police camps or colonies and monastic schools. One such place could be the police camp in Thimphu. There is a need to lend a helping hand in vegetable cultivation. There are many small patches of kitchen gardens, which

were not optimally managed. In addition, the place seems to be crowded with many infants and children in their critical growing stage for whom diet with proper nutrition is crucial. However, the cultivable area is very limited and an effort in identifying and allotting a separate area is deemed to be necessary if cultivation should ascend to the higher level.

If something like Thrimsung or Gaagdhey Aumsu Phendhey Tshogpa could be formed to take on board the same idea and practice, this would provide a huge leap in their nutritional requirement. In addition, the armed forces get free supply of all other items, except vegetables. So the lower income group might not be in a position to afford all varieties of nutritious vegetables. Thinking big and working on vegetable export is one thing but it is equally crucial for us to work on making healthy, antioxidant crammed vegetables available in sufficient quantity to each and every one with major impetus on the vulnerable section of the society.





Red Lentil:

A promising crop for Chuzagang farmers

Tashi Darwa

Chuzagang geog, Sarpang

Red Lentil (Musoori Dal) was once upon a time cultivated by a few of the Chuzagang farmers but later the practice faded away gradually. It was in 2103, the Climate Smart Agriculture of SNV and the Geog Agriculture Sector came together with a plan to reintroduce the lentil for so many advantages it has. Since then, Chuzagang came quite far with the promotion of Lentil.

Red lentil is a good winter crop which helps fertility of the soil. It can be grown at zero tillage with minimum farm labour. It also provides additional income and nutritional supplement as well as ensures the optimum utilisation of winter fallow wetland.

The program started with the two pioneering farmers, where one farmer was given 7kgs as he had access to irrigation and had an ideal field for the crop and the other farmer, only 3kgs red lentil seed. The lentil seeds were brought from India. The farmer who tried the maximum seeds failed due to excess water in his field. While the other farmer produced 70kgs of red lentil from

3kgs seed under extreme conditions. It was an achievement for 2013-2014.

In December 2014, upon the 70kgs production, an additional 15kgs seeds were procured and distributed among 10 farmers of Chuzagang and 16 from Umling geog. The program was further extended to Umling as per the farmers' interest but failed due to irrigation scarcity.

Nevertheless, Chuzagang farmers produced around 1000kgs from the seeds provided. Their savings for home consumption and seeds are unaccounted. They earned Nu.80/kg for the unpolished lentil. Some seeds were also distributed and promoted to other geogs in Sarpang.

In 2015, the number of lentil growers increased with increase in production due to the promising income it fetched at the prime time of the school year. Twenty one farmers of Chuzagang were distributed with 100kgs of lentil seeds covering almost 10 acres of wetland.

There was additional 473kgs of lentil worth Nu. 37,840/- from seven other farmers who were late in delivering the seeds, taking the figure up to a total of 1183kgs marketed figure worth of Nu. 94,640/-.

Therefore, it was confirmed that in March 2016, Chuzagang had produced about 1500kgs of lentil, including the savings for home consumption. Every year increase in production and marketing is encouraging for the growers and other keen farmers. The budget for the seed procurement was provided by the Department of Agriculture.

However, there have been few bottlenecks affecting the desired production such as the free cattle grazing into the vast fields during winter makes the lentil growers difficult to guard the crop. Others issues included the irrigation shortages, post harvest loss to bean weevil which is now being taken care by super bags and lack of lentil polishing machine. Nevertheless, red lentil have successfully become an additional crop for

Chuzagang while the geogs of Sarpang is picking up the pace.

Both geog and Dzongkhag at large is planning to establish a lentil cleaning and polishing processing unit for better market. We did tried once through local grinders but its finishing was not good enough. For the past three years, the production was focused on promoting and encouraging farmers to cultivate lentil to meet the demand. We all know that the market offers the imported musoori dal for Nu. 120/kg which can be replaced by our own home produced lentil and it may come cheaper and tastier.

The Dzongkhag have enough seeds saved for more than 150 acres in its fourth year. Some geogs like, Umling, Taraythang, Gelephu, Samtenling, Dekiling and Singye have their share and the old hand growers have theirs seeds ready. So, there is no stopping. We are confident to produce enough to meet the peoples' demand.



Connecting PEOPLE WITH BIODIVERSITY

Letro and Pankey Dukpa, JSWNP

Jigme Singye Wangchuck National Park (JSWNP), the third largest protected area in Bhutan with an area of 1730 sq.km in central Bhutan forms the heart of Bhutan Biological Conservation Complex (B2C2). The park connects with northern and southern protected areas of the country's either directly or through biological corridors thus forming indispensable linkages for ecological connectivity.

JSWNP in itself forms a biological repository owing to its diverse habitats. From sub-tropical forests in the south to alpine highlands of Mt. Jowo Durshingla in the core of the national park, the park has a rich floral and faunal diversity which are of conservation significance. Besides there is diversity of communities residing inside the national park, including some of the Bhutan's first settlers, the Oleps of Rukha and Monpas of Jangbi.

Over 588 subsistence households reside inside the multiple use zone of the park in harmonious co-existence with nature. Since 1995, JSWNP have put in tremendous effort in conserving the natural resources without compromising the needs of the park residents and here we highlight some of the holistic conservation goals achieved by the park in 2015-2016.

1. Inventory and conservation of species

JSWNP boasts of having 39 species of terrestrial mammals and 12 of them fall under schedule I of the forests and Nature Conservation Act 1995. Amongst them are the charismatic Royal Bengal Tiger (*Panthera tigris*),

Himalayan black bear (*Ursus thibetanus*), Common leopard (*Panthera pardus*), Gaur (*Bos gaurus*), Musk deer (*Moschus moschiferus*), Red panda (*Ailurus fulgens*), Golden langur (*Trachypithecus geei*), etc. The park also recorded the presence of 285 bird species including the critically endangered White-bellied heron (*Ardeola cinerea*), 139 butterflies and 16 fishes which calls for inclusive conservation programmes in different habitats.

Between January-June 2016, intensive survey of herpetofauna was conducted in the western region of the park which covers over 40% of the total areas. We recorded the presence of 16 snakes, 3 lizards, 2 geckos, 2 toads and 8 frog species. Obtained from 13 transects laid on various micro habitats, this checklist is the first ever baseline on herpetofauna. Amongst the species recorded, Burmese Python (*Python bivittatus*) is listed threatened under IUCN Red List.

Musk deer is a key species that require conservation priority. Based on evidences, poaching of musk deer in the park is one of the primary threats for the species. In an effort to assess the extent of occurrence of musk deer in the prime habitats, we conducted an extensive sign survey and found that over 400 sq.km of musk deer habitat between the elevation ranges from 3000-4400masl. We mapped the potential habitats and recorded the coordinates of all the sites where poaching evidences were found which helps us in better planning of patrolling.

Meanwhile, the field survey works for Biological Corridor No. 2, connecting JSWNP with

Jigme Dorji National Park for preparing the first management plan is completed in a collaborative effort between JSWNP, Wildlife Conservation Division and Wangdue Forest Division. The park also have successfully installed two weather stations, one in higher elevation region (3959 masl) and another in a lower valley (1129 masl). Our park staffs are trained for regularly monitoring and recording the weather variables which will help us to identify specific and appropriate climate adaptation measures for the community living in the park

2. Enforcement of SMART to strengthen patrolling

Poaching is a serious issue which the conservationists need to combat. JSWNP being home to diverse wildlife, often we encounter poachers attempting to snare trap musk deer in the Black Mountains. Risk of losing tigers and Himalayan black bears are also higher considering its viable population in the pristine habitat and thriving black market in the region for animal parts which calls for regular patrolling. In order to switch from conventional patrolling method, all the frontline conservationists of JSWNP were trained on how to use SMART tool through rigorous trainings. We then, successfully enforced SMART patrolling in all the park ranges starting May 2016, becoming the second protected area to implement SMART patrolling in Bhutan.

The result generated from the SMART software shows that 21 frontline staffs of JSWNP have executed 19 patrols in May and June 2016 accumulating 54 patrol days. A total of 662.29 km stretch of forest was patrolled. Through the tool, the park also could produce animal distribution map by recording animal presence evidences. Most important of all, the SMART tool helped map the conservation threats like evidences of poaching and illegal harvestings. Such information has helped us in planning the patrols for curbing wildlife poaching and allocating limited resources.

3. Integrated Conservation Development Programmes for Sustainable socio-economic well-being of communities

The farmers of JSWNP often report rampant crop depredation cases. Resolving human-wildlife conflict (HWC) has always been a complex issue nationwide. Solar electric fencing, a locally fabricated method to guard the crops from wild animals through psychological barrier has now become the most sought method by farmers. The JSWNP management over the last few years have not only provided the people with materials but also trained them on how to install and repair the fences.

In 2016, the park has supported the installation of 7.55km stretch of fence in four different locations benefiting 50 households. Such interventions have greatly helped the farmers as they could harvest 100% without any lose. More people are coming forward to seek support either fully or on cost sharing basis. The works have been executed through collaborative effort between the park and communities with people themselves engaging into the physical works. A rapid assessment for HWC was also initiated in the park to understand the issue better.

The Nabji-Korphu Eco trail, first of its kind in the country then has proven successful. A similar eco-trail has been established in the park in Adha-Rukha region with home-stay approach of catering. In 2016, we have constructed two hot stone bathing facilities and conducted a thorough maintenance of the campsites and the 24km stretch trail between two major communities of Adha and Rukha. A visitor information signage was also constructed to offer first hand trekking guide to the visitors. It is a low altitude winter trek of 5 days and 4 nights. Adha Lake, the practice of smoke dried fish, besides their sedentary farming practices and way of living are the attraction. These activities will greatly impact on the socio-economic well being of the communities.

Meanwhile, the park also supported the schools and monastic institutions within the park with electric rice cookers to help reduce the fuel wood demand by them. A total of 24 rice cookers (20 litres) were distributed to 7 primary schools and 5 monastic institutions. Records with school show that 55 cubic metres of fuel wood are being consumed for every 45 children in a month at Jangbi School.

Conclusion

With numerous infrastructure developments throughout the country, the protected areas of Bhutan will significantly help in maintaining undisturbed pristine forest cover and would play a paramount role in conserving the endangered species. The Biological Corridors though critical for wildlife movement, its functionality would come to stake with pressure from increasing population and vehicular movements. Long stretches of BCs have already faced massive breakage due to road widening so conservation in the parks should not be compromised.

The human communities are integral part of the protected areas. Effective management of protected area would entail harmonious coexistence of the park residents with the nature. In JSWNP, while we give much emphasis on conserving the natural heritages, we also value the people's sentiments and their cultural heritages. Being subsistence farmers, park collaborates with relevant stakeholders in enhancing the socio-economic livelihoods of communities inside the park. This way we are building environmental conservation stewardship at the core of our park residents so that park and the people can have a harmonious coexistence for all the time to come.

Many of these success stories are achieved through the WWF funded project titled 'Intensive priority Conservation through Community participation for maintaining viable Biodiversity and Ecological Connectivity in B2C2 landscape.'



Musk Deer



Rehabilitation of Barren and Degraded Community Forest Land

A success story of
Dungkarling Community
Forest Management

Gem Tshering

Divisional Forest Office, Sarpang

Dungkarling Community Forest was approved by the Department of Forests and Park Services in 2004 and handed over to the 62 households of community forest management group (CFMG) members. The members are from Tuney Dangra, Khempagang, Kopchey, Mongar gaon, Rai gaon and Ghallay gaon in Samtenling geog. The forest has an area of 285.10 acres which comprises of barren and abandoned unregistered land.

Dungkarling has an area of 13 acres. It falls in the degraded and barren Tsheri land which once belonged to six settlers who later abandoned the land and left it as a state reserve forest land. The group members were overwhelmed by the CF initiative and 8 acres of barren land was converted to forest plantation in 2003 through labour contribution from the group members. This was in accordance to the overall CF management objectives which is primarily for its economical, ecological and environmental functions ensuring sustainable production of timber, other forest products and protection from soil erosion.

Before 1994, shifting cultivation or slash and burn agriculture (Tseri) was one of the main forms of agriculture, in the foot hills of southern Bhutan. In view of the mountainous terrain, settled cultivation constitutes only in a portion of the total cultivated land which is mostly confined to the valley lands and plain lands. In order to meet the growing food demand, the Tseri cycle

got shortened which resulted in the overall decrease of crop yield. Today, the scientists view shifting cultivation as environmentally destructive and a faulty land use practice having very low output-input ratio. So that was the main objective to initiate and establish forest plantation in Dungkarling.

During the initial establishment of this CF, quantitative resource assessment was not conducted in Dungkarling since the area was mostly barren. Only few scattered tree species like Simal (*Bombex ceiba*), Chelowne (*Schimawallichii*) and Seris (*Albezzia* species) were found. The CF was purely focused for plantation of commercial valued timber species and the management objective was to protect the landscape from landslides and promote regeneration as well.

After 10 years, during the final evaluation of the CF, there was a need to carry out quantitative forest resource assessment as the plantation has grown up and the barren area was covered with vegetation of Sal (*Shorea robusta*) Champ (*Michelia champaca*), Khamari (*Gmeliania arborea*), Teak (*Tectona grandis*), Panisaj (*Termanilia* species) and bamboos. Diametre at breast height was measured for the five species found in the plantation. The change in vegetation cover with the plantation was a big success for the community at large.

The quantitative forest resource assessment tally sheet for 8 acres of plantation

Species/Scientific Name and Suitability		Species diameter class					Total
		0-9.9cm	10-19.9cm	20-29.9cm	30-39.9cm	40cm+	
Gmelina arborea	Timber	-	-	3 nos.	1 no.	-	4
Shorea robusta	Timber	54 nos.	41 nos.	14 nos.	1 no.	-	110
Michelia champaca	Timber	29 nos.	41 nos.	29 nos.	7 nos.	-	106
Tecktona grandis	Timber	38 nos.	42 nos.	18 nos.	6 nos.	2 nos.	106
Terminalia species	Timber	1 no.	12 nos.	7 no.	3 nos.	3 nos.	26
Grand total							352

The trend of change in shifting cultivation to forest plantation was a complete change of land cultivation pattern. Comparing the reduction in barren CF area with rise in plantation in the context to this particular CF is showing very good results. It is not possible to accomplish such afforestation program single-handedly. Scientists, planners, policy makers, extension workers should join hands and work together. One should also keep in mind the CFMG's basic needs like timber, fuel wood, fodder, food and a secure future. Thus, care should be taken to see that these programs continue not for a day or month but for several years, in the process, bonding will be formed among the foresters and the local people.

One of the most important strategies adopted for Dungkarling CF was the raising of economic valued timber plantations. The plantation was conceived to provide a lucrative alternative to all the CFMG members in addition to their cash crops like betel nut and orange.





A new and endemic species of Bhutanese snail spotted

A new and endemic species of a Bhutanese snail called *Truncatellina bhutanensis* spec. nov. was documented by Bhutanese researchers together with a team from Naturalis Biodiversity Centre, Netherland.

It was discovered during the snail specimen collections carried out in the country as part of the National Biodiversity Centre's (NBC) project on Invertebrates in Bhutan.

The species better known as Bhutanese snails is commonly found in the calcareous areas of western Bhutan, within the altitude range of 2100 to 2650masl. Belonging to Vertiginidae family, it is different from other species in terms of having a genital tract without an externally visible prostate and a gut-furrow crossing the albumen gland instead of running parallel with it.

The presence of a radula with a tricuspid central and bicuspid lateral teeth, and a mandible with many small plates separated by narrow ridges are also some of the unique characteristics of the new species.

Its shell is fragile with light brown, appearing glossy, running almost cylindrical with a domed apical part. Further, the species is said to have a teleo-conch with a relatively coarse growth lines, one or a few of which may be thickened as riblets, near the aperture.



A new indigenous citrus variety identified from Bhutan

A new type of wild citrus has been identified by Tshering Penjor from the Agriculture Research and Development Centre, Wengkhar in collaboration with researchers namely, Takashi Mimura, Nobuhiro Kotoda, Ryoji Matsumoto, Atsushi J Nagano, Mie N honjo, Hiroshi Kudoh, Masashi Yamamoto and Yukio Nagano from the University of Kagoshima and University of Saga, Japan.

The new identification now called 'Himalayan Lime' is found to be a hybrid of Citron and Mandarin. Locally known as 'Kagati' is morphologically similar but genetically different to Mexican lime.

Himalayan lime can be a new accession in Bhutan's Indigenous Citrus Germplasm and an alternative to Mexican Lime. It is found



to be grown in the wild forests of Bhutan ranging from 300 to 1500masl.

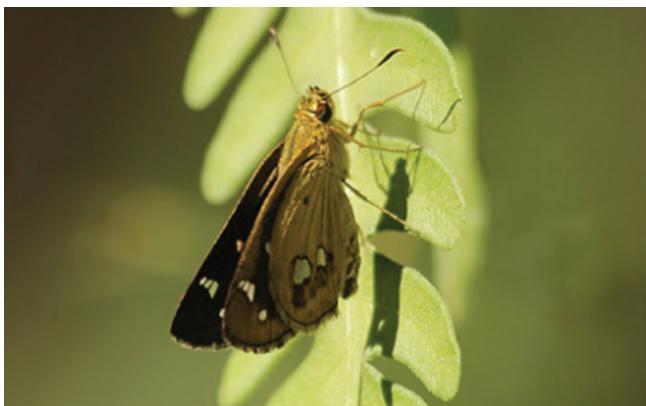
Some southern farmers grows these trees in their backyard orchards either through seedlings or seeds. The fresh fruits are mostly consumed as salad and pickle. It is also used in treating diarrhea and stomach ache. It has potential for commercialisation as lime fruits or processed as Himalayan Lime Juice.



Pointed Perrot



Brown Onyx



Khasi Forest Bob



Ambon Onyx



Khaki Silverline

Five new Butterfly species recorded

Bhutan recorded five new Butterfly species namely, Scobura isota-Khasi Forest Bob, Niphanda cymbia-Pointed Perrot, Horaga viola-Brown Onyx, Horaga Syrinx-Ambon Onyx (Female) and Khaki Silverline (*Cigaritis rukmini*).

The first four species was spotted by a team from UWICE during a Butterfly survey in Darla, Lhamoizingkha and Phuentsholing while Khaki Silverline was spotted by Kado Rinchen from the Jigme Singye Wangchuck National Park in October 2016 at Tongtophey, Trongsa.

With the addition, Bhutan now has 177 species of Lycaenidae and 145 species of Hesperidae, and a total of 728 Butterfly species.

Rice ear-cutting caterpillar

(*Mythimna separata*)

It is a sporadic pest, during years of heavy rainfall. The larvae are gregarious in habit and are commonly known as Armyworm. Host range includes sorghum, maize, gram, rice, and sugarcane. It is one of the most serious pests of cereals in Asia. Armyworms are nocturnal.

The larvae usually feed in the upper portion of the paddy maize and canopy on cloudy days or at night while the adult feeds, mates, and migrates at night and rests in daytime at the base of the plant.

There are four types of armyworm viz. African armyworm (*Spodoptera exempta*), True armyworm (*Mythimna unipuncta*), Fall armyworm (*Spodoptera frugiperda*) and Rice ear-cutting caterpillar (*Mythimna separata*)

Factors favouring armyworm outbreak

- Periods of drought followed by heavy rain
- The presence of alternate hosts also sustain the development of armyworms
- Adult armyworms survive better and produce more eggs when the temperature is at 15°C maximum, and when plants are naturally fertilised

How do you manage Armyworms:

The key to managing armyworms is to detect infestations before they have caused economic damage:

- Flooding seedbed is the best defense against



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armyworms when the population is in the larvae stage. Flooding drowns the swarming larvae.

- Cut grass weeds from bordering fields (particularly gramineae) regularly to reduce breeding sites and shelter for armyworm.
- Plough a deep ditch and filled it with water. This method is helpful when caterpillars are found to be moving towards your field from the adjacent fields.
- Another method is to dig a deep ditch with vertical sides to trap the caterpillars and prevent them from crawling out. Collect and properly dispose the trapped caterpillars.
- To prevent the caterpillars from moving to another field, apply a 40 foot border spray around the non-infested field.
- If there is high infestation of army worm chemical spray is necessary. Spray cypermethrin@1 ml/1 L water. Since the armyworm usually feeds at night, the best time to spray is late in the day.

Source: National Plant Protection Centre

Know about B-Coop Shop

The B-COOP shop is a place where local products from cooperatives (includes groups and individual farmers) are displayed and retailed.

Vision

Contribute to strengthening the marketing of local products through cooperative marketing

Objectives

1. To assist the cooperatives to market their products
2. To make local products readily available to the consumers with standard quality
3. To showcase the proper packaging and quality standards
4. To create a niche market by developing and promoting potential Geographical Indicator (GI) products

Products available

The shop will have selected items such as fresh milk, butter, cheese, egg, fermented cheese, flattened and ground maize, bitter and sweet buckwheat flour, dried persimmon, ground nut, green tea, soyabean, tea leaves, bamboo shoot pickle, dolley, honey, shilajit, lemon grass oil among others which is subjected to change.

Modus Operandi

The Department of Agricultural Marketing and Cooperatives will operate through an operator on a pilot basis for one year. In the long run, it will operate through an operator on a pilot basis for one year. In the long run, it will be operated by cooperative or farmers groups if the venture is found economically viable and potential operators avail training.



Why shop at the B-COOP?

- a. The products are sold at competitively lower prices
- b. All products are qualitatively and hygienically packaged and labeled
- c. Special products from time to time
- d. Contribute to farmers income
- e. Natural products

Source: Department of Agricultural Marketing and Cooperatives

How to ensure safe use of power tiller:

1. Pre-operation safety

- Wear a suitable cap, fitting clothes and safety boots or gum boot during operation
- Acquire proper training on operation of power tiller from authorised training institute
- Read the operation and instruction manual carefully before operation
- Place the main clutch lever in parking brake position and shift the gear lever into neutral position before starting the engine
- Check all the safety pins at the hitching point and the wheel axle
- Maintain proper position and posture before starting the power tiller
- Hold handle from the bottom of the base and rotate in the clockwise direction while starting the power tiller and never release the starting handle forcefully as it releases automatically

2. Safety during operation

- Do not start the power tiller in poorly ventilated area since exhaust emissions are injurious to health
- Do not operate the power tiller with rotary attachment in high speed causing to lift the power tiller and hitting to the operator
- Maintain a safe distance between the moving rotary and an operator
- Do not operate the high speed while ploughing in an un-leveled field
- Use proper plank size of 5cm x 30cm while shifting the power tiller from one field to another



- Operate the power tiller in reverse position in low speed with implements attached in the sloppy area
- Disengage the rotor gear while driving rearwards and also while moving from one field to another
- Never allow passengers to sit on the operator's seat
- Do not drive the power tiller in high speed leading to loss of controls
- Disengage the clutch and use the brake during trailer operation as the brake on the power tiller is primarily for parking brake application
- Do not over load beyond trailer capacity
- Do not engage both the steering clutches in the sloppy area since the gear will automatically come to neutral position
- Do not place the gear in neutral position while driving downwards the slope
- Do not open the radiator cap immediately after operation or when it is hot
- Be careful from touching hot muffler right after operation
- Keep away from inflammables like fire, smoke during refueling
- Power tiller should be stopped while conducting any adjustment maintenance

Source: Agriculture Machinery Centre

What is Ear rot?

When a pathogen infects and causes rotting of kernels in an ear, it is referred to as ear rots. Various soil borne fungal pathogens cause ear rots. The most common ones are those caused by Fusarium group.

There are two types of ear rots common in our areas. One type is called Aspergillus ear rots caused by Aspergillus flavus and the second type is Fusarium ear rot and gibberella ear rots caused by Fusarium graminearum (syn. F. roseum) and Fusarium verticillioides (syn. F. usurium moniliforme).

1. Symptoms

It is a serious problem when ears are stored at high moisture conditions. A. flavus normally forms yellow-green masses of spores and Gibberella rots are most common in cool and humid areas. It forms a white mycelium moving down from the tip which later turns reddish-pink.

F. moniliforme occurs mainly on individual ears or on limited areas. The infected ear develops cotton-like growth between the grains.

2. Favourable conditions

A. flavus occurs mid to late season, under hot and dry weather conditions when plants are stressed. While Gibberella rots are common in cool and moist conditions and F. forme is common in hot and dry weather after flowering. Minimum tillage, damaged kernels or ears due to birds and insects



also makes the crop prone to ear rots.

3. Disease management

- Use clean seeds
- Follow proper crop rotation
- Prevent plant stress (nutrient deficiency, water stress, insect and pest etc.) especially after pollination
- Harvest crop on time (23-25% MC) and maintain low moisture level in storage (20% MC for ear corn and 14% MC for shelled corn)

Caution: Ear rot fungi produce different mycotoxins known as aflatoxins harmful to birds and mammals. Do not feed ear rot infected grains to birds and mammals.

Source: Agriculture Research and Development Centre, Wengkharr

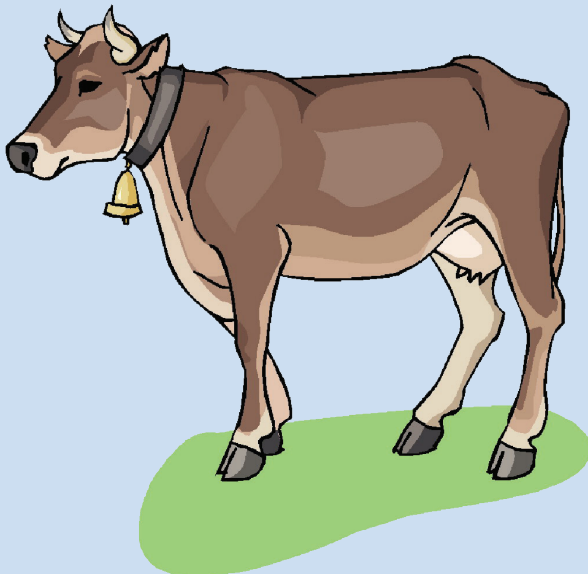
How to ensure Animals and Animal Products Movement:

Unregulated movements of animals and animal products from one place to another spread animal diseases. Therefore, avoid unnecessary movements of animals and animal products where possible. Otherwise, do it following the proper norms to reduce risk of spread of diseases.

How can I move my animals or animal products from one Dzongkhag to another?

Live animal movement

- Live animals should have been vaccinated at regular intervals and vaccination records maintained by the owner
- Movement of live animals from one Dzongkhag to another is allowed only with the In-country Movement Permit issued by the concerned BAFRA Office
- Complete the Live Animal Movement Permit application form in consultation with your Geog Livestock Extension Officials
- Submit the completed Live Animal Movement Permit application form to the nearest BAFRA Office
- Concern BAFRA office would conduct assessment of the risk
 - ❖ If risk of disease spread is minimal, permit granted
 - ❖ If risk of disease spread is high, application declined



Animal products movement

- Animal products should have been inspected and certified by BAFRA officials
- Movement of animal products from one Dzongkhag to another is allowed only with In-country Movement Permit issued by concerned BAFRA Office
- Approach the nearest BAFRA office and apply for In-country Movement Permit in the prescribed application form
- Concerned BAFRA office would conduct assessment of the risk
 - ❖ If risk of disease spread is minimal, permit granted
 - ❖ If risk of disease spread is high, application declined

Failure to abide by the norms shall attract penalties based on the Livestock Act of Bhutan 2001 and Livestock Rules and Regulations of Bhutan 2008



Source-BAFRA

Cabbage White Butterfly (*Pieris brassicae*)



The adult is a large white butterfly with black tip forewings. Two black spots are present on the upper side of the forewings in the females, while in the males these spots are on the underside of the wings. The caterpillars are about 25mm when fully grown and are with three longitudinal yellow stripes with many black spots. This insect mainly occurs as pest of Brassica like cabbage, cauliflower, spinach and mustard.

The orange coloured eggs are laid in groups on the underside of the host plant leaves. The caterpillars of this insect feed in groups on the underside of the leaves. The aggregation feeding habit of these caterpillars can completely defoliate an individual plant leaving only the tough midrib and the veins in leaves.

How do you control Cabbage White Butterfly:

The following measures are recommended:

- Grow cabbage as an early crop, as early-grown cabbage is seldom severely injured

because it reaches maturity before the imported cabbageworm populations have built up significantly.

- The adult butterfly is very conspicuous and can be easily seen in the field while laying their eggs. These eggs are easily visible and should be handpicked and destroyed. Care should be taken not to pick the eggs of ladybirds, which are also orange coloured and of the same size. Closer examination of the eggs will reveal the ladybird eggs to be smooth, whereas the eggs of Cabbage White Butterfly are with longitudinal ridges.
- Since the larvae feed in groups they can be easily located and destroyed.
- In case of serious problems, contact insecticides like Cypermethrin @1ml in 1 litre of water and Malathion at the rate of 2ml in 1 litre of water can be sprayed.

Source: National Plant Protection Centre

Vermi-Composting

It is a process of making compost by letting earthworms eat organic materials and produce excreta rich in nutrients.

How to prepare:

1. Collect cattle dung and break into smaller pieces
2. Pour dung into open surface container and wet with water
3. Add 500-700 worms per 70kgs of dung
4. Cover with wet gunny bags
5. Keep container protected from sun and rain
6. Worms feed and multiply
7. After 45 days -sieve composted dung
8. Processes compost is now ready for use

What are its Benefits?

1. High nutrients content
2. Improves soil texture and structure
3. Helps water retention
4. Helps to prevent pests and diseases

Composting

It is a process of transforming organic materials of plant or animal origin into humus in heaps or pits. The heap method is preferred because it is easier to handle and there is better air circulation.

How to prepare:

1. Collect plant materials
2. Chop plants into smaller pieces
3. Place hard plant materials at the bottom for proper drainage
4. Pile chopped plant material into layers of 10-15cm
5. Apply moderate amount of liquid dung over each layer
6. After heap is 1.2m³ (spring, summer) and 1.5m³ (autumn, winter) Cover with artemisia or gunny bags. Do not press over heap
7. Turn the heap once a week. Add water if heap appears dry
8. After heap turn into compost, spread it and let it dry for few hours
9. Seive compost and pack in gunny bags. Use unfinished parts for next composting

What are its Benefits?

1. Increases soil organic matter
2. Provides right proportion of nutrients
3. Improves nutrient content
4. Can suppress soil borne diseases
5. Improves plant root growth and soil micro-organisms

Source: National Organic Program



How to AVOID dog bites:

What should I do if a dog(s) is aggressive and I am in danger of being bitten?

- DO NOT RUN. Stay perfectly still
- BACK AWAY SLOWLY. Do not turn around and walk, very slowly walk backwards until you are out of danger
- BE QUIET. If you yell the dog may be threatened more and they will become more aggressive
- AVOID EYE CONTACT. If you stare at a dog, they are further threatened
- PUT SOMETHING BETWEEN YOU AND THE DOG. Such as a bag or anything around you

If you are being attacked

- Drop to the ground
- Curl-up in a ball
- Cover your face using your arms

Just like people, dogs perceive a new person as a stranger, and a threat!

In order to avoid dog bites, it is important to follow these simple rules:

DO NOT:

- Rush up to a dog
- Interact with a dog that is not familiar with you or that is tied up
- Stare at a dog
- Speak loudly or high pitched
- Make sudden bold movements
- Enter into the dogs personal space

Please Remember:

- Never approach a dog that is sleeping or eating
- Mother dogs are often very protective of their puppies. Never go near them, as they might bite
- Never approach a dog that is sick

What should I do if a dog bites me?

- Immediately wash the bite wound thoroughly with soap under running water for 15 minutes
- Tell your parents/guardian/elder
- Report the bite incident to the hospital for post exposure rabies vaccination

Source: National Centre for Animal Health

