

Know about GALS to ensure agriculture crops, human health, environment and cement plaster

What is GALS?

Giant African Land Snail (GALS) is an exotic invasive species of snail. It is a major pest to plants and a threat to human health. It's hermaphrodite and highly prolific, laying about 1200 eggs per year with hatchability of 90%. It lives up to 10 years and can survive without food for up to 3 years.

What does GALS look like?

It looks like any other snail and the adult is about 20 cm in length and 13 cm in diameter. When fully grown, its shell consists of seven to nine whorls, with a long swollen body whorl. The brownish shell with darker brown lengthwise stripes covers at least half the length of the snail. The snails of this species may have either left or right turns in their whorls.

Where it is found in Bhutan?

It is currently found only in Gyalpoishing and Lingmithang in Mongar.

Whats are the threats?

The GALS feeds on more than 500 types of plants causing extensive damage to ecology and environment, and agricultural crops. They even feed on paint and cement plaster of structures like houses, drains, walls, etc. It also carries diseases that are harmful to humans. These diseases are acquired through handling of live snails and close contact with its mucous.

Are quarantine/eradication programs in place for the GALS?

Yes, Bhutan Agriculture and Food Regulatory Authority and Department of Agriculture of Ministry of Agriculture and Forests have put in place Standard Operating Procedures to contain and eradicate GALS. This includes collection and destruction of snails and strict quarantine to check further spread in other areas.

What methods are used to control the GALS?

Physical collection with gloved hand and application of salt or salt solution to destroy the GALS is adopted.

How can you help?

- Destroy GALS whenever and wherever sighted.
- Do not dispose GALS in the forests, river system and water bodies, open land and agriculture field.
- Do not collect snail or its shell for decoration, rituals, gifts, etc.
- If you spot GALS, report immediately at **TOLL FREE nos. 204 or 155**
- Participate in GALS campaigns
- Prevent its movement to other areas



SANAM DRUPDREY

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March 2014



A shining dairy enterprise



A step towards cooking oil self-sufficiency



Black-necked cranes abandon their habitats in Bumthang



Reaping the bounty of rice twice a year



The **RNR family** would like to wish everyone
a very happy and prosperous

WOOD MALE HORSE YEAR 2014

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5. Department of Agricultural Marketing and Cooperatives – 2009
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BRIEF ON GCCA PROJECT



The Global Climate Change Alliance (GCCA) is a four year project supported by European Union particularly to enhance resilience of Bhutan's rural households to the effects of climate change. It will also ensure climate change readiness of the Renewable Natural Resources (RNR) sector by mainstreaming climate change and ensuring that the steps are taken towards increasingly addressing climate change adaptation at the multi-sectoral level.

The project is being implemented by the Project Coordination Unit at the Council for RNR Research of Bhutan.

PROJECT FUND: Approximately Nu 300M (Euro 4.30M)

PROJECT PERIOD: 2013-2016

PROJECT STAKEHOLDERS: DoA, DoL, DoFPS, BAFRA, PPD, NBC, DAMC, CoRRB and ICS (with focal person from each offices and a scientific technical committee comprising of specialists)

PROJECT AREAS (4 DZONGKHAGS): Lhuentse, Mongar, Pemagatshel and Zhemgang (Kuri chu watershed and parts of Mangde chu basin).

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Foreword



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



“

Agriculture, by which I mean all RNR fields, including fruits and forests, is the backbone of our country. Food self-sufficiency has been our goal for a long time now. Young adults have to be encouraged to take up farming not only as a source of livelihood, but also as a profitable venture.

”

Dear Readers,

This is the first time I am writing to you through this foreword to our Annual RNR Magazine, '*Sanam Drupdrey*'. But in no way does this mean that I am a stranger to this magazine. I have been an avid reader of it since its conception and have followed it with interest through the years. This is the fourth issue.

I hope I will be able to contribute to its continuity and I hope you all will do your part. This is a magazine that reaches out to people from all walks of life to engage them in the RNR world of Bhutan.

Agriculture, by which I mean all RNR fields, including fruits and forests, is the backbone of our country. Food self-sufficiency has been our goal for a long time now. Young adults have to be encouraged to take up farming not only as a source of livelihood, but also as a profitable venture. However, as the situation stands today, the majority of our youth do not seem to prefer farming, thus leading to increasing rural to urban migration.

The young people must be educated on the advantages of farming and the new developments in this sector. One way to achieve this is this magazine.

This issue of the magazine looks at various issues, seemingly varied, but all related to the RNR sector such as oil self-sufficiency, rice, seeds and honey. This issue brings you, among others, a breakthrough from a fishery initiative in Gelephu, community forestry silently transforming lives in poor rural villages, price analysis of vegetables

at the Centenary Farmers' Market in Thimphu, and pro-poor and gender-sensitive programmes in the villages.

In Bhutan, we have laid wetland fallow and left behind villages as people migrate to the cities in the hope of a better life. Does the dream of a better life in the cities always come true? Of course, not.

Today, with institutes such as College of Natural Resources offering multiple short courses in various types of farming such as mushroom and paddy cultivation, the National Seed Centre and the National Plant Protection Centre putting concerted efforts in seed production and fertilisers respectively, and Bhutan Development Bank giving out loans to the farmers, the future has never been brighter for potential farmers. If the fresh graduates and the young took up farming as a means of livelihood, our country could come closer to achieving the National Food Self-sufficiency, unemployment and crime would be reduced, and Gross National Happiness would be within our reach.

I would like to thank all the contributors to the magazine and congratulate ICS on bringing out the magazine with professional vigour.

Trashi Delek !

Yeshey Dorji
Minister

Editorial

Singye Wangmo
Program Director
ICS

“

While ensuring intensive agriculture, it tries to promote conservation of forests, watershed and endangered flora and fauna that form major links in our food chain. Communities falling in the protected areas and those affected by wildlife are compensated to minimise the human-wildlife conflict and to conserve endangered species.

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Information and Communication Services (ICS) of Ministry of Agriculture and Forests (MoAF) would like to usher in the year of Wood Male Horse Year 2014 by bringing out the 4th issue of *Sanam Drupdrey* to all our readers. On behalf of MoAF, ICS would like to wish everyone a very fruitful year ahead.

Agriculture intensification and modernisation have become a buzz word in today's world, mainly due to the pressure on the scarce cultivable land resulting from rural to urban migration. This has prompted agriculturists and agriculture policy makers to look for an alternative way to meet the demand for agriculture produce from the growing urban population.

The theme for the 11th Five-year Plan (FYP) is “Rural Prosperity and Urban Well-being”, which expounds the importance given by the government on food self-sufficiency and food security for a sovereign nation. Since the implementation of the first FYP, the government has placed due importance on the agriculture sector. This tradition has come a long way and today, despite the shortage of farm workers and scarcity of cultivable land, the local markets abound with local produce, unlike in the past when most farm produce was imported from the neighbouring Indian states. This is mainly because of the Government of Japan's support for farm mechanisation and the support extended by donor countries in training agriculture technicians in modernisation and diversification of our agriculture.

Bhutan is blessed with an ideal

geographical location with altitudes ranging from sub-tropical to alpine and treeline zones. This offers favourable climatic conditions to grow a variety of crops and raise a variety of livestock across different seasons. The areas that grow vegetables in summers are the north, west and some parts of the east. These areas supply vegetables to the south and other parts of the country while the southern region and some parts of the east and west supply vegetables in winter to rest of the country. This helps gradually reduce the import of vegetables from India.

MoAF as a partner in the conservation of our natural environment pursues a balanced approach to development. While ensuring intensive agriculture, it tries to promote conservation of forests, watershed and endangered flora and fauna that form major links in our food chain. Communities falling in the protected areas and those affected by wildlife are compensated to minimise the human-wildlife conflict and to conserve endangered species.

Formation of Community Forests Groups is yet another wise step taken by the government and the ministry in conserving our environment. This has benefited the people through the harvest of forest products and furthered the government's conservation goal as the communities look after the forests.

With all the support from the government and efforts made by the people, we hope to gradually achieve food self-sufficiency and security for all and ultimately attain “Rural Prosperity and Urban Well-being”.

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A eureka moment in Gelephu

A breakthrough made in artificially incubating Golden Mahaseer

By Namgay Dorji
NCA

A breakthrough that resulted from National Centre for Aquaculture's (NCA) initiative in Gelephu could go a long way in saving the endangered Golden Mahaseer (*Tor putitora*).

NCA under the agriculture ministry had made aggressive efforts since mid-2012 to research a technology to artificially breed the fish. In early February, 2013, the centre managed to strip a few hundred eggs from a mature female and incubated them successfully in ingeniously prepared makeshift incubators. Another 15 or so mature females were stripped of ripe eggs, which were subsequently successfully incubated. NCA has been making great efforts to collect fingerlings of Golden Mahaseer from the wild and rear them in earthen ponds.

Golden Mahaseer, a famed game fish, is under threat from overfishing and loss of habitat and breeding grounds due to anthropogenic activities such as the construction of hydroelectric dams.

The population of Golden Mahaseer could decline by about 80 percent if many huge hydroelectric projects continue to come up in the country.





Golden Mahaseer hatchlings

The International Union for Conservation of Nature and Natural Resources considers Golden Mahaseer endangered species and urges the countries the world over to make efforts to save the fish from extinction in several locations.

In Bhutan, Golden Mahaseer is found in Punatshangchu in Punakha-Wangdue-Dagana region, Mangdechu in Trongsa-Zhemgang region, and Sarpangchu, Mouchu, Bhurchu, Phibsoochu, Taklaichu and Kanimakarachu in Sarpang region.

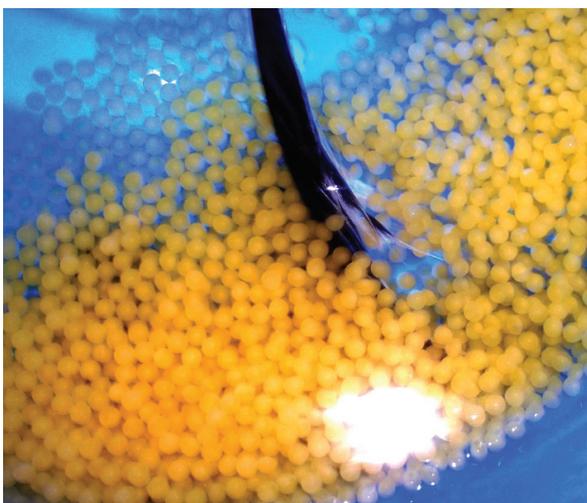
As of now, the NCA has about 1,500 fingerlings of average weight of 14 g, and another 3,000 hatchlings in the process of being reared to fingerlings. The fingerlings thus produced artificially at the NCA will

eventually be released into the country's natural waters to reinforce the fish's natural populations. The fingerlings from the first ever brood, dating back to February 2013, will be ready for release into natural waters by February 2014.

NCA is making efforts to further refine the rudimentary technique that it has already developed to breed what may arguably be the hallmark of our aquatic ecosystem. NCA has received a grant of Nu 12.964 million from Mangdechu Hydroelectric Project (MHPA) to execute a three-year project to augment the nation's efforts to conserve the endangered Golden Mahaseer.

The most important objective of this project is to establish a Hatchery-cum-Conservation Centre (HCC) at the NCA to serve as a hub for technologies, data, and information related to the artificial breeding/propagation of the endangered Golden Mahaseer and other important native fishes. Once established, the HCC shall strive to (i) refine the rudimentary Golden Mahaseer breeding protocol that the NCA has already studied, and (ii) develop technologies to artificially breed other important native fish such as the Chocolate Mahaseer (*Neolissocheilus hexagonolepis*).

HCC at NCA will serve as a vital instrument for conserving important and endangered sub-tropical native fish species.



Golden Mahaseer eggs



Honey

Despite several challenges modern beekeeping is picking pace in many parts of the country

**By Dawa L Sherpa
RDC-Jakar**



The improved way of beekeeping is a new venture in Bhutan. Beekeeping in Bhutan is still traditional. It takes more efforts to make people understand and adopt the modern beekeeping technologies and use them skillfully.

Towards this end, efforts are underway to introduce improved ways of beekeeping and encourage beekeepers to form self-help groups, develop infrastructures for honey collection, processing, packaging and marketing.

Traditional beekeeping in log and wall hives existed since the early part of this century in Bhutan. However, modern beekeeping started only from 2006. With the initiative taken by the Research Development Centre (RDC) Jakar in Bumthang, 40 farmers were trained in two training programmes conducted in 2006 and 2007 in Sarpang. The first local beekeepers' group was formed and a honey village was created towards the end of 2006.

The first lot of honey harvested by the group was successfully marketed to Bio- Bhutan. In the same year, a similar training was provided to the beekeepers of Bhur geog in Sarpang and Darla and Pachu geogs in Chukha.



Another beekeepers' group was formed in Pemathang, Samdrup Jongkhar, in 2008, with the initiatives of the Dzongkhag livestock sector. Today, there are eight informal beekeepers' groups with a little more than 300 trained members in the six southern Dzongkhags. Between 2009 and 2012, the International Centre for Integrated Mountain Development based in Nepal provided US\$ 12,000 for beekeeping.

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Creating awareness among the enthusiastic beekeepers on the improved method has compounded the challenge. Unavailability of adequate hive materials, wax and equipment add up to the challenge.

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The main objectives of the project include enhancing production of honey and other bee products, increasing farmers' income through dissemination of improved technologies and skills, facilitating the formation of farmers' groups, developing basic beekeeping infrastructure, and developing awareness on improved method of beekeeping through brochure, leaflet, booklet, audio-video materials, and broadcast media.

The RDC-Jakar has so far achieved a number of objectives in terms of capacity development, distribution of hive materials and equipment, honey production and marketing, installation of hive making workshops, and production of publicity materials.

Since 2006, about 400 farmers from Dagana, Tsirang, Samtse, Sarpang, Chukha and Zhemgang have been trained in beekeeping. A degree-level syllabus for apiculture module was developed for the College of Natural Resources in Lobeysa.

Till date, the centre has distributed 70 sets of full hive materials to the beekeepers' groups as samples. About eight sets of equipment were also given to the farmers' groups.

In 2013, 785 kgs of honey worth Nu 0.228 million



Resource person demonstrating bee transfer from log to a modern hive

was produced by the beekeepers' groups. Today, the price for a kg of honey ranges from Nu. 250 to Nu. 400.

The beekeepers trained on hive making in Nepal have started making hive and hive materials for the beekeepers within and outside their communities.

The centre has so far published a Handbook on Guidelines for improved management of local honeybees in Bhutan, developed posters and brochures in English and Dzongkha, and carried out a study on the status of rockbee in Bhutan.

Being the only focal centre in the country, RDC-Jakar has been challenged with shortage of staff to coordinate this development programme. Creating awareness among the enthusiastic beekeepers on the improved method has compounded the challenge. Unavailability of adequate hive materials, wax and equipment add up to the challenge.

Another problem facing beekeeping is unexpected rains during the honey flow period (floral presence), which prevents bees from foraging resulting in little or no honey production.



Learning to prepare frames

To address the current challenges and move forward, further research needs to be done on the effect of imported bees on the indigenous bees, RDC-Jakar will have to be the national coordinating centre for honey bees in Bhutan, training and formation of beekeeping groups need to continue, beekeeping materials must be made available, and a centrally located honey processing plant must be built. Besides, the domestic market for the Bhutanese honey must be assured and an export market explored, not to mention the need for product diversification and value addition, and organic certification of Bhutanese honey.



A shining dairy enterprise

A community dairy group in Haa operates with rigour and entrepreneurial spirit

By Loden Jimba
Dzongkhag Livestock Sector, Haa

If a community group is exemplary today, it must be Yangthang Om Gongphel Detshen under Bji geog in Haa. The milk cooperative is among the Dzongkhag's 13 community groups, which includes a yak group.

Started in early 2008 with 27 members, the group today has 34 members comprising 24 women and 10 men.

The group aims to involve the communities in self-help projects, create a fresh milk market for rural income, create employment opportunities, improve dairy farming in the communities, and minimise the import of dairy products from neighbouring countries, among others.

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Some of the challenges for the community dairy groups include limited market for milk and milk products, short shelf-life of the products, and people's preference for ready-made factory products.

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Most of Haa Dzongkhag's approximately 12,963 people are dependent on dairy farming because agriculture is not as intensive as in other Dzongkhags due to harsh climatic conditions.

Before, there were only a few backyard poultry farms in the Dzongkhag supported by Wang Watershed Project. The household-level enterprises could not sustain when the project term ended.

With the start of Yangthang dairy group, a Milk Processing Unit (MPU) was established in 2008. The main reason for starting the MPU was that all the milk collected during the day could not be sold. The unsold milk, along with the evening's collection, is processed into milk products. Initially, the MPU collected 80 to 90 litres of milk from the group members and non-members from the community.

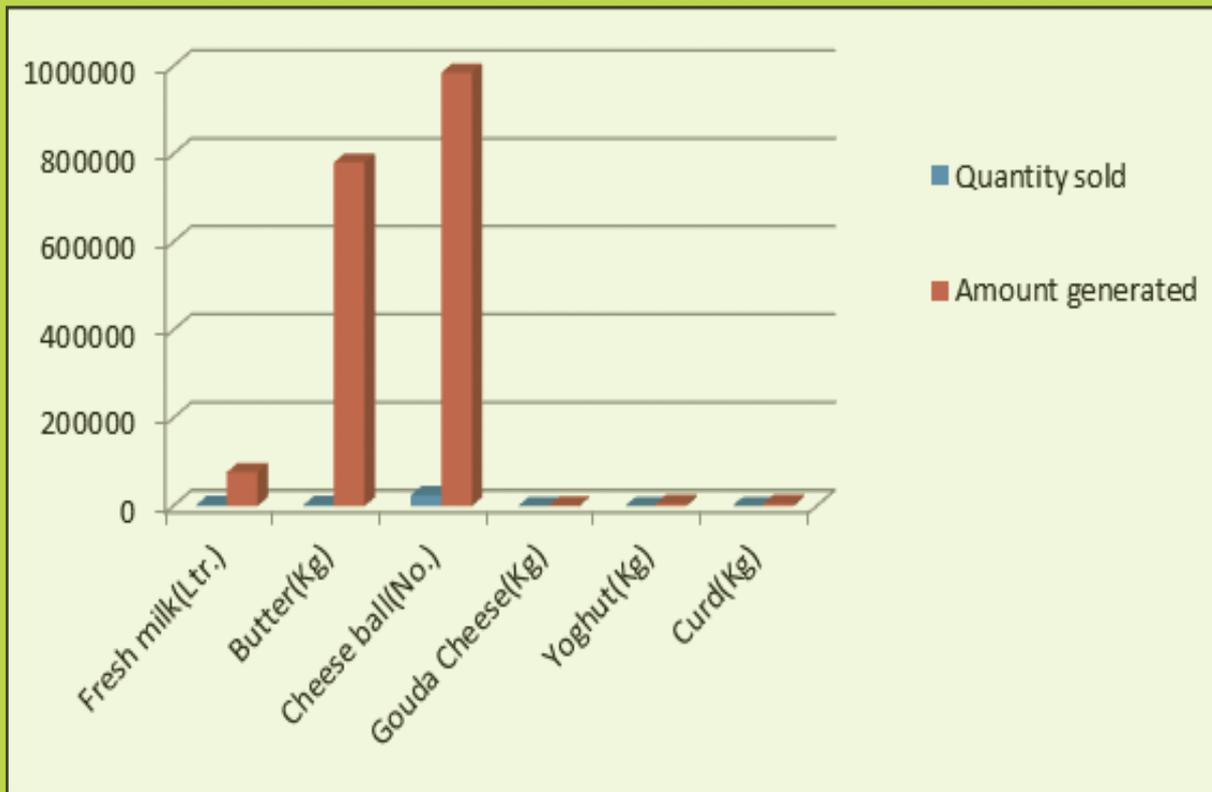
Earlier, the collection of milk was easy as Talung was the only area that supplied fresh milk. Today, with the establishment of many dairy groups, the MPU has to collect milk from various places such as Hatey, Chumpa, Gyensa, Kagayna, Nagtsho, and Ingo villages.



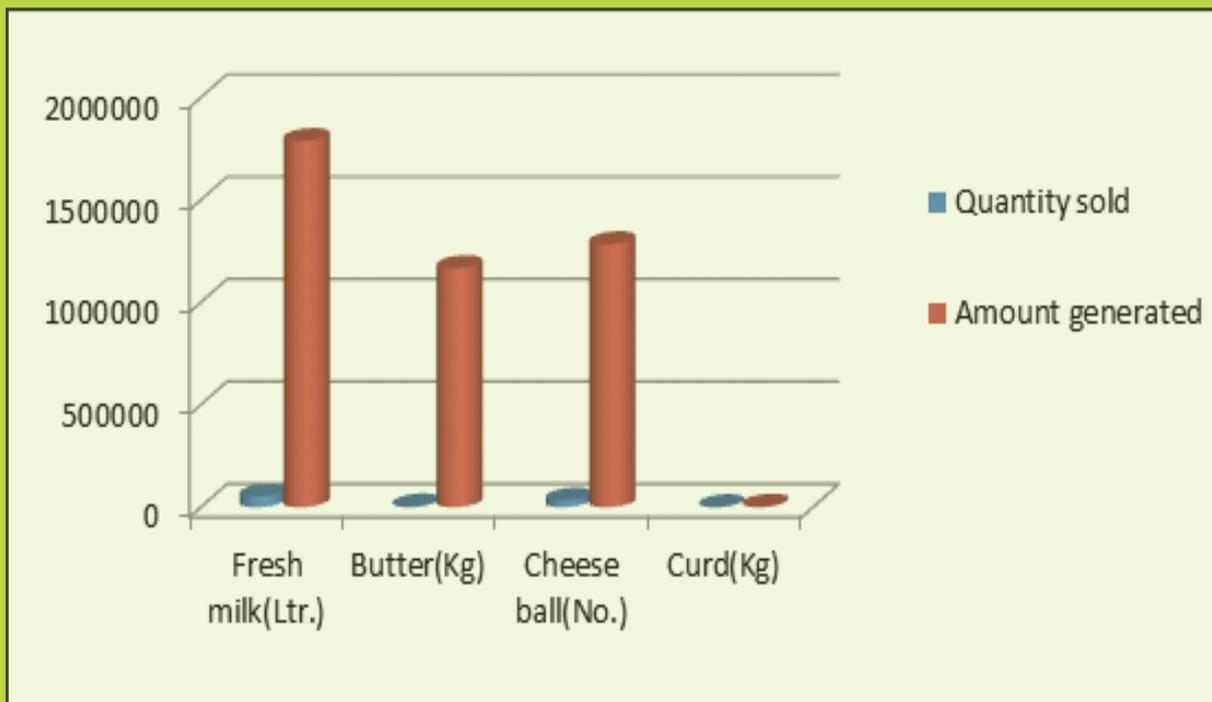


Milk being churned out at MPU

Market opportunity for milk and milk products



Milk and milk Products produced and marketed in 2013



**Fresh Cheese,
one of the group products**



Milk is physically tested for impurities and for density using lactometer. The milk is accepted if lactometer reads more than 25. If lactometer reads less than 25, the milk is put through milk analyser. If the analyser finds the product adulterated or impure, it is rejected and action is taken against the defaulter with the penalty of Nu. 500 as per the group by-law. The penalty amount is deposited directly into the group's savings account.

The Dzongkhag Livestock Sector (DLS) has carried out a price comparison study for fresh milk and milk products (butter, cheese, yoghurt, curd) for two years now. Figure 1 indicates that among the milk and milk products, cheese and butter had a better market opportunity and cash returns in 2012. However, Figure 2 clearly shows that fresh milk had the highest market opportunity and good economic returns.

The payment for the milk supply is made monthly. The group members compulsorily meet on every 5th working day of the month during which payment is made to the milk suppliers. The meeting discusses milk and milk products and group-related issues. DLS intervenes only if the group is not able to resolve an issue. However, the geog livestock extension officers are present all the time to observe, guide and clear doubts as and when required.

Some of the challenges for the community dairy groups include limited market for milk and milk products, short shelf-life of the products, and people's

preference for ready-made factory products.

In the future, there should be wholesalers or middlemen who can play a vital role of stocking the entire milk and milk products. The Department of Livestock, in consultation with the Department of Agricultural Marketing and Cooperatives, should find an alternative means to sustainability of the groups.

A few years back, the price of a litre of fresh milk was between Nu. 15 and Nu. 20 and that of a kg of butter, Nu. 200 and a ball of cheese, Nu. 12. The Rupee crunch and general commodity price hike have come as a blessing in disguise for the rural communities that are now able to fetch a better price for their products.

Since the beginning of 2013, the price of milk in Thimphu has increased to Nu. 35-40 a litre, that of butter to Nu. 350 a kg and a cheese to Nu. 40-45 a ball.

The annual net income generated from the sale of fresh milk and milk products after calculating all the expenditures incurred till September 2013 comes to (4238385.00-600524.50=Nu. 1,337,530.50), the net profit generated for the community dairy group.

DLS was required to set a benchmark for the annual milk production. It was a difficult task but we could outperform the benchmark by 150 litres to 500 litres of milk. The sector produced more than 50,000 litres of fresh milk from community dairy groups. Haa Dzongkhag has even bigger potential for animal husbandry.



The return of **KHAM BJA**

*Upland paddy, once popular in eastern Bhutan,
is reclaiming its traditional popularity*

**By Passang Wangmo
RDC-Wengkhar**



Cultivation of upland paddy, known as kam bja in Dzongkha and kam bara in Tshangla language, is gaining popularity once again. Upland paddy cultivation was practised in eastern Bhutan in the past. Today, the farmers in east who traditionally grew only maize, are also increasingly growing upland paddy.

Khinadrang village in Pemagatshel is a case in point. Khinadrang is a small resettlement village in Zobel geog. The farmers from the three remote villages of Whaphay, Chongshing and Nanong, who did not have enough land to cultivate, were resettled in this new village so that development could reach them easily. Khinadrang is electrified and is well-connected to other villages and the Dzongkhag headquarters by road.

There are today 46 households in Khinadrang. Each household owns a minimum of 2.5 acres of land. All the houses are of similar design with proper lavatory and running water. The village also has an extended classroom.

Khinadrang is situated at altitude between 853 and 1184 metres above sea level where crops like maize and paddy can be grown.

The Research Development Centre (RDC) Wengkhar in collaboration with the agriculture

sector of Pemagatshel introduced upland paddy in Khinadrang. Upland paddy is grown on dry land. In the first year, five upland varieties—two exotic and three local varieties—were in the fields of seven farmers. By mid-September, the paddies were ready for harvest. Three varieties from Nepal—Chandhanath 1 and 3 and Machaphurchery—did not grow well and were discarded in the nursery.

A popular released variety called Khangma Maap produced the highest yield, an average of 1.12 tonnes per acre. Zangthey 1, a local variety indigenous to Zangthey village in Shingkharlauri, also produced good yield. A local selection called Lumang Local produced an average of 0.27 tonnes per acre, followed by Zangthey 2 at 0.24 tonnes per acre. With an average yield of 0.18 tonnes per acre, Sam Bara, a local variety, yielded the lowest.

Today, people of Khinadrang grow Khangma Maap and Zangthey 1 besides traditional crops like maize, potato and mandarin.

RDC-Wengkhar will support the farmers by supplying high-yielding seeds for free. The seeds from on-farm evaluation will be shared among the farmers.



A step towards cooking oil self-sufficiency

The farmers of Khamey in Gasa lead the way in growing organic mustard

By Tanka Maya Pulami
RDC-Bajo

High up in Gasa, a geog is working towards achieving self-sufficiency in cooking oil by growing mustard (*Brassica spp*).

Khamey is a geog in Gasa comprising 91 households making up five chiwogs. Although the practice of growing mustard in Khamey dates back to a long time, it wasn't until recently that a major boost came with Mustard Production Programme for 64 households of Yemina, Paniko, Khailo and Damji.

Mustard is a major oilseed crop in Bhutan. In recent years, however, the area of cultivation and production of mustard in the country has been shrinking. Demand for cooking oil in the country is met by imports from India.

In the 1990s, Khamey farmers received improved mustard seeds through a promotional programme. Households grow mustard on a small scale for home consumption and still use the seeds from this improved variety. Dominant crops grown in the villages of Khamey are rice, wheat, barley and potato.

Triggered by the recent Rupee shortage in the country and rising inflation, the Research Development Centre (RDC)-Bajo, National Organic Programme (NOP) in Semtokha and the Dzongkhag extension office jointly started Mustard Production Programme in Khamey to enhance self-sufficiency in cooking oil and to boost the income of the farmers of

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In the 1990s, Khamey farmers received improved mustard seeds through a promotional programme. Households grow mustard on a small scale for home consumption and still use the seeds from this improved variety.

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Khailo village. That was in November 2013.

Mustard releases biotoxic compounds or metabolic byproducts that act against bacteria, fungi, insects, nematodes, and weeds. Thus, mustard plants are least attacked by pests and can be grown organically.

Since the programme started, 132 kgs of mustard seeds have been sourced out locally from Khailo village and distributed to the farmers. Seeds were sown within the first and second week of November, 2012. Constant monitoring for pests and diseases was carried out. Upon crop maturity, crop samples were taken from three locations for yield assessment. In each field, three sample crop cuts were taken from 6 m² area.

The crop performed better in Yemina, Khailo and Paniko, but there was no harvest from Damji as the crop was damaged by heavy frost. The crop matured in three month.

The organic mustard production programme in Khamey was successful. However, farmers lacked oil processing facilities, and that is one of the main constraints. The product had to be transported to Punakha for oil extraction, which was costly for farmers.

NOP recently provided financial support to install oil expeller in Khailo. As production increases, the farmers will be able to sell organic mustard oil in the local markets.

Bhutan has the potential of achieving self-sufficiency in oil crops, particularly mustard, without displacing other crops. But the crop has to receive national level recognition.





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Maize is a major food crop and is widely grown in at least 13 Dzongkhags in the country. It ranks first in terms of area of cultivation among the food crops and occupies 44 percent of the total area under cereal cultivation.

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Producing quality seeds the modern (and communal) way

Community-based seed production may well be the answer to Bhutan's lack of quality maize seeds

By Dorji Wangchuk, Lhap Dorji, Rinzin Choney, Namgay Wangdi and Wang Gyeltshen RDC-Wengkhar

Sangay Tshewang and Doley RDSC-Tsirang

The success of high-yielding maize varieties and improved cultivation practices is highly dependent on the availability of quality seeds. The traditional seed production system is not measuring up to the quality requirements of the modern farming system. It's a big dilemma. The Community-Based Seed Production (CBSP) initiated by the National Maize Programme (NMP) at RDC- Wengkhar seems to have found the answer to address this dilemma.

CBSP, which emerged from the work of CIMMYT (International Maize and Wheat Improvement Centre), is growing of a crop (maize in this case) for the purpose of seed production through improving the traditional seed selection system. The members of



a community participating in the programme become the source of good quality seeds, which can either be used by themselves or sold to others.

In Bhutan, the approach has been tried in areas such as Martshala and Dewathang in Samdrup Jongkhar (2006), Broxsar in Mongar (2007), and Tsholingkhar and Rangthaling in Tsirang (2008). Results from these places show that the approach can be effective.

Maize is a major food crop and is widely grown in at least 13 Dzongkhags in the country. It ranks first in terms of area of cultivation among the food crops and occupies 44 percent of the total area under cereal cultivation.

However, the unavailability of quality seeds is one of the serious constraints in enhancing maize production in the country.

In the past, the majority of maize farmers in Bhutan depended on seeds selected and maintained through the traditional seed production system. This traditional seed selection practice tends to overlook some essential steps in seed production and maintaining seed quality.

Taking advantage of our maize-based farming system and the potential benefits of the CBSP concept, the NMP initiated the formation of CBSP groups in major maize growing areas. There are today

nine maize CBSP groups that produce high quality maize seeds.

The most noticeable impact and benefit of CBSP has been seed replacement for crops affected by diseases. Following the outbreak of two fungal diseases, gray leaf spot (GLS) and turicum leaf blight (TLB), since 2006, the maize programme has developed and released two disease tolerant varieties. In order to supply the new seeds to the affected farmers, mass multiplication was done by the CBSP groups under the technical guidance of RDCs. The groups were able to produce 27 MT high quality seeds.

Considering the critical role that the CBSP groups play in enhancing maize production through supply of high quality maize seeds, the NMP with the support of Decentralised Rural Development Project, supplied a set of post-harvest machines for free. This way, the CBSPs have dual benefits-it benefits group members as well as other farmers.

NMP has set an ambitious target to increase the maize production 39 percent. To achieve this target, the use of high quality seeds would be one of the most important factors.

In the absence of strong and dynamic public or private seed companies in the country, the farmers' groups like maize CBSP groups can play an important role in supplying high quality maize seeds.

New realities for farming women

Changing agricultural landscape demands pro-poor and gender-sensitive programmes in the villages

**By Dr. Lungten Norbu , CoRRB
and Chokey Nima, RDC-Wengkhar**

Silambi is a far-flung and poor village in Mongar. The village has 80 households. Some 20 years ago, all the households practised tseri cultivation. With the enactment of the Land Act 2007, tseri land began to be used as dry land. However, some form of tseri cultivation with three-year fallow period rotation is still practised within the dry land.

And with change in agricultural landscape-evolution of agriculture from subsistence to income-generating sector-gender roles are also changing, rather swiftly.

In Bhutan, it is widely believed that there is no gender disparity, that both women and men are equally represented in most spheres of life. In the face of development, many educated women participate in nation building processes in equal terms with their male counterparts. Women are increasingly stepping into professional careers that were traditionally male-dominated.

About 10.5% of women are in wholesale or retailing of services against only 8.9% male. Agriculture engages 59.4% of the workforce, which constitutes about 63.3% women and 54 percent of men.

In the face of rapid development, the composition of agricultural workforce in Bhutan is changing due to rural to urban migration. According to the agriculture

ministry's 2005 records, 60 percent of men migrate to urban areas in search of better opportunities while women stay back in the villages.

Tseri farming in Silambi is gradually being replaced by dry land farming. With the shift to dry land farming and many development activities have come to the village. This is aiding change in gender roles.

An analysis of the division of work on the basis of gender in the two farming systems indicated that in the tseri system there was no gender bias. Most activities and responsibilities were shared between men and women, and specific jobs were undertaken in response to gender needs. More strenuous tasks were done by men (e.g. tree felling, site selection), while more dexterous works (e.g. seed selection) were carried out by women.

While switching to dry land farming, the activities that could be shared between men and women fall on women's shoulders as men are engaged in off-farm activities for cash. The study showed that women participation and access to decision-making avenues (e.g. meeting, membership in forum, training) and economic development (marketing, credit) are increasing with development

interventions pursued by the agriculture extension staff and non-governmental organisations like Tarayana Foundation.

Although agriculture development programmes have pro-poor agenda with emphasis on food security and improving livelihoods, they are often not translated into explicit pro-poor and gender-sensitive activities.

Food security relates not only to food production and food availability but access to food. For poor households like those of Silambi, to get access to food is a key to household-level food security. Access to food requires cash income, among other things. The survey found that when income-generating opportunities do not exist in villages, men usually migrate in search of work that pays while women stay in the villages and are exposed to overworking and poverty.

Therefore, providing the poorer households better income-generating activities and creating enabling avenues for women to increase their decision-making power and well-being can bring about positive changes. Rural to urban migration could be checked and prevalence of poverty reduced. This could help narrow the existing gender gap, especially in the villages.



Black-necked cranes **abandon** their habitats in **Bumthang**

There is an urgent need today to bring the habitats in Bumthang under crane conservation areas

By Rinchen Namgay
Dzongkhag Forestry Sector, Bumthang

Bhagat Subberi
College of Natural Resources

Sangay Wangchuk
Ugyen Wangchuk Institute for Conservation and Environment

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It is believed that the cranes are abandoning their habitats mainly due to fields being increasingly left fallow and draining of wetland in the Dzongkhag.

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In Bumthang, one of the few places in Bhutan where the iconic black-necked crane roosts in winter, habitats are increasingly becoming a threat to the birds. If biological threats – the major threats facing the cranes in the Dzongkhag-continue, there is real danger of cranes abandoning their habitats soon.

The black-necked crane is the only alpine crane species and the last of the world's 15 crane species to be discovered.

The population of black-necked cranes worldwide is estimated anywhere between 10,070 and 10,970 individuals. The bird is classified as vulnerable under the revised IUCN Red List.

Besides China and India, Bhutan is one of the major wintering areas for the cranes. The cranes visit Bhutan from late October to mid-February every year. Major crane habitats in Bhutan are located in Phobjikha and



Khotokha in Wangdue, Bumdeling in Trashiyangtse and a few places in Bumthang.

The population of cranes visiting Bhutan is thought to be increasing, but the rise in number is attributed to the increase in number of cranes visiting Phobjikha, the major wintering habitat. In other wintering habitats, however, the number of cranes is found to be decreasing.

Crane habitats in Bumthang are mainly in the three geogs of Chumey, Choekhor and Tang. However, no inventory of roosting and foraging habitats of the cranes in these areas has been done or mapped so far. As a result, there is no clear or precise documentation of crane habitats in the Dzongkhag.

The bird habitats in Bumthang do not receive as much conservation support from stakeholders as do habitats in Phobjikha and Bumdeling.

Recently, a field survey for habitat mapping was carried out using the Garmin GPSMAP 60CSx to record the coordinates of the cranes' habitats. The coordinates from both former (based on local information) and current roosting and foraging habitats were collected and mapped.

There are five roosting habitats for cranes in Bumthang—two in Chumey, two in Tang, and one in Choekhor. The Dzongkhag has already lost



The Five Cranes (2 pair and a juvenile) at Foraging sites (Wheat land) at Hurchi Chiwog

three roosting habitats, one in Chumey and two in Choekhor.

The cranes usually foraging and around agricultural fields and marshes. The highest number of cranes—eight—was sighted in Chumey foraging habitat, followed by six in Tang, and two in Choekhor.

The survey found that cranes have abandoned the roosting ground near Usang, Gyetsa and Thomey. Likewise, in Choekhor, areas around the villages of Gongkhar and Dorjibi have been abandoned by the cranes. In Tang, cranes do not roost in Khoyear anymore.

It is believed that the cranes are abandoning their habitats mainly due to fields being increasingly left fallow and draining of wetland in the Dzongkhag.

If the crane habitats in Bumthang must be protected, there is an urgent need to bring the habitats under crane conservation areas like in Phobjikha and Bumdeling.



Treating a purpling cauliflower

Cauliflower turning purple is the sign of a disease or lack of care

**By Prem Dan Limbu and Indra Bdr Raika
Dagana**

Have you seen cauliflower turn purple? It is not a miracle, nor an unnatural phenomenon. It can be quite common, particularly if you didn't give enough care and attention to the vegetable.

Purpling can develop in white varieties of cauliflower if the developing heads are exposed to intense sunlight without protection for a long period. Purpling can also happen because of genetic propensity, or deficiency of either nutrients or trace elements.

Cauliflower grown in Bhutan is white, but even white heads have some colour variations from slight purple to pink. In a place that experiences strong sun, the same harmless water soluble pigment found in eggplants, red cabbage,

berries, plums and grapes causes the heads of cauliflower to colour.

Cauliflower grows best in sunny locations, but only when planted in time to mature during cooler months. At the height of summer, strong heat and direct exposure to the sun sometimes result in an increase in pigmentation.

If the entire plant hasn't turned purple, but only parts of the stem, it could be because of a disease. Although cauliflower is not as susceptible as cabbage to the disease known as black leg, fungal disease may attack the plant. If there are brownish spots on the stems of cauliflower seedlings, check to see if they have dark purple edges, which is an indication of it being attacked

by black leg. Remove the affected seedlings immediately and maintain the field sanitation. Do not grow cauliflower where other cole crops, including broccoli and cabbage, were grown in the previous year.

There are ways to prevent cauliflower purpling.

To keep curds creamy-white, protective measure called blanching must be taken in the temperature range of 8°C to 25°C. When cauliflower heads are blanched, their heads are protected by a covering. Often the plant's leaves are large enough to cover the heads, especially if held in place with twine or a clothespin. Paper bags fastened around the heads can also keep cauliflower curds from turning purple.

Well-developed solid white curds must be harvested before they start losing or changing colour. Loosen the leaves over the head when the head is mature. Cauliflower is ready for harvest in about 7 to 12 days after the blanching process is started. Cut the main stem to harvest the head. The curd should not have obvious florets and should be fairly smooth. If cauliflower is left too long, the texture gets ricey and the individual florets become coarse. Always harvest on time.

Technically, purple cauliflower isn't a cauliflower at all. But it tastes like common white cauliflower.

Plant cauliflower in raised beds and transplant in the evening. Irrigate immediately afterwards. It is important to maintain spacing-60 cm between rows and 45 cm between plants. This will reduce the incidents of downy mildew. Whatever the type of fungal 'fuzziness' cause problems,

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There are ways to prevent cauliflower purpling:

To keep curds creamy-white, protective measure called blanching must be taken in the temperature range of 80C to 250C.

Deficiency of either nutrients or trace elements can be solved by using liquid fertiliser and regular watering.

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destroying the affected plant parts or seedlings is important to prevent the spreading of disease just as crop rotation.

Deficiency of either nutrients or trace elements can be solved by using liquid fertiliser and regular watering. Apply an all-purpose fertiliser.

If cauliflower has a lot of purpling, it is probably best to use it raw for flavour in salads. Heat may induce a colour change from purple to gray or slate blue, especially if the water is hard or has an alkaline pH. While cooking cauliflower, add a little vinegar or cream of tartar (tartaric acid) to the water.



Normal Cole crops



Good seeds for better vegetables

Village-based quality vegetable seed production is seen as a viable farm enterprise

**By Kinley Tshering, N.B. Rai, Thinlay Penjor
and Sonam Tshomo
RDC-Wengkhar**

Sixteen trained vegetable seed growers in eastern Bhutan are making a notable difference in the way quality vegetable seeds are produced and sold in the region.

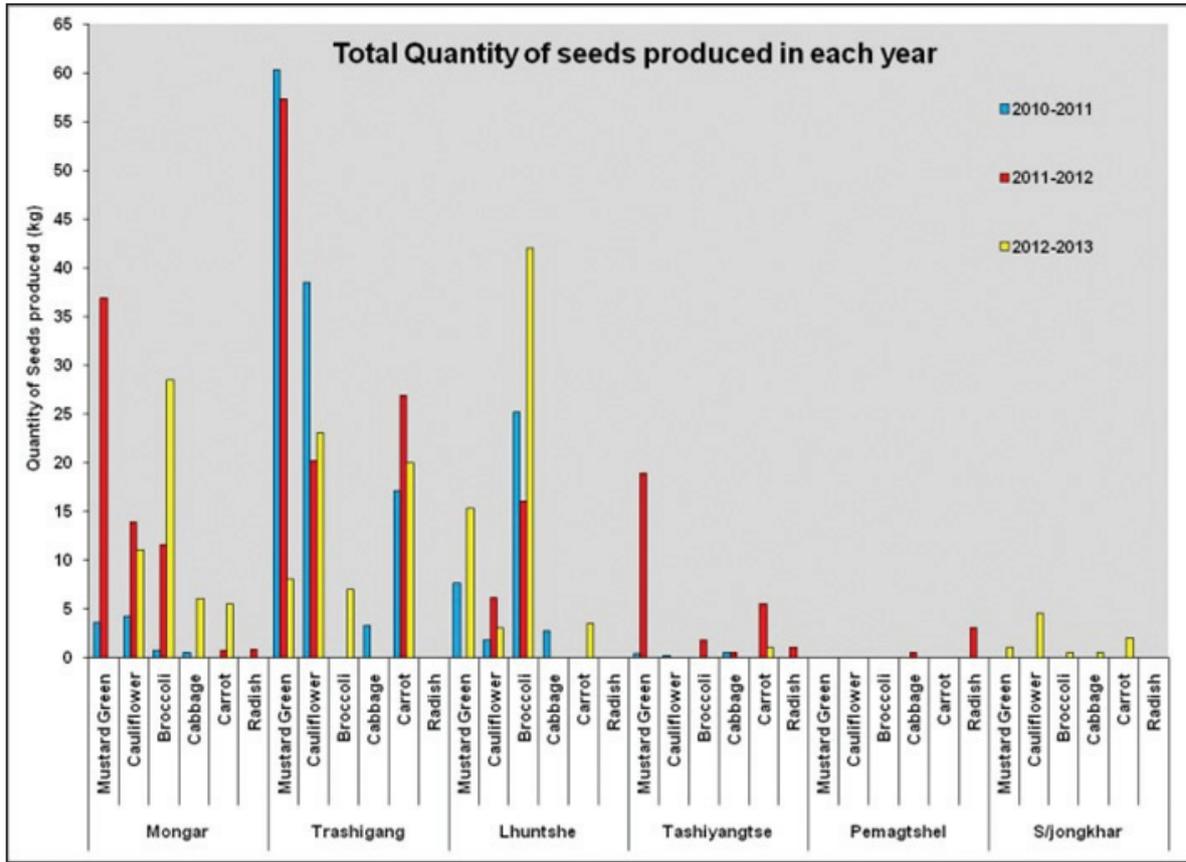
The Research Development Centre (RDC)-Wengkhar, in collaboration with the eastern Dzongkhags and Horticulture Research and Development Project (HRDP), initiated vegetable

seed production for a selected group of farmers in 2010.

It started with the production of seeds of vegetables like cabbage, cauliflower, broccoli, and carrot owing to their being in high demand in the eastern Dzongkhags. In each site, a single cole crop (each site produced a different crop) along with mustard green and carrot seeds were produced. This was done to

maintain the isolation distance and to avoid out-crossing, particularly for the cole crops.

The 16 seed growers have been in the seed production business for the last three years now. Because good seeds are a pre-requisite for a good crop, the centre has been training the growers every year for the last three years on seed production techniques, sowing, processing and packaging.



Seeds being selecting for propogation

The project experts and counterparts constantly monitor thinning, irrigation, fertilisation, roguing, pinching, selection, harvesting and drying processes. To ensure that the seeds produced are of good quality, the growers are registered with Bhutan Agriculture and Food Regulatory Authority and quality control measures are adopted.

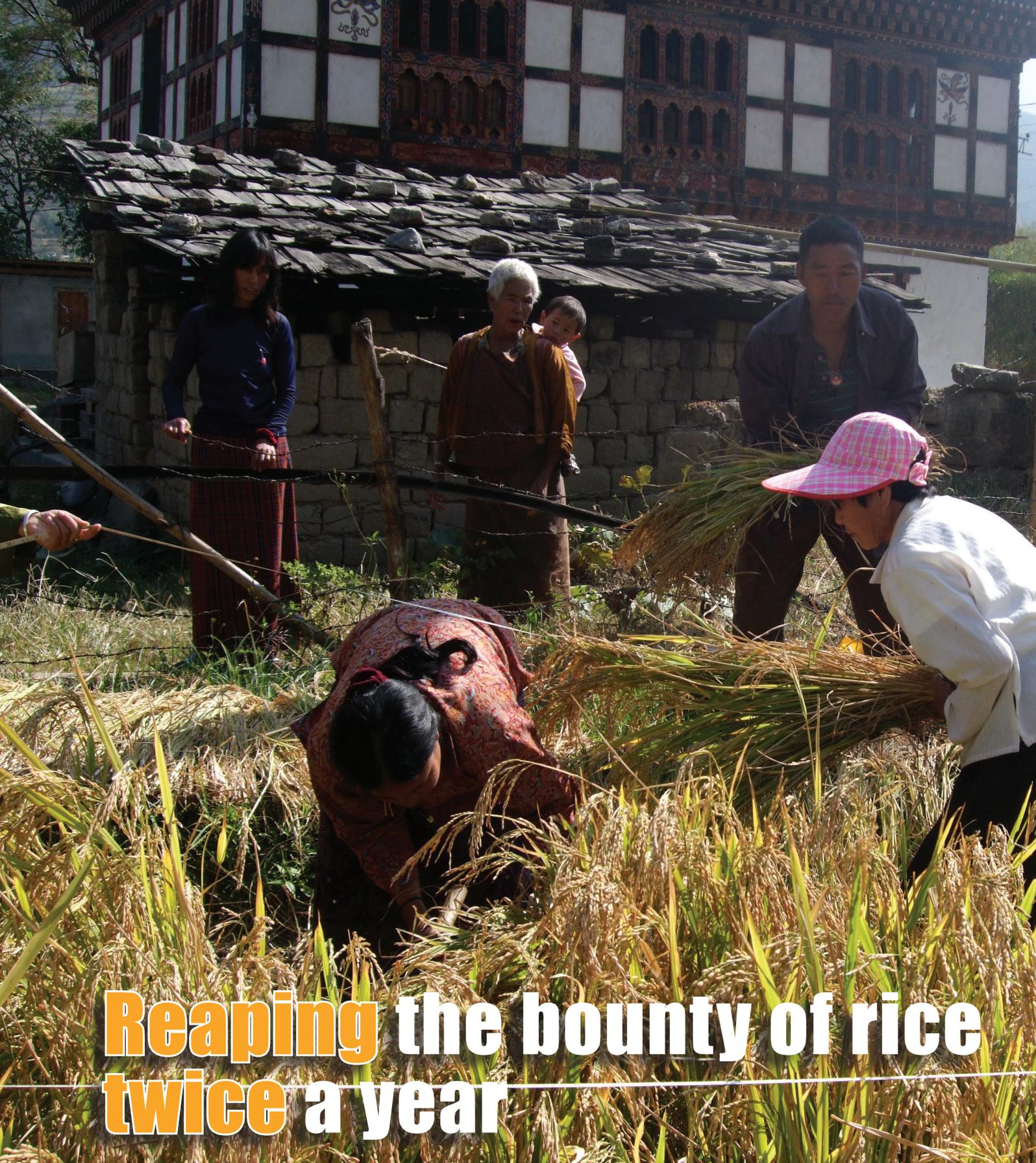
The programme also supports the growers by supplying watering cans, irrigation pipes, polythene sheets, bird nets, tarpaulin sheets, fertilisers and pesticides and seed packaging materials for free.

As the farmers of eastern Bhutan try to increase their vegetable production, lack of

quality seeds has been a constant impediment. The bulk of Bhutan's vegetable requirements is met with vegetables imported from India, which leads to trade deficit and shortage of Rupee in the country.

Vegetables play a major role in increasing the income of rural households, improving nutritional standards and in providing employment to the rural people.

Meanwhile, the capacity development of the seed growers and seed production will be continued until the project ends. For the sustainability of the seed growers, they will be linked with National Seed Centre and registered as seed growers from the region.



Reaping the bounty of rice twice a year

Rice double-cropping may be the answer to Bhutan's food self-sufficiency

By Ngawang Chhogyel, Cheku Dorji and Yadunath Bagjai
RDC-Bajo



Rinchengang is a clustered settlement opposite Wangdue Dzong. Until recently, it was one of the few villages where double cropping of rice was practised. Efforts are being made today to revive the practice.

Rice double-cropping could play an important role in improving rural livelihood and it has the potential to enhance food self-sufficiency in the country. Under this system of crop production, rice is grown as spring crop (first crop) and as the main season crop during monsoon season (second crop).

Although rice is a staple diet in Bhutan, increasing rice productivity has been a challenge for the Department of Agriculture.

Spring rice can be produced in Bhutan's mid-altitude and southern belts. If spring rice is taken up by the farmers of these regions, there will be substantial production of rice in the country. Even if only one third of the farmers in these regions undertook spring cropping of rice, Bhutan's annual rice production could cross 100,000 tonnes, which will reduce Bhutan's dependence on India for rice substantially. This in turn will have a positive impact on Rupee reserve in the country.

Since the start of rice commercialisation programme under Accelerating Bhutan's Socio-economic Development (ABSD), rice double-cropping has been given due importance. The programme was first piloted in Chuzagang geog in Sarpang. This is, however, not to say that the practice of growing rice in spring did not exist in Chuzagang before. It did. Under the pilot programme, there have been interventions to scale up spring rice production wherever feasible.

The history of rice double-cropping in Bhutan dates back to the early 1900s when International Fund for Agriculture Development (IFAD) project supported spring rice cultivation in Rinchengang. It continued for more than a decade until it came to a screeching halt when off-farm opportunities increased and development projects started coming to the Dzongkhag. After the withdrawal of support from IFAD, double-cropping of rice was discontinued. The farmers of Rinchengang stopped spring rice cultivation from 2002. Cheaper rice

Spring rice production in Chuzagang

Year	Area (ac)	Yield (kg/ac)	Production (kg)	Remarks
2009	4	876.5	3506	Calculations were based on the yields of two varieties, IR 20913 and B2983B.
2010	30	687	20610	
2011	30	715	21450	
	64	759.5	45566	

from India had become widely available in the country by then.

Lobzang, an extension agent of Chuzagang, who tried spring cropping of rice in Dewathang village in 2006, says that 4.45 tonnes of paddy was produced from about 4.45 acres of land, which benefited 22 households. According to Doley, the focal person of Chuzagang Rice Commercialisation Project (2008-2012), the geog practiced spring rice cropping consecutively from 2009 to 2011. His report showed that the area under spring rice cultivation increased from 4 acres in 2009 to 30 acres in 2011, producing 45,566 tonnes of additional paddy.

In 2013, the Research Development Centre (RDC) -Bajo, the Agriculture Machinery Centre and Wangdue Dzongkhag tried to revive spring



Farmers threshing paddy

rice production in Rinchengang through a series of interventions like supply of free seeds, improvement of irrigation channels, farm machinery services and training programmes. Under this support package, a higher-yielding, cold-tolerant japonica rice variety called No. 11 seed was supplied to the 48 farmers. The beneficiaries also received poly tunnel and tray nursery training. Altogether, about 22 acres of land was brought under spring rice cultivation, 2 acres of which was fully mechanised for transplanting, land preparation, harvesting and thrashing.

Sample crop cuts were conducted to assess grain yield. The average yield from the crop was 2,449 kgs per acre which, when extrapolated for 22 acres, worked out to 54 tonnes of paddy out of which 32 tonnes were marketable rice. That was a success. Encouraged by good result, RDC-Bajo and the partner agencies are now all set to not only scale up acreage in Rinchengang, but also to start spring rice cultivation in other Dzongkhags.

Issues and constraints remain, though. Irrigation continues to be the greatest problem as water sources dry up. Peak irrigation requirement coincides with renovation timing and harvest timing coincides with the monsoon that spoils grain quality. Harvest delay leads to germination while grains are still on stalk. There are no drying facilities to bring down the grain moisture level, and pest infestation, birds and rodents (pre-harvest and storage) attacks are rampant due to off-seasonal nature of production. Also, crop yield is low compared to main season crop and is damaged by straying cattle. In addition, labour shortage and alternative source of income are also constraints.

But, if Bhutan is to achieve rice self-sufficiency, rice double-cropping is a viable solution or option.



New Discovery

The sighting of Hodgson's Frogmouth (*Batrachostomus hodgsoni*) at Gomphu on June 5, 2013 adds another new record of birds for the Royal Manas National Park (RMNP). Till date the park has listed 431 species of birds within an area of 1057 km². The interesting part about this new addition is that it is also found to breed in the locality for the first time in Bhutan.

Hodgson's Frogmouth belongs to the Podargidae family of birds. Globally, it is found in Bangladesh, Bhutan, China, India, Laos, Myanmar, Thailand and Vietnam. The literature shows that it occurs mostly in temperate forests. The International Union for Conservation of Nature (IUCN) has listed as Least Concern in their Red List of threatened species.

Over the last seven years, RMNP has added three new records to the list of mammals and five new records to their list of birds. While the Rapid Biodiversity Survey conducted in 2006 confirmed 58 mammal species, and 426 bird species, the new records of both mammal and birds remained unpublished. The Asiatic Brush-tailed Porcupine (*Antherurus macrourus*), Chinese (aka Small-toothed) Ferret-badger (*Melogale moschata*), and Hodgson's Giant Flying Squirrel (*Petaurista magnificus*) are three new additions that now make up 61 species of mammals in RMNP.

The recent new additions of birds include Black Baza (*Aviceda leuphotes*), Water Cock (*Gallicrex cinerea*), Lesser Adjutant (*Leptoptilos javanicus*) and Malayan Night Heron (*Gorsachius melanolophus*). As Sherub and Wangchuk, D. (2006) predicted over 530 bird species occurring in RMNP and the park management expects more new records over the years to come.

RMNP plans to conduct a Rapid Biodiversity Survey and Socio-economic

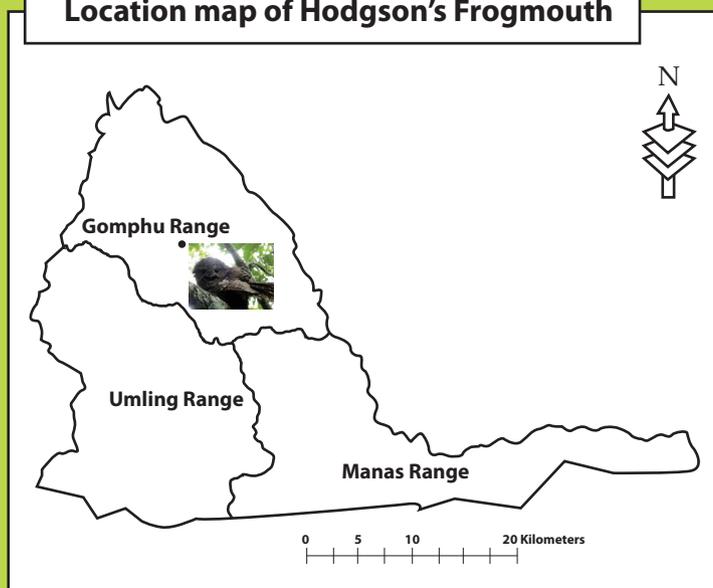


survey to update their management plan in July 2014. With another new management plan in place, the park management is looking forward to take up in-depth scientific research on species as well as the habitat. With such management interventions, RMNP hopes to explore more new records of species and create reliable database in the future.

The park is currently funded by Royal Government of Bhutan and WWF Bhutan.

- RMNP

Location map of Hodgson's Frogmouth



Highlights of 2013



23 Technical Graduates joins MoAF

January 8, Thimphu: Lyonpo Dr. Pema Gyamtsho, including the head of the departments and agencies met with 23 new graduates who were appointed to join various offices under the Ministry.

Lyonpo during the meeting informed that graduates that MoAF is regarded as one of the most important ministries in terms of its contribution to the growth of green sector; especially in its contribution to the food production and environmental conservation through land management, conservation of water and natural resources.



Bhutan participates in the 13th Delhi Sustainable Development Summit

January 31-February 2, New Delhi: The Royal Government of Bhutan's delegation to the 13th Delhi Sustainable Development Summit (DSDS) was led by Lyonpo Dr. Pema Gyamtsho, the Minister for Agriculture and Forests.

During the meeting, Lyonpo highlighted that "Bhutan has long since recognised the critical need to replace reliance on fossil fuels by clean, more sustainable, environmentally friendly means of driving economic growth and development".



Fourth Annual Nomads' Festival held in Bumthang

February 23-24, Bumthang: The Wangchuck Centennial Park hosted the fourth annual Nomads' festival in Nagesphel, approximately 23 kms from Chamkhar.

During the festival, about 105 nomads from eight Dzongkhags of Bhutan along with over 400 visitors thronged the celebration arena to participate in amalgamation of sports (traditional archery, shoksum, doegor, pillow fighting, pole climbing, Nyagoe dendhur, shotput, calf weight guessing, milking competition, horse and yak riding, tug of war etc), quizzes, entertainment (singing, masked dances, dances by cultural groups, schools and audiences) and many more.

Highlights of 2013



Three Cherr(ies) to the friendship of Bhutan and Japan's Fukushima

February 28, Thimphu: A six-member delegation from Miharu in Japan led by the Hon'ble Mayor Yoshinori Suzuki planted three Taki-Sakura Waterfall Cherry saplings at the Gongzim Sonam Tobgay Dorji and Lyonchen Jigme Palden Dorji memorial garden at Langjophaka. The ceremonial plantation was done together with Lyonpo Dr. Pema Gyamtsho and other distinguished guests.

The gift of the sapling from the 1000 years old Cherry tree was the token of appreciation for the visit of His Majesty the King and the Gyaltsuen to Fukushima Prefecture.



Immense and remarkable progress by the RNR sector in 11th FYP

March 1, Thimphu: Over the past five years, the Ministry of Agriculture and Forests has made tremendous achievements towards enhancing the rural livelihood and conservation and sustainable utilisation of forest and water resources. This was highlighted in the RNR sector program and project coordination meeting held at the Terma Linca Resort.

According to a report presented at the meeting, the 10th five year plan (FYP) has successfully brought down poverty rate from 30% to around 16% in rural areas. For this, the initiatives such as 'One Geog, Three Products' played an important role in enhancing the product diversification and providing farmers with more opportunities for their better living standards.



In promising Food Safety

March 2, Yusipang: The Bhutan Agriculture and Food Regulatory Authority in its fight towards food safety have strengthened its defense with the accreditation of the National Food Testing Laboratory (NFTL) and the inauguration of the biotechnology laboratory for testing genetically modified organisms and their products in food and feed.

The NFTL is the first laboratory in the country to achieve accreditation certificate for ISO/IEC 17025:2005 and is now at par with international laboratories for testing of five categories of food products i.e. processed fruit and vegetables, cereal products, confectionary and bakery products, tea and drinking water in 12 clinical and 3 microbiological parameters.

Highlights of 2013



Handing and taking over of the 23rd Japanese KR-II Grant 2010

March 18, Paro: During the handing and taking over ceremony of the KR-II Grant 2010 at the Agriculture Machinery Centre, the Hon'ble Chief Guest, Ms. Yumiko Asakuma, Chief Representative, Japan International Cooperation Agency Bhutan Office handed over 165 units of two wheeled tractors with rotary tillers and 172 units of single reversible plough for two wheeled tractors to Lyonpo Dr. Pema Gyamtsho.

The Japanese Government has been providing assistance of farm machines through the KR-II Grant since 1984. These farm machineries are used for agricultural and farming purposes and have immensely benefited the farming communities.



The rare and elusive Marbled Cat caught on camera

March 29, Thimphu: One of the most elusive and rarely spotted creatures in the wild, a Marbled Cat (*Pardofelis marmorata*/*Felis marmorata*) was caught on a camera trap set by the Jigme Singye Wangchuck National Park and the Wildlife Conservation Division on December 30, 2012. One of the most fascinating feline species in the world, from the point of view of mystery, beauty and rarity, is certainly the almost unknown creature commonly called the Marbled Cat, now also seen in Bhutan.

The little-known Marbled Cat, whose tail is nearly the length of its body, was captured by camera traps set as part of an ongoing biodiversity survey in the northern biological corridors for developing the management plan.



Farm machinery hiring services launched

May 6, Punakha: The Department of Agriculture formally launched the farm machinery hiring services in Serigang village, Kabisa geog under Punakha Dzongkhag. The hiring service will be managed by the Agriculture Machinery Centre (AMC) through the regional AMC offices.

The services is instituted mainly to address a long standing issue of labour shortage, agriculture feminisation and ageing rural population. It also aims to achieve land intensification, utilisation of fallowed land, income generation through crop intensification and commercialisation of agriculture. Range of machineries available through hiring services includes land preparation, paddy transplantation, harvesting, among others.

Highlights of 2013



The first Hazelnuts in Bhutan for Mountain Hazelnut Venture appear

May 10, Thimphu: The Mountain Hazelnut Venture (MHV) informed the DASHO Sherub Gyaltshen that their field staff has spotted the first hazelnuts growing on farmers' trees. The Memorandum of Understanding between the Ministry of Agriculture and Forests and the Hong Kong based MHV was signed on January 30, 2009. The first two hazelnut orchards in Rangshikar and Yongphula in Trashigang were established in 2010. As planned, Hazelnut yield will only be minimal for the third and fourth years, before coming into bigger production in years 5 and 6.



First-ever Rhododendron festival in Bhutan

May 11-13, Lamperi: The first ever Rhododendron festival in Bhutan was held at Lamperi highlighting some of the cultural richness of the park and its interrelation with the nature attracted more than 1000 local visitors and about 350 foreign tourists.

It was organised by the Nature Recreation and Ecotourism Division in collaboration with the Meto Pelri Tshogpa. The festival provided an opportunity for the participating communities to generate cash income through sale of local products. Locals put up stalls serving as sale outlet for array of local products, cuisine and beverages.



Bhutan celebrated International Biological Diversity Day

May 22, Thimphu: The International Day for Biological Diversity with the theme 'Biodiversity and Water' was celebrated at Babesa Middle Secondary School; the first time being celebrated with a school.

The half-day event included quiz, speech and art competitions between the different house groups and classes of the school. The participatory event saw many students expressing themselves through an impressive array of art on water and biodiversity. A series of other activities carried out to celebrate the day includes, essay writing and art competition by students from across the country and the composition of song on agro-biodiversity. The winners of the essay and art competitions were also declared.

Highlights of 2013



Social Forestry Day celebrated across the Country

June 2, Thimphu: Schools, institutions and individuals across the Country on June 2nd celebrated the Social Forestry Day with the theme “Plant Trees for Clean Air and Water”. The day was marked by the planting of tree seedlings in addition to other environmental awareness programmes.

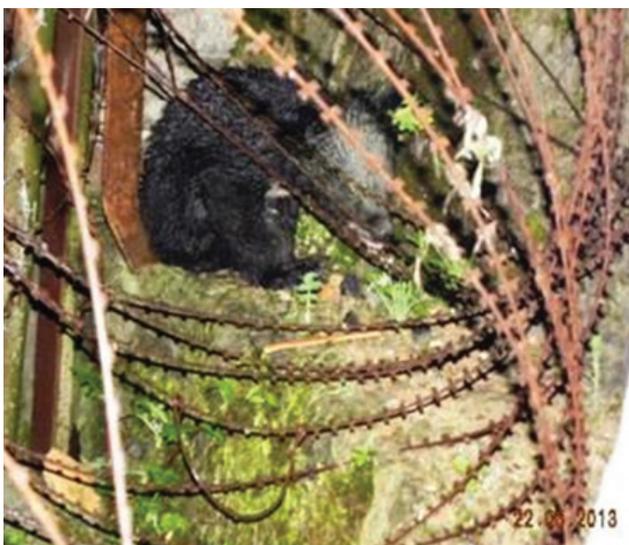
In Thimphu, the day in collaboration with the Thimphu Dzongkhag Education Sector was celebrated at Khasadrapchu Middle Secondary School. The Director General of the Department of Forest and Park Services, Mr. Chenchu Norbu, graced the occasion as Chief Guest. The teachers and students from four schools of Thimphu also gathered for the celebration.



Bilateral meeting between FAO and MoAF

June 22, Rome: The Food and Agriculture Organisation (FAO) Director General, José Graziano da Silva, discussed soil and water issues with Dasho Sherub Gyaltshen, the Secretary for Ministry of Agriculture and Forests, Bhutan at the 38th Session of FAO Conference.

Dasho Sherub said that expansion of urban areas is rapidly eroding Bhutan’s already limited resources of arable land (7% of her total geographical area), with fertile valley soils being lost to housing and shopping complexes. Dasho also spoke of the collaboration between Bhutan, Thailand and FAO in the Global Soil Initiative and in the International Year of Soils.



Himalayan Black Bear Cub successfully released into the wild

June 23, Thimphu: The wildlife rescue team received a report about a cub of a Himalayan Black Bear *Ursus thibetanus* entangled in the barbed wire in the vicinity of the Chamgang Central Jail.

Upon reaching the site, the rescue team observed an unusual behaviour of the cub sheltering inside a pocket of barbed wire, who had presumably got separated from her mother due to the presence of several stray dogs in that area. The rescue team tranquilised the cub with the required drugs, and as no physical injuries were observed on its body, the cub was relocated to its natural habitat.

Highlights of 2013



Bhutan becomes an associate member of International Cooperative Alliance

June 28, Thimphu: With due approval from the Royal Government of Bhutan, the Department of Agricultural Marketing and Cooperatives (DAMC) has become a 268th member of the International Cooperative Alliance (ICA) and joins the global cooperative family.

The ICA is the apex body of the world's cooperative movement which acts as the custodian and voice of the cooperative movement worldwide. It is a special support to Bhutan's growing cooperative movement by the ICA which otherwise rarely considers government organisations like DAMC. Bhutan's membership to ICA sets a landmark milestone in our cooperative movement.



MoAF and Sanyu signs agreement on Taklai

July 11, Thimphu: An agreement was signed between the Ministry of Agriculture and Forests and Sanyu Consultant, Japan on consultancy Services for construction for rehabilitation of Taklai Irrigation System to be started from October 2013.

The agreement signing was done by Dasho Sherub Gyaltsen and Mr. Kazuna Akiyoshi, Project Manager, Sanyu Consultant, Japan.

Also present during the signing were officials from the Department of Agriculture and Planning and Policy Division of the Ministry.



Agriculture based project for Female Inmates

July 16, Paro: The Royal Bhutan Police (RBP) in collaboration with the Ministry of Agriculture and Forest started a project called the 'Agriculture Based Open Air Female Prisoners' to be implemented on an area of six acres registered under a provisional thram with RBP.

The project is a noble initiative of His Majesty the King which aims to give the female prisoners an opportunity to abandon their old habits and take up a progressive and productive lifestyle. It would also help them to improve their psychological conditions and provide them a platform to join the mainstream of the society without social stigma and discrimination with their rehabilitation and self-reformation.

Highlights of 2013



Global Tiger Day celebrated

July 29: Recognising the importance of the Tiger in Bhutan, the Department of Forest and Park Services celebrated this year's Tiger Day with the theme *"Empowering Local Communities for Tiger Conservation"* at Norbuling Middle Secondary School, which is located in the buffer zone of Royal Manas National Park, a place also considered to be a hotspot for wild felids particularly the tiger.

Ecologically, Tiger stands at the top of the food chain, and its presence in the Bhutanese forest symbolises the well-being of many other species living with it including their function to control the population of ungulates like serow, sambhar, barking deer, etc.



BAFRA celebrates its 13th Birthday

August 5, Thimphu: The Bhutan Agriculture Food Regulatory Authority (BAFRA) celebrated its 13th Birthday at the BAFRA Head Office. Lyonpo Yeshey Dorji graced the occasion along with the Dasho Secretary and other senior officials from Ministry including the BAFRA staff.

BAFRA was established on August 5, 2000 as a perpetual, public-sector instrument to promote the quality and safety of goods and products related to the Ministry. It also coordinates and liaises with other national, regional and international agencies that are related to regulation of quality and safety of agricultural products including foods.



Fourth Annual Masutake Festival held in Ura

August 24-25, Bumthang: The Fourth Annual Masutake Festival was held in Ura. The Director General of the Department of Forest and Park Services, Mr. Chencho Norbu was the Chief Guest at the festival.

The festival was aimed at offering an opportunity to local communities to showcase their cultural and natural heritage that are unique to their locality. It also helps open an avenue to other economic opportunities such as sale of local products, encouraging product diversification and ecotourism. This year, the festival also saw more tourists compared to last year.

Certificates and cash prizes were awarded to the winners of the cultural performances and waste managers.

Highlights of 2013



Experts meet to discuss on Animal Diseases in the Asia-Pacific region

September 23-26, Thimphu: Experts from fourteen out of the eighteen member countries of the Animal Production and Health Commission for Asia-Pacific (APHCA) met to discuss on the impact and intervention of zoonosis, food borne disease and anti-microbial resistance (AMR) in the Asia-Pacific region. This was the 37th session of APHCA meeting.

APHCA based at Thailand provides the platform for the member countries to share technical information on animal health services and coordinate the joint action of collaboration to tackle the same.



MoU to recognise the certification system of EIC

September 27, Thimphu: A Memorandum of Understanding (MoU) was signed between the Export Inspection Council of India (EIC) and Bhutan Agriculture and Food Regulatory Authority (BAFRA) to recognise the export inspection and certification system of EIC for Bhutan. Hereafter, certificates issued by EIC would be recognised as a proof of certification as prescribed by BAFRA. However, random checks will be carried out to ensure continued compliance of products under the MoU.

The MoU covers all food and agricultural products which are imported from India. BAFRA will notify the list of food commodities to be certified by EIC based on the commodity risk analysis and national priority.



Bhutan observed World Rabies Day

September 28, Phuentsholing: The Phuentsholing and Pasakha areas of Chukha Dzongkhag are especially endemic to Rabies with increasing cases in livestock and human deaths being reported. Therefore, this year, Bhutan observed World Rabies Day particularly in these areas to strengthen the awareness on rabies.

The program was organised at two locations such as at Phuentsholing Higher Secondary School and Alley Middle secondary School through talk shows which was attended by more than one thousand participants. There was a presentation by livestock and health experts on rabies. A street show on rabies was also organised at the Children's Park along with free registrations and vaccination cum treatment at four locations.

Highlights of 2013



Agriculture Minister on familiarisation tour of Punakha Dzongkhag

October 4-7, Punakha: Lyonpo Yeshey Dorji, Members of the Parliament of Limbu-Toewang Constituency Mr. Chhimi Dorji and Kabji-Talo Constituency Mr. Dopfu Dukpa and officials from the Ministry completed a tour of eleven geogs under Punakha Dzongkhag.

The most pertinent issues highlighted in every geog was the lack of constant irrigation water, all weather farm roads, human-wildlife conflict, labour shortages due to rural urban migration and market access for farm produce among others.



Combination Harvesters inaugurated in Paro

October 8, Paro: A total of six Combination Harvesters provided through the Japanese Non-Project Grant Aid were demonstrated and operated by Japanese experts at Tomja, Shaba. The machine which costs more than Nu. 2 m each was inaugurated by Lyonpo Yeshey Dorji, the Minister of Agriculture and Forests.

Speaking at the function, Lyonpo informed that MoAF during 11th Five Year Plan will focus on construction and renovation of irrigation channels, land development and management, farm mechanisation and addressing of human-wildlife conflict among others.



Bhutan observed World Food Day at Bjishong

October 16, Gasa: Hundreds of people including students, locals and officials gathered at the Bjishong Middle Secondary School, Gasa to celebrate the World Food Day with the theme 'Sustainable Food Systems for Food Security and Nutrition'.

The day is marked worldwide to create awareness and educate the people on the efforts made by the Food and Agriculture Organisation on the world food problem and strengthen support against hunger, malnutrition and poverty. The day is normally held in one of the remote schools, which have the school feeding program funded by the World Food Programme and is a member of the School Agriculture Programme.

Highlights of 2013



Bhutan launches NAP alignment process

October 21, Thimphu: Bhutan has launched a process to update and align its National Action Programme (NAP), the country's strategic document for the fight against Land Degradation and poverty. Dasho Sherub Gyaltshen graced the occasion as Chief Guest.

The main objectives of the workshop was to “kick-start” the process of NAP alignment, sensitise the stakeholders on land degradation issues, the importance of Sustainable Land Management and need to align existing NAP, and to seek support from relevant stakeholders in actual NAP alignment.



Bhutan took part in Global Snow Leopard Forum

October 21-23, Kyrgystan Republic: The Government Ministers of 12 Snow Leopard Range countries and heads of the International Conservation Community gathered in Bishkek for the first ever Global Snow Leopard Forum (GSLF). The delegates discussed urgent action required for the conservation of the iconic but highly endangered species of the mountain ecosystem.

The twelve range countries are Afghanistan, Bhutan, China, India, Kazakhstan, Kyrgystan, Mongolia, Nepal, Pakistan, Russia, Tajikistan, and Uzbekistan. The Bhutanese delegation was led by Lyonpo Yeshey Dorji along with senior officials from the Ministry.

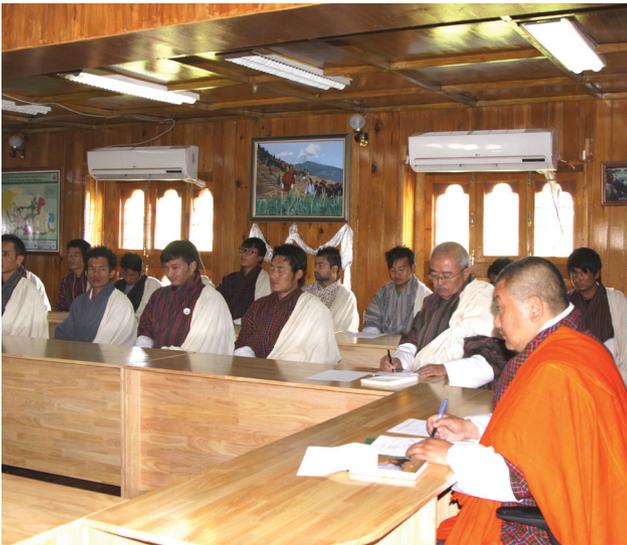


Jhomolhari Mountain Festival held for the first time

October 23-24, Thimphu: The Jhomolhari Mountain Festival was held for the first time in Soe geog under Thimphu Dzongkhag.

The objectives of the festival were to showcase Bhutan's rich natural heritage, promote ecotourism opportunities in the Jhomolhari region, showcase local culture and tradition, encourage yak herding and promoting dairy products, create awareness on high land biodiversity conservation and waste management and promote wildlife conservation (focusing on snow leopard conservation) through community participation and support.

Highlights of 2013



Second Batch of Agriculture Interns selected for Israel

October 31, Thimphu: Thirty university graduates have been selected as agriculture interns to be sent to Israel for eleven months. These are the second batch of interns being sent by the Ministry of Agriculture and Forests, the first batch comprising ten (8 extension staff and 2 school dropout) was sent in October 2012.

The interns will be placed in some of the farms and will be taken care by Agro Studies, one of the international training institutes in Israel. Their program will consist of one day theory class and five days work experience with at least 8 working hours a day.



Agriculture Minister visits all eight geogs of Lhuentse Dzongkhag

November 8-13, Lhuentse: The team, led by Lyonpo Yeshey Dorji along with the Director General of the Department of Agriculture and Chiefs of the various departments under the Ministry, and Dzongkhag officials visited the eight geogs in Lhuentse.

The team briefed the people about the policies, programs and activities set aside in the Ministry which directly benefits the people. This includes cereal, vegetable, horticulture production, value addition and group marketing in the agriculture department, dairy and poultry production, value addition and marketing in the livestock department and community forestry, non-wood forest products in forestry department.



Bhutan calls for greater Global solidarity to tackle Climate Change

November 20, Poland: Addressing the Plenary of the Conference of Parties to the UN Framework on Climate Change in Warsaw, Lyonpo Yeshey Dorji, the Minister for Agriculture and Forests and Vice Chair of the National Environment Commission, urged the international community to demonstrate greater global solidarity to tackle the threat of climate change.

Speaking at the conference, Lyonpo urged the developed states to assume the lead in fulfillment of obligations under the Climate Change. The Conference, which concluded on 22 November was expected to set the contours of a new, universal and legally binding climate agreement that will be adopted in 2015.

Highlights of 2013



Ground breaking ceremony held for the rehabilitation of Taklai Irrigation System

November 28, Gelephu: The ground breaking ceremony of the rehabilitation of Taklai Irrigation System at Sershong geog in Gelephu was led by the Director General (DG) of the Department of Agriculture Mr. Tenzin Dhendup. The Taklai irrigation system is situated along the Taklai River covering the two geogs of Chuzagang and Sershong in Sarpang Dzongkhag. The gross area under these two geogs is about 1500 hectares of which the net cultivated Chuzhing area is around 1300 ha benefiting over 500 households. The large command area and relatively large infrastructure build therein makes this scheme a unique type and is currently the largest irrigation system in Bhutan.



Experts from SAARC countries meet to strengthen One Health Initiatives

December 2-6, Paro: More than hundred technical specialists and decision makers from the SAARC members countries of Afghanistan, India, Nepal, Pakistan, Sri Lanka, Bangladesh and Bhutan gathered for a five day long, the South Asia Regional One Health Symposium in Zhiwaling Hotel. Aimed to strengthen One Health Initiatives in South-Asia, the symposium brought together both animal and human health professionals to be prepared for effective management of the infectious diseases including zoonoses. One Health is an interdisciplinary approach to combating emerging infectious diseases by addressing the complex interactions of human and animal health and the environment. It has significantly contributed in improving the regional interaction over the years.



Bhutan Biodiversity Portal launched

17 December, Thimphu: The Bhutan Biodiversity Portal (www.biodiversity.bt) was officially launched on the National Day of Bhutan, 17 December, 2013 by Lyonpo Yeshey Dorji, Minister of Agriculture and Forests at Namgay Heritage Hotel. The Bhutan Biodiversity Portal (BBP) is an official on-line repository of Bhutan's biodiversity, aiming to provide the most updated and comprehensive information on Bhutan's biodiversity through a single window. The portal also has features to promote citizen participation in documenting and understanding the biodiversity of Bhutan. Simply by registering in the portal, anyone can contribute their observation and sightings of any taxa of biodiversity in the form of pictures or videos.

Highlights of 2013



Third Forestry Conference held

19 December, Samtse: More than 180 foresters and conservationists from across the country gathered at Samtse to discuss issues and deliberate clear understanding of the existing gaps in policies and strategies of the Department of Forest and Park Services (DoFPS).

Hon'ble Lyonpo Yeshey Dorji graced the third Forestry Conference "enhancing sustainable forest management through improved forest governance" as the Chief Guest. In his opening address, Lyonpo praised the foresters for their excellent services in the conservation of the environment.



Regional workshop on use of bio pesticides in crop production

23-25 December, Wangdue: The three day long regional expert consultation meeting on "Extent and potential use of bio-pesticides for crop protection in SAARC Countries" was held at Bajothang. The meeting was attended by delegates from Afghanistan, Bangladesh, Bhutan, Nepal, Pakistan and Sri Lanka and professionals from the Ministry of Agriculture and Forests.

Dr. Abul Kalam Azad, Director SAARC Agriculture Centre (SAC) in his remarks highlighted the role of SAC in facilitating agriculture development in the region.



SAARC representatives meet to review Vegetable Adaptive Trials

28-29 December, Thimphu: Representatives from Bangladesh, Nepal, India, Pakistan, Sri Lanka and Bhutan met at Hotel Migmar to review the vegetable trials result and problems encountered by six member countries.

The member countries initiated the vegetables adaptability trials for tomato, brinjal, okra, cucumber and pumpkin since May 2012 through the SAARC Agriculture Centre (SAC), a regional centre of South Asian Association for Regional Cooperation (SAARC). The vegetables were chosen on the basis of their need and preference especially targeting small/marginal farmers.

Need to tread the middle path

Policies and laws must be put in place, without losing time, to ensure that economic development doesn't come at the cost of the environment

By Tashi Phuntsho
Dzongkhag Forestry Sector, Lhuentse

Nestled in the mighty folds of the Himalayas, Bhutan is a small Buddhist kingdom blessed with rich cultures, beautiful traditions, and pristine natural environment that continue to flourish, thanks largely to well-advised government policies and earnest, often fierce, guardianship of the people.

At a time when forest cover is fast disappearing in many countries because of mindless extraction of natural resources, here in Bhutan, forest cover has been steadily growing. Bhutan's Constitution requires that at least 60 percent of the country should remain under forest cover for all time. It is, therefore, incumbent on every Bhutanese citizen to protect and conserve the country's rich natural wealth and biodiversity that it sustains.

As the country becomes more modern with rapid economic development, the question of whether the country should strive for effective environment management strategies or focus on economic development alone ought to be considered. Bhutan cannot totally ignore economic development because it takes a toll on the country's natural environment. Nor should it forget management of the environment completely because economic growth is equally desirable. However, while debate on the merits of the two continues, we must realise that we cannot afford to lose time.

Decision must be made, and the sooner the better. And that is to strike a balance between economic growth that the country ought to

achieve and development of strong and effective environment management laws and strategies so that economic growth does not come at the cost of the environment.

With economic boom in the country, many heavy industries and hydropower plants have been set up. Road networks have vastly improved. All these developments put pressure on the country's natural environment. In the coming years, more such development activities will be initiated in the country. If stringent environmental laws and sound and effective protection strategies are not put in place, there will be unchecked degradation of our natural environment that will affect the entire ecosystem.

Deforestation, littering, and forest fire are some of the problems facing the environment today, as the result of which water sources are drying up and glacial lakes are melting fast. These will have a huge impact on the environment and the lives of thousands of people. Measures like environmental mainstreaming in policymaking, planning and budgeting are put into place by ministries, commissions and NGOs to mitigate environmental problems. And so far, this has been a success story for Bhutan.

But we need to do more and adapt to the fast-changing climate scenario and ever-increasing economic growth. Only then will we be able to protect our environment well. Only then will we be able to pursue economic development in a more sustainable way.



Outline for **RNR-Sector's** 11th Five Year Plan

The RNR sector continues to be the major player in improving the economy, livelihood and environment of our country. Akin to the past plans, the 11th Five Year Plan (FYP) is guided by the philosophy of the Gross National Happiness (GNH) and its four pillars. In view of this, the 11th FYP goals, objectives, strategies and programs are formulated towards strengthening the four pillars of GNH: i) Promotion of equitable and sustainable socioeconomic development, ii) Preservation and promotion of cultural values, iii) Conservation of the natural environment, and iv) Good governance.

VISION

Sustainable natural resources for the equitable social and economic well being of the Bhutanese people and the nation wide

MISSION

To ensure sustainable social and economic well-being of the Bhutanese people through adequate access to food and natural resources

GOAL

Green economic growth, inclusive social development, poverty alleviation and climate smart sustainable management and utilisation of natural resources

OBJECTIVES:

Following four key objectives are set out to be fulfilled during the 11th FYP:

1. Enhance food and nutrition security by making various kinds of foods available through improved production, access and enabling effective utilisation of food.
2. Enhance Sustainable Rural Livelihood by making rural livelihood productive and sustainable by generating employment opportunities, increasing rural households cash income and implement Rural Economic Advancement Programs in the selected vulnerable geogs.
3. Accelerate RNR sector growth to 4% through agriculture commercialisation/ diversification, private sector participation and value addition on export.
4. Promote sustainable management and utilisation of natural resources for health, happiness and economy.

The achievements of these objectives are to be measured through the achievements of six sector key result areas (SKRAs) and a number of key program indicators (KPIs). Towards achieving those objectives and SKRAs, the following are the focus areas for the Ministry:

- National Field Crop Commodity Development Program
- National Horticulture Commodity Development Program
- Agriculture Infrastructure Development Program
- National Organic Development Program
- National Livestock Commodity Development Program
- Targeted Highland Development Program
- Sustainable Management of Forest Landscapes and Conservation of Biodiversity Program
- Sustainable Management of State Forests Program
- Integrated Watershed Management Program
- Agriculture Marketing and Cooperative Development Program
- RNR Research and Extension Services Program
- School Agriculture Program
- Rural Development Training Program
- National Bio-security and Food Safety Program
- Biodiversity Conservation and Sustainable Utilisation Program
- Support Services Program.

RNR Sector Strategies

Although much has been achieved in the past plan periods, challenges still remain in achieving food security, poverty reduction, transformation of agriculture from subsistence to commercial farming, markets and efficient use of inputs. It is therefore imperative to face these challenges through the following strategies:

- Optimisation and effective utilisation of resources to enhance productivity and production
- Strengthening commercialisation and agriculture marketing
- Participation in commodity value chain and compacts
- Sustainable management and utilisation of land, water, forest and biodiversity resources
- Contract farming and private sector participation
- Infrastructure development
- Enhance investment in RNR Sector
- Adapting to climate change and disaster risk reduction
- Encouraging research, innovation and technology
- Farmer groups and cooperatives

Budget allocation: The RNR Sector during the 11th plan is allocated Nu. 4,856.22 (Capital only) which is about 2.3% of the total outlay (209.3 billion) and about 7.25% of the total outlay allocated to the central agencies.



When locals and forests **HELP** each other

Forests are more beneficial to the poor when protected, utilised and managed by the communities

By Gem Tshering
Dzongkhag Forestry Sector, Haa



Participatory approach to forest protection, utilisation and management may be new in Bhutan, but community forest management groups (CFMGs) bring substantial income to rural communities.

The legal basis for community forest (CF) was laid in 1995. The Forest and Nature Conservation Act of Bhutan recognised traditional and cultural rights of local people to access and use forest resources.

Individuals and households of a community, therefore, have traditional claims to forest

produce and are responsible to take care of their forest. CF ownership process received a further boost during the 10th Five Year Plan (2008-2013).

CFMGs in Bhutan generate their funds through different means such as the sale of timber, firewood, non-wood forest products, membership fees, timber fee, donation, reward, and penalties. The income from these sources is used for development of CF.

Participation of local communities is a key to conservation and sustainable management of forest resources. In the beginning, CF was primarily promoted to ensure forest protection, but now it is increasingly viewed as a means to improve rural livelihood and to contribute to poverty reduction. CF, however, constitutes less than 1 percent of the national forest over.

And because CF is a new idea in the country, limited fund is generated from it. According to a 2009 field study, the CFMG in Yargay CF in Tsirang was able to sell 597.16 cu. ft of sawn timber and generated net income of Nu. 50,000.

Allocation and utilisation of CF funds differs from one CF to another.

Whatever the case, it has been observed that community forestry has improved after handing over the forests to local users. To strengthen their management, the CFMGs and other relevant stakeholders must, however, explore other options to generate more funds. And for judicious use of funds, annual plans should be developed and implemented on the basis of priority with more emphasis on income and employment opportunities for poorer and disadvantaged households.

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Participation of local communities is a key to conservation and sustainable management of forest resources. In the beginning, CF was primarily promoted to ensure forest protection, but now it is increasingly viewed as a means to improve rural livelihood and to contribute to poverty reduction.

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Conservation needs compensation

Rural people say conservation is important, but calls for a workable compensation system for wildlife damage on crops and livestock

By Gem Tshering
Dzongkhag Forestry Sector, Haa

The recent decades have seen a paradigm shift in conservation strategy from the protectionist approach to people-oriented approach. The shift has given birth to an integrated and holistic mechanism that links development with biodiversity conservation known as Integrated Conservation and Development Programme (ICDP).

Beginning 2008, many parks in Bhutan started implementing ICDP to harmonise socio-economic development and conservation goals in the protected areas (primarily protected areas with people).

ICDP is implemented through promotion of ecotourism, community development activities, fostering infrastructure and human capacity

development amenities. This approach to conservation has led to improved livelihood of people and positive attitudes towards biodiversity conservation.

A study carried out within the buffer zone of Wangchuck Centennial Park (Bumthang, Wangdue, Trongsa and Lhuentse) since 2008 showed that majority of the respondents held positive perceptions of importance of forest conservation (98 percent) with 44 percent attributing importance to the need for timber and firewood for their daily use.

However, people in and around the park invariably faced a perennial problem of human-wildlife conflict such as loss of livestock to wild predators (tigers, leopards and bears) and crop damage by wild animals (wild boars, barking deer, sambar and porcupines).

Fifty percent of the farmers faced hardship of guarding their fields from wild animals and keeping their cattle inside the shed at night. Eight percent of the respondents desired extermination of the problematic wild animals while 95 percent thought it was the farmers' responsibility to guard the fields. Four percent expressed the need for equal and fair compensation for the crops damaged by wild animals while 3 percent highlighted the need for solar fence and alarm devices.

The logistic regression revealed that the older respondents above 44 years and family size of fewer than or equal to 7 had positive attitudes towards ICDP.

Most of the respondents (93 percent) held negative perceptions of the compensation scheme because the scheme compensated for the damage caused by the charismatic faunas like the tiger and the leopard although the damage caused by the bear on heifers and calves was common, particularly in Bumthang Dzongkhag. Lack of expeditious mode of payment was the other reason for less appreciation of the scheme. There is no workable crop compensation scheme initiated through the ICDP programme.

One component of ecotourism is promoting farmhouses (rural home-stay guest houses). Local people (64 percent) had benefitted from rents (lodging and catering) and sale of local hand-woven products such as yathra and livestock products (cheese and butter) and exchange of cultures with visitors. Community elites revealed in the interview that an average of Nu. 50,000 could be earned by the people who put up hotels and owned farmhouses during the nomadic festival.

Other ecotourism activities included promotion of cultural trails and restoration of historic sites.

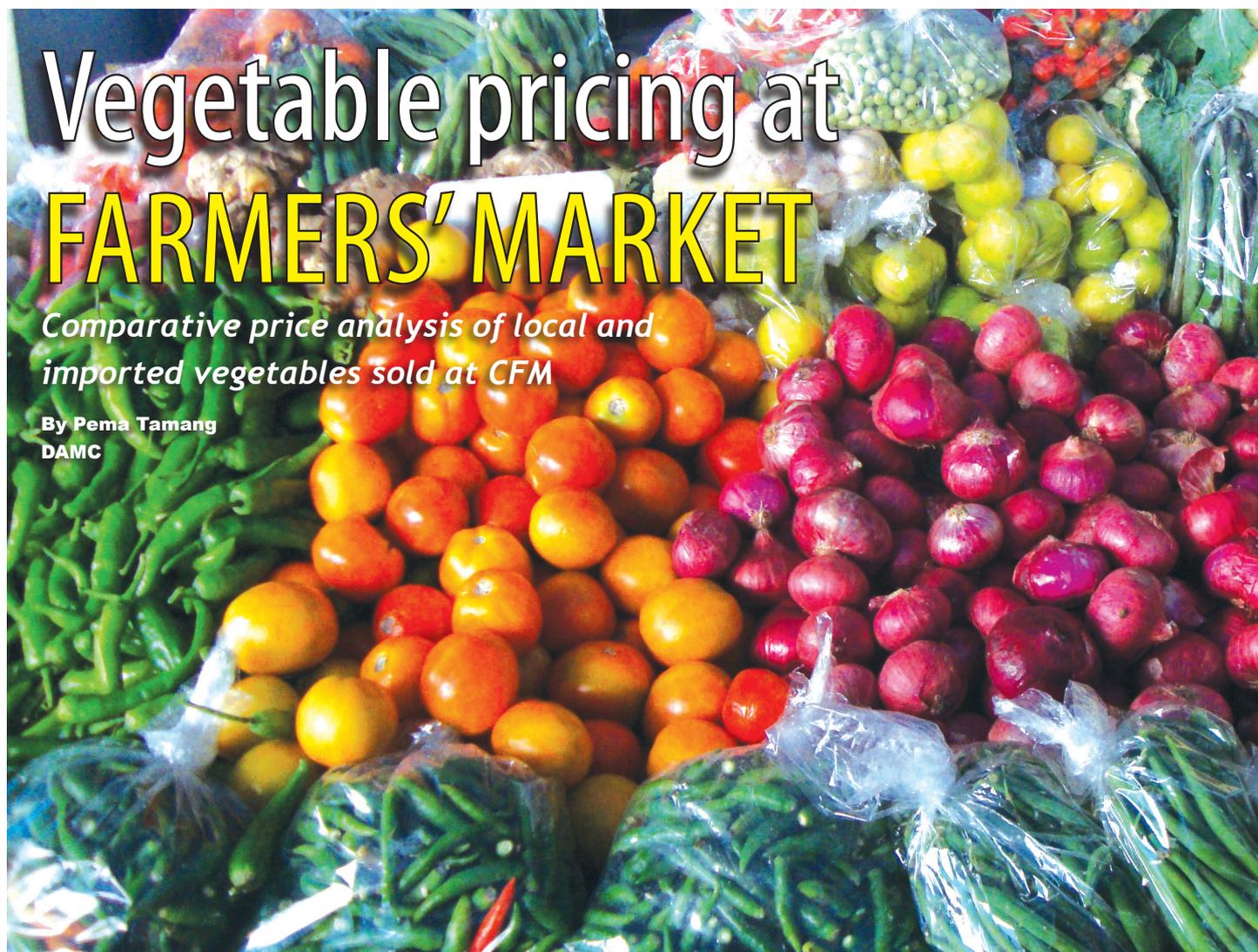
Close to 60 percent of people had benefitted from the training on nature guides. Formation of Women's Weaving Association had provided self-employment opportunities.

The local people's attitudes towards integrated development were positive in general. Their attitudes were linked to their perceived or real benefits of project-sponsored services such as human capacity development, local community services and promotion of ecotourism programmes.

Wild animals cause crop and livestock damage incurring heavy economic losses to the farmers, which lead to unfavourable attitudes towards wildlife protection. Literate respondents seemed to exhibit more favourable attitudes towards wildlife conservation indicating the importance of education and awareness in shaping positive attitudes.



A Weaving Centre, Dorjibee



Vegetable pricing at **FARMERS' MARKET**

Comparative price analysis of local and imported vegetables sold at CFM

By Pema Tamang
DAMC

The prices of most local vegetables sold at the Centenary Farmers' Market (CFM) in Thimphu are higher compared to those of imported vegetables. Vegetables like bitter gourd, snake gourd, ladyfinger, tomato, and bottle gourd are available locally, but they are also imported from India. However, the prices of the locally produced vegetables are higher.

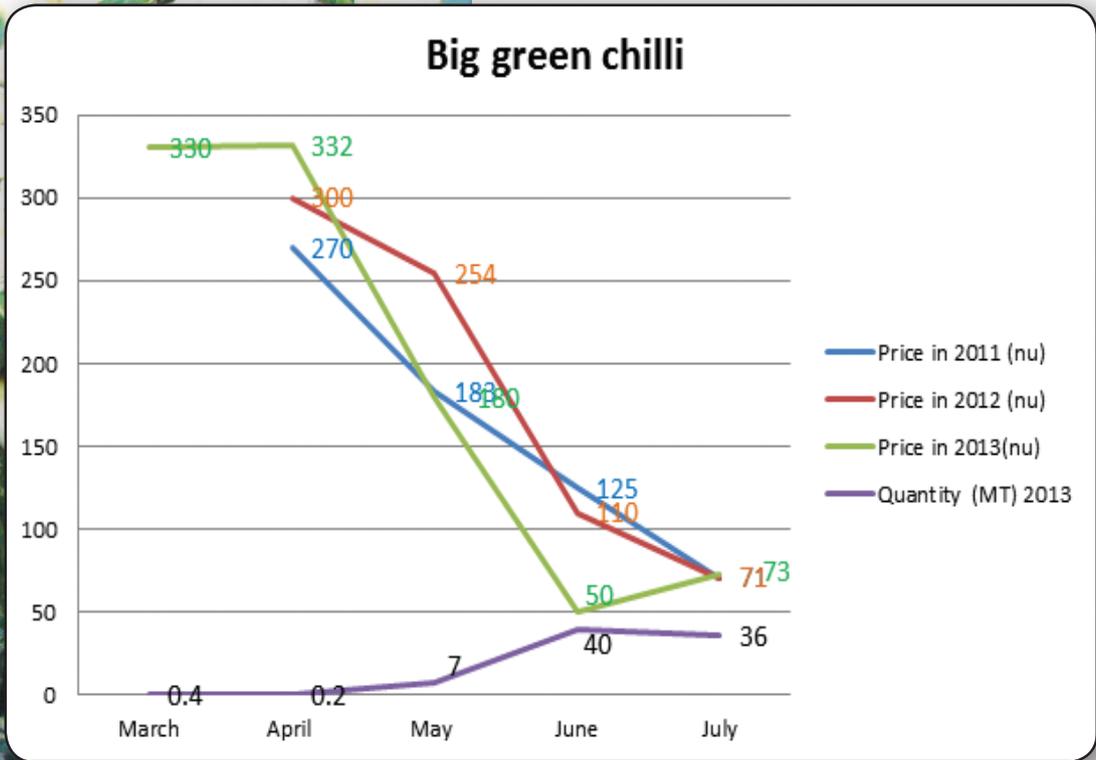
That's what price analysis of vegetables at the CFM carried out by the Department of Agricultural Marketing and Cooperatives found.

The average price of imported onion was highest in 2013 at Nu. 61 per kg just as the average price of local bean in 2012 at Nu. 85 per kg and the average price of imported chillies in 2012 at Nu. 84.75 per kg.

The average price of imported tomato was lowest in 2011 at Nu. 32.25 per kg just as the average prices of local cabbage and Bhutanese chillies were lowest in 2013 at Nu. 29 per kg and Nu. 159 per kg respectively.

The analysis found that the price of imported vegetables is heavily influenced by weather conditions and yield in India. For instance, the price of vegetables imported from India increased rapidly in July 2013 due to heavy rains that damaged the crops in India. Soft-skin vegetables like imported chillies and tomatoes were sold at no less than Nu. 72 and Nu. 71 per kg respectively. By the second week of August, 2013, however, the price for imported tomatoes came down to Nu. 55, a drop by 29 percent, due to increased supply in India.

The price of chillies in three years (spring to mid-summer)



Likewise, the price of imported onion is predicted to increase as Nasik in Maharashtra, India, which supplies onion to the entire country, experienced low production this year.

The prices of vegetables were higher in 2013 compared to the past two years. The average price of a kg of onion between April and July 2013, for example, was Nu. 35.25, an increase of 18 percent over 2012 and 29 percent over 2011.

The price of onion is expected to rise as it is in short supply.

For the majority of the Bhutanese farmers, production and marketing of local vegetables is the

main source of income during summer. The prices of some vegetables like saag, coriander, fern and small round chillies are high due to the perishable nature of these vegetables (saag: Nu. 30-40 per bundle, coriander: Nu. 30-40 per bundle, fern: Nu. 25-40 per bundle, and small round chillies: Nu. 200-400 per kg).

The price analysis found that the prices of most vegetables kept fluctuating depending on demand and supply.

For example, in 2013, local fresh chillies started coming to market from the month of March. At that time, they fetched as high as Nu. 330 per kg. As the quantity increased to 7 MT in the month of May, the price fell to Nu. 180 per kg. When the supply further increased to 49 MT, the price plummeted to Nu. 50 per kg.

However, general inflation like increase in fuel price also led to increase in transportation cost, indirectly leading to higher selling prices of vegetables.

There was no significant variation of prices of vegetables sold at the CFM except for the imported onion.

COMMUNITY FORESTRY GROUP repairs house, life

A community forest cements communal bond in Paro

**By Naphel, Akey Dorji and Dorji
Dzongkhag Forest Sector, Paro**



Aum Dechen Lham, 53, from Dotey village in Paro is a happy woman today. She wasn't. The mother of five is so poor that she couldn't afford to repair her crumbling house. She had dreamt for a decent shelter for a long time. Today she is living her dream.

This heart-warming story from Paro is one of

many stories made possible by community forestry. Considering Aum Dechen's economic situation, Druk Pegong Community Forest in Dotey voluntarily contributed labour and some cash from the community forestry fund for the renovation of her house.

Although many Bhutanese seem to denounce

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When she thinks of how her life has been transformed by the members of her village's community forest, tears come to her eyes, yet she breaks into a chuckle as if to mock fate.

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the concept of community forestry and are often reluctant to transfer the management responsibilities of community forests (CFs) to illiterate farmers, community forestry is silently transforming lives in poor rural villages. Several studies have revealed the importance of CFs in reducing rural poverty. It's true

in Bhutan's context as well.

However, economic and environmental valuation is not adequate enough to quantify and assign numerical value to CFs owing to vast unquantifiable values. Generalisation of data from the study of a few community forest user groups (CFUGs) across the country seems unreliable because of the difference in socio-economic settings, forest conditions and management practices.

Community forestry as a grassroots initiative is not only helping reduce poverty, but also cementing socio-cultural bonds. The benefits of community forestry can be understood in terms of its utility to households with different levels of income and wealth.

Although most CFs in Paro Dzongkhag are not in the production stage, they are already contributing to a better livelihood for poor and ill-fated farmers who are reaping benefits in terms of direct and indirect values. Hence, the real benefits of CFs in transforming the lives of poor farmers cannot be quantified.

In Dotey, community forestry has proven its worth beyond economic and conservation values. Aum Dechen Lham's story has made it abundantly clear that community forestry can be a soft power of socio-economic transformation.

"It was a blessing in disguise," Aum Dechen Lham says. When she thinks of how her life has been transformed by the members of her village's community forest, tears come to her eyes, yet she breaks into a chuckle as if to mock fate.

Aum Dechen has now regained her confidence and she is beaming with joy in her new house. She believes in the unity of communities. She has now developed a profound belief in the benefits of CFs, which gave her a new life. She thanks the members of Druk Pegong Community Forest, Dzongkhag Forestry Sector and the government for bringing the noble idea of community forestry to her community.

This humble, yet generous, gesture from the members of the community forest has repaired a battered life and reclaimed socio-cultural cohesion among the people of Dotey, which was disappearing. Besides, the community forest is also found to have reduced the incidents of forest fire and illegal timber trade.

Given the direct and indirect benefits of community forests to the rural poor, we can consider community forestry as a flagship programme.

Bhutanese Farmer wins World Food Day Award



Bhutanese farmer, Sithar Dendup, received one of the Food and Agriculture Organisation (FAO)'s World Food Day Model Farmer Award for his water management and teaching contributions to the Himalayan Kingdom's environment and agriculture sector. Her Royal Highness Princess Maha Chakri Sirindhorn of Thailand presented him the award.

Dendup is an active caretaker of a water users group in Tsamang village, Mongar. He says he "takes a keen interest in water management, including watershed improvement, irrigation water distribution, canal maintenance and drinking water supply." He is also the spokesperson for a farmers group. He teaches illiterate farmers in his village how to read and write for several hours after his farm chores are finished. 'No one ever said that farming is an easy life. But farming can be especially challenging when you live in one of the most remote corners of one of the most remote countries in Asia', he says.

Chief Forestry Officer receives the National Order of Merit

Mr. Kaka Tshering who was awarded the "National Order of Merit" by His Majesty the King at the 106th National Day Celebration receives the "Certificate of Recognition" for his admirable honesty and integrity in his 32 years of services in the forestry sector. Hon'ble Lyonpo Yeshey Dorji awarded him the certificate during the Third Forestry Conference.



Mr. Kaka Tshering joined service as a Forest Ranger and later served under various capacities. He is currently serving as the Chief Forest Officer of Paro Territorial Forest Division and has contributed tremendously in conserving and protecting the natural resources. During his tenure as CFO, more than 200 poachers have been apprehended in the area with a fine of more than 52 Lakh Ngultrums imposed.

In his acknowledgement, Mr. Kaka Tshering said 'I, alone wouldn't have made it this far. It is because of all the supports and dedications from my staff and heads. So therefore, I would like to dedicate and share the honour that I received with everyone I have worked with and would like to thank everyone from the bottom of my heart.'

In addition to the numerous letter of appreciation from the Ministry and Department, he was also awarded a silver medal in 2008 for his contribution during the coronation of the 5th King of Bhutan.

Sr. Forest Ranger receives highest University Academic Honour in Thailand

28-year-old Tashi Dendup, Sr. Forest Ranger, who is undergoing his Bachelors in Bioscience at the Asia-Pacific International University, Thailand, was listed as one of the highest achievers and receives highest University Academic Honour. Students taking a minimum of 12 credits and receiving GPA (Grade Point Average) of 3.75-4.00 are listed on the President's List. This lone Bhutanese secured 3.82 out of 4.00 scale for the academic year 2013-2014.

In a mail, he said "I am extremely happy to have been bestowed with this honour, getting my name on the President's List is a great honour and privilege for me and I am happy my hard work has paid off. Indeed it was a great challenge to achieve this, I nearly got homesick and faced many problems. I had to give up everything for the sake of my studies and never dreamed that my life would be here at this point struggling for success. But my wife morally supported me and consoled me. That was the greatest strength I received."



WCD Officer bags home two medals in Wildlife Management Course

One lady forest officer from the Wildlife Conservation Division, Ms. Thinley Choden, returned home with two of the three medals awarded to the best performing trainees at the Wildlife Institute of India.

Her award consisted of the institute medal of gold for being the top trainee in her course and secondly, institute medal in silver, also a top medal for all round wildlife respectively. She attended the three months certificate course in wildlife management along with trainee officers from India, Lao PDR, Malaysia, Nepal, Thailand and Vietnam. The trainees were assessed for each module on daily basis, both in the classroom and during field exercise, including evaluation through group discussion, assignments, written tests and oral tests.

The Wildlife Institute of India is an autonomous organisation under the Ministry of Environment and Forests and offers both short term and long-term courses in wildlife management with duration ranging from three months to over a year.





Getting to know the rice we eat

Knowing the carbohydrate content of the rice one eats can help prevent some lifestyle diseases

**By S Wangchuk, T Choden and T Samdrup
School of Life Sciences, Sherubtse College**

Human development index (HDI) is an important indicator of Gross National Happiness. One of the tools for measuring HDI is life expectancy. Consumption of a balanced diet is important for good health and longevity, which is why it is necessary to be aware of the nutritional quality of food we consume.

A variety of rice grown indigenously has been the staple food of Bhutanese people for centuries. But, subsistence farming practised in Bhutan is slowly giving way to a semi-commercial agrarian system under the influence of changing social, ecological, political and economic systems.

Under changing circumstances, local rice is supplemented with rice imported mainly from India. As the Bhutanese increasingly consume imported rice, it is important to have nutritional quality of the indigenous rice assessed and compared with the nutritional quality of imported rice varieties to facilitate a better dietary planning.

In a study, 25 rice varieties were analysed colorimetrically for their carbohydrate and protein contents. The amounts of carbohydrate and protein, along with the places of collection/origin of rice varieties, were tabulated.

Samples of native and introduced varieties of rice were collected from various parts of Bhutan

and were processed for colorimetric estimation of carbohydrate and protein contents. For both the estimations, extracts were prepared by extensive hydrolysis. Acid hydrolysis was used to prepare extract for carbohydrate estimation which was then processed using anthrone reaction. Alkaline hydrolysis was used to get the extract for protein estimation by Folin-Lowry method.

The IR-64 variety had the highest carbohydrate content. Tsirang Zam, a rice variety collected from Thrinangbi in Mongar, had the lowest carbohydrate content. The protein content was highest in Yangkhum variety from Punakha and the lowest in Sorbang from Radhi (See Table I for details). Inclusion of rice varieties with low carbohydrate content in the Bhutanese diets will help prevent lifestyle diseases like diabetes mellitus and obesity.

Carbohydrates and proteins, together with lipids, are macronutrients. Carbohydrates are classified based on the extent of polymerisation and chemistry into mono- and disaccharides, oligosaccharides and polysaccharides. Some carbohydrates are easily digested by intestinal enzymes and easily absorbed by the body providing instant energy. They are called glycemic carbohydrates (starch and soluble sugars).

On the other hand, carbohydrates like hemicellulose and cellulose (fiber) that cannot be digested by intestinal enzymes are called non-glycemic

carbohydrates. Glycemic index is a measure of the ability of a nutrient to raise the blood sugar level after its consumption. Carbohydrates that are digested easily, such as simple carbohydrates, have a high glycemic index while those that are difficult to digest have a low glycemic index.

Carbohydrates from rice are complex carbohydrates mostly comprising starches that are highly glycemic along with a small proportion of dietary fibre and non-digestible oligosaccharides. Carbohydrates are important because they are the main source of energy, providing between 40 percent and 70 percent of daily energy requirements for humans. Despite providing daily energy, dietary carbohydrate has effects on satiety/gastric emptying, control of blood glucose and insulin metabolism, protein glycosylation, cholesterol and triglyceride metabolism, bile acid dehydroxylation, and fermentation. Diets with low glycemic index

are recommended to avoid development of type 2 diabetes mellitus and insulin resistance. A low carbohydrate diet can cause ketosis.

Protein is an essential nutrient required for normal growth and maintenance. Deficiency of protein can result in wasting, anemia, delayed wound healing, oedema and weakened immunity. Protein-calorie malnutrition (PCM) is caused by the deficiency of protein and energy in the diet. It can manifest itself as marasmus and kwashiorkor afflicting children mostly below the age of three and a half years. The signs and symptoms of marasmus include poor growth, extremely wasted muscles with wrinkles; diarrhoea, poor appetite, anemia, skin sores, anorexia and dehydration. Clinical signs of kwashiorkor are oedema, poor growth, wasting of muscles, fatty infiltration of the liver, poor appetite, dermatitis, anemia, diarrhoea and “moon face”.

SI. No.	Variety	Place of collection/import	Carbohydrate (mg/g)	Protein (mg/g)
1	Yangkhum	Punakha	770	127
2	Lumang (Local)	Lumang	640	106
3	Zhung Bara (local)	Radi	800	105
4	Khamti (local) 88	Bangtar	710	88
5	Khangma Maap	Nepal	600	100
6	Machapurchrey	Nepal	630	106
7	Zangthi-1 (local)			
8	Zangthi-2 (local)	Zangthi	740	105
9	Sorbang	Zangthi	650	52
10	Chandhanath-1	Radi	850	47
11	Chandhanath-3	Nepal	860	75
12	Or	Nepal	610	95
13	Radha-4	Nepal	680	92
14	High jang	Nepal	830	78
15	Japanese variety sticky	India	820	70
16	Tsirang zam (local)	Japan	540	95
17	Karjat	Thinangbi	410	107
18	Wengkhar Ray-2 Khumal-6	India	430	65
19	Khangma ray kaap Khumal-2	Nepal	720	85
20	Khamtey (local)	Trashigang (Kanglung)	800	106
21	Paropa (local)	Trashigang (Kanglung)	690	90
22	Zhung bar (Local)	Trashigang (Kanglung)	480	108
23	Thong rapu (Local)	Trashigang (Kanglung)	910	87
24	IR-64	Trashigang (Kanglung)	620	103.5
25	Brena (Local)	Trashigang (Kanglung)	620	103.5

Farmers diversify rice snacks products in Sarpang

Zaw Boyo and Maykhu making is part of the Agriculture Department's initiative for product development and value addition

By Ngawang Chhogyel and Cheku Dorji
RDC-Bajo





Maykhu being produced

“
The training was aimed to enhance the farmers’ skills and help them to make the best use of their unmarketable rice by converting it into saleable products.
”

Chuzang Agriculture Farmers’ Cooperative (CAFC) in Sarpang Dzongkhag will soon add two new rice snacks for sale at their sales counter in Chuzang. These snack products are traditionally not commonly available in the southern regions of Bhutan. Zaw Boyo is popular in the northern and eastern parts of the country, while Maykhu is popular especially in Punakha and Wangdue valleys.

The Research Development Centre (RDC)-Bajo conducted a four-day training from April 4 to 7, 2013 for 41 participants (21 men and 19 women) on the preparation of Zaw Boyo (puffy hardened rice) and Maykhu (flattened rice pan cakes) in Chuzang. Resource persons for the training were two female farmers from Lobeyisa in Wangdue who have been successfully carrying out a lucrative business preparing and selling various rice snack products for about two decades.

The training was conducted as part of the Department of

Agriculture’s (DoA) initiative to enhance the capacity of rice farmers on product development and value addition. The training covered the entire process for the development of the two products, starting from grain selection to soaking, drying and roasting. The training was aimed to enhance the farmers’ skills and help them to make the best use of their unmarketable rice by converting it into saleable products. Diversifying rice grains into rice snack products have the potential to bring in additional or enhanced income to the farmers while encouraging rice farming.

The locals farmers trained felt that the new rice snack products will be an added attraction in their sales outlets and they hope to reach out to both local as well as the regional markets. They recognised and appreciated the efforts of DoA for providing avenues and opportunities for generating additional sources of income for their families.

Make your **crunchy rice snacks**

Has anyone ever given a thought to how Zaw Boyo and Maykhu is made? Here is the both recipe for you to try out free

By Tashi Dawa, RNR-EC, Chuzagang

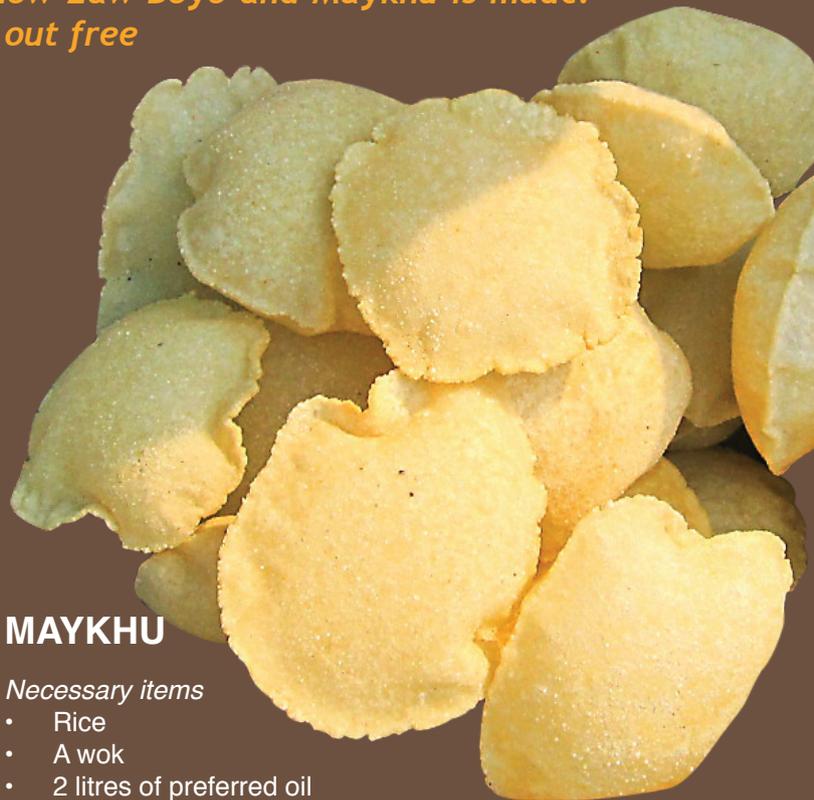
ZAW BOYO

Necessary items

- Paddy (unhusked rice)
- Container for boiling water
- Roasting pan
- Sieve (1-2mm) to sieve and separate boyo from sand
- Scooping ladle of convenient size
- Fine dry riverbed sand, preferably from meanders which are considered best and can be re-used for a longer period of time.
- Salt water. Prepare your own, adjusting to taste in boyo
- 1-2 helping hands needed at your convenience as per the amount of boyo you want to roast

Procedure

- Boil water in a container of desirable size
- Put paddy in the boiling water. The water level should be an inch above paddy level ease of stirring. Stir for a while.
- The paddy should be half cooked. Certain softened feeling in between the teeth will indicate its readiness
- Stir and let it cool at room temperature overnight
- On the following day (after 12-24 hours), half roast the paddy and dry in the sun. Don't dry too much or else the rice will lose its puffing tendency and rice while milling
- Mill the paddy for rice (par-boiled rice)
- Keep the water and salt solution ready
- Take a handful and a half of fine dry river bed sand and heat it up in a roasting pan
- Take half a handful of rice in a scooping ladle and pour desirable amount of salt water and mix it. Then roast in/with sand. Within seconds the rice will puff out.
- Sieve the sand in a container and pour the puffed rice in another dry container. The sand should be put back in the pan for the next process, and continue until the last handful of rice.
- Store the puffed rice in an airtight plastic bag to retain its crispiness



MAYKHU

Necessary items

- Rice
- A wok
- 2 litres of preferred oil
- Salt
- Sieve
- Containers

Procedure

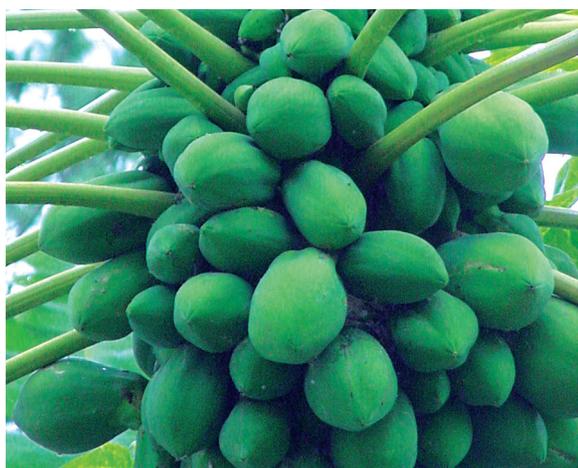
- Soak desirable amount of fine rice in lukewarm water for 5-10 minutes
- Drain the water out
- Pound in a local pounder to bring rice to fine flour
- Sieve the flour and re-pound the remains again for quality flour
- Knead the flour into dough with a pinch of salt for taste (Some add Indian flour (Maida) and baking soda for commercial purposes)
- Warning: Adding flour (Maida) will make your maykhu lose its crunchy taste
- Heat half a litre of oil in the wok. Add more as per need.
- Roll dough into pancakes with your palm or with a roller (1-2mm thickness with 8-10cm diameter)
- Deep-fry in the wok. Needs to turn over the cake from time to time to cook uniformly.
- Your best judgment is required to judge whether the maykhu is well cooked.

NOTE: The procedure detailed above is for Teytey Maykhu variety. The other kind of maykhu is called Luu-ma Maykhu, which is made a little larger in size and much thinner. The pancakes are not directly fried. Instead, pancakes are spread on a bed of pine needles and stored in a cool dry place or plastic. It is deep-fried when needed, usually for annual pujas, family rituals and family gatherings.



CULTIVATION PRACTICES AND TIPS





Cultivation practices for Papaya:

A potential crop for diversifying cash crops in tropics and mild sub-tropics

Source: RDC-Wengkar

BACKGROUND

Papaya is a nutritious fruit that has high potentials in low altitude areas as well as in mild sub-tropics up to 1000 masl.

BOTANICAL NAME: *Carica papaya* L

COMMON NAMES: Madhufala (Dzongkha and Sharshokpa), Mewa (Lhotsam kha), Papaya and melon tree (English).

CLIMATIC CONDITIONS: Papaya grows well in tropical and mild sub-tropical climates. It is very sensitive to frost, strong winds and water stagnation.

SOIL: Rich well drained sandy loamy soil with PH ranges between 5-8 is ideal.

SEED RATE: 150-200 g or about 400-450 plants per acre

MATURITY: 6-7 months after transplanting

CULTIVATION METHODS:

I. SEED COLLECTION FOR NURSERY

RAISING: Seeds from fully matured fruits of good shape from healthy plants should be collected and washed

in cold water, removing the gelatinous substance covering the seed. Proper removal is necessary since this substance inhibits germination.

Clean seeds collected could be either sown directly or stored in air tight containers and kept in cool dry place.

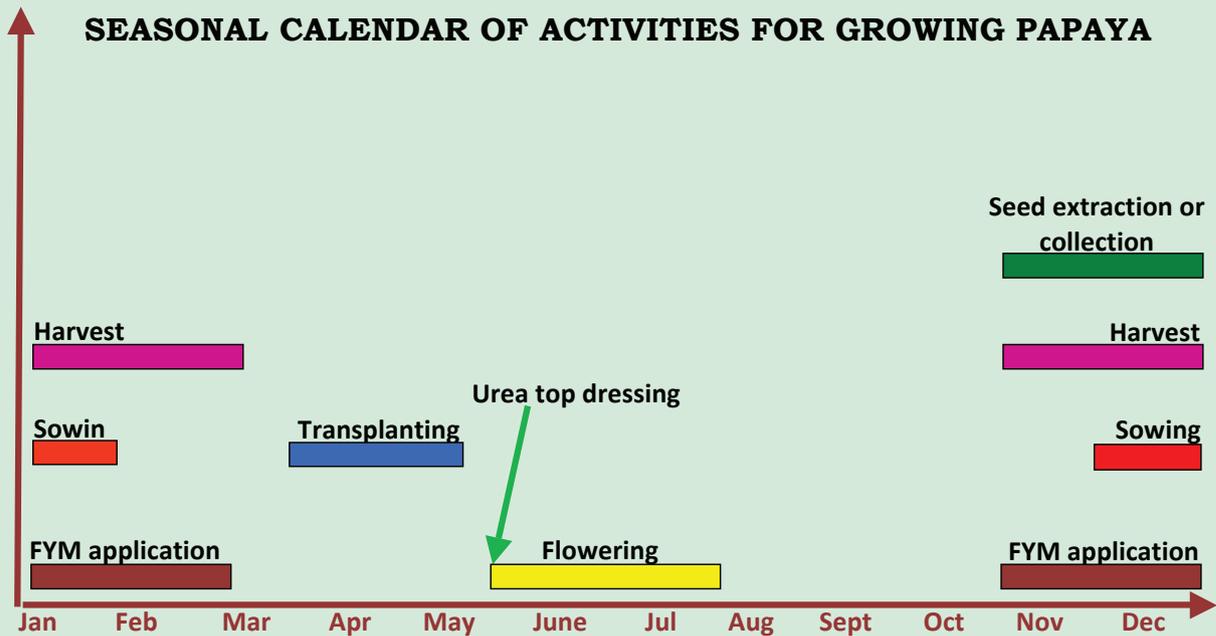
2. SEEDLING RAISING: 2-3 seeds should be sown in poly pots filled with a good mixture of Farm Yard Manure (FYM) or compost and sand between November to January.

Germination takes place in about a month. As seedlings grow, rogue out the weak ones and allow the healthy seedlings to grow (1- 2 seedlings per poly pot is fine). Irrigate once or twice a week in the morning and evening.

3. TRANSPLANTING: Seedlings can be transplanted after 4-5 months, at 2-3 leaf stage or when the plant height is about 40-45 cms. Evenings in March and April are best time to transplant the seedlings.

Since it is not easy distinguish between male and female plants at this stage, sometimes two seedlings may also be transplanted in one pit or planted very close which can be thinned after flowering.

4. PLANT SPACING: Seedlings can be transplanted into pits of 30x30 cm at an plant spacing of 1.8x1.8 m



or 5x3 m if you plan for intercropping.

Rogue weeds and any other dry materials from the field could be used for basin mulching. Plant matters as mulch provides organic matter, maintain soil temperature soil moisture and controls weeds.

5. FLOWERING: Transplanted plants flowers after about two months between June and July. It is important to identify male and female plants because all plants may not bear both male and female flowers on the same plant. Generally one-two male plants for 25-100 female plants is found to be enough for fertilisation.

Male flowers are usually yellowish, 2-4 cm long. The petals fused into a long tube. Have 10 fertile stamens and a rudimentary or non functional ovary.

Female flowers are usually larger than male flowers 3-4 cm long, white or cream in colour with five free petals, no stamens but a large ovary with 5 fan shaped stigmas.

6. HARVESTING: It is time to harvest when fruit colour changes to light green with tinge of yellow at the apical end or when the latex ceases to be milky and become watery. Some varieties may remain green even when matured. Thus, fruits may be selectively harvested until March.

CROP YIELD: An average of about 30-35 fruits per plant have been harvested under Lingmethang conditions.

MAJOR PESTS AND DISEASES

A major problem in growing papaya is viral infections (ring spot virus) transmitted by aphids. This infection shows symptoms like yellowing and vein clearing of young leaves, followed by mottling. Dark green streaks on petioles and stems and prominent C shaped markings that become grey and crusty. Viral diseases affects fruit setting and its taste.

FERTILISERS AND APPLICATION RATES

3-4 kg of FYM per plant at the time of transplanting is essential for good crop stand and at least 10 to 20 g of urea top dressing at the onset of flowering is essential.



Growing Sugarcane for Winter Fodder

Source: RDC-Bhur

Background

Sugarcane (*Sachharum officinarum* L.), originally a south-east Asian crop, is a very efficient plant in converting solar energy into carbohydrates. In Bhutan, sugarcane is grown as a backyard crop throughout the lower elevations. Traditionally, it has been grown for stalks to extract juice for preparation of jaggery, locally known as Gur (Lhotsamkha) or Khumin Guram (Sharchopkha), which are required during religious ceremonies. Sugarcane stalks for human consumption are found widely in local markets in Bhutan. Sugarcane may be a potential feed source for beef cattle in subtropical and tropical areas. The most important decision when growing sugarcane for animal feeding is variety selection.

Sugarcane has numerous varieties with widely varying characteristics. The three important items to consider are crop yield (plant and ratoon crops), nutritive quality (i.e., sugar and fibre contents) and ease of harvesting. In 1997, RDC-Jakar listed sugarcane as one of the most promising sub-tropical crop. The same year, it was recommended by the extension programme in Zhemgang as a source of winter fodder.

Nutritional quality and yield

Sugarcane is rich in energy source because of its high carbohydrates content but it has 2% crude protein, which is relatively low. High weight gains have been reported from animals fed with sugarcane. Sugarcane juice is an excellent feed for pigs. Further, it has been proven that sugarcane can replace cereals in pig feeds. The nutritional value of sugarcane increases with crop

maturity. In terms of yield, the crop can produce up to 32 tons of dry matter per hectare yearly under favourable climatic conditions and with good management. This yield is much higher than that of other fodder plants available. With moderate addition of protein, sugarcane from one hectare would be sufficient to feed up to 12 milking cows daily.

Planting method

Sugarcane is grown with vegetative plant part, and its seed is virtually unknown. Hence, stem cuttings with at least three nodes from well developed plant should be used as planting material. Sugarcane grown for forage should be treated the same as cane for sugar production with regard to agronomic practices such as cultivation, fertilisation, and pest control. It requires a very thorough and clean preparation of land. Sugarcane needs deep tillage. Shallow ploughing with local ploughs limits the development of root system resulting in lodging of cane plants. Sugarcane requires reasonably fertile soil with good amount of organic matters. The crop can be cultivated from April through September. The plant cuttings should be planted in furrows dug with spade and at a distance of about 1m between furrows. Once this is done, the furrows should be filled with soil and pressed the covering firmly with feet. Weeding may be necessary during the first few months by hoeing.

Sugarcane can also be grown as a ratoon crop. Ratooning is a practice of growing a crop from the stubbles of previous crop. The main advantage of rationing is that it saves cost on preparatory tillage and planting material as

well as the ratoon crop matures earlier. When harvesting sugarcane, it is important to cut the stalk properly to insure good ratooning and re-growth of the stubble crop. The sugarcane crop whose ratoon is to be kept should be harvested at ground level. Generally all trash and dried canes should be removed from the harvested field but, in case of lack of moisture in soil trash is kept as such in field for mulching. Irrigation should be given for a period of 4 to 6 weeks after harvesting to initiate new shoots from the stumps.

Feeding Methods

In Bhutan, whole sugarcane is not commonly fed to animals or cultivated as a fodder crop since it fetches a fairly high price for consumption of culms by human. Therefore, only the top portion of canes which is not fit for human consumption is used as the cattle fodder. However, under certain conditions, such as excessive production of cane in remote areas where marketing for human consumption is a problem, whole sugarcane is sometimes fed to the animals. Tops of sugarcane average from 15 to 25% of the aerial cane plant, thus usable estimates of forage yield can be derived from the total cultivated area. The cane must be chopped before feeding to the cattle. The chopped stems should be fed to animals in clean containers. As soon as the cane is chopped, the sugars begin to ferment into alcohol and organic acids, which tend to have a negative effect on animal performance. Thus it is important that the chopped cane be consumed by animals with a minimum delay. Because of the low crude protein content of sugarcane, diets based on cane forage require a large quantity of supplemental nitrogen. Natural protein

feeds are expensive, particularly in regions where sugarcane would be fed. The economics of feeding sugarcane might be improved by using a less expensive source of crude protein like urea. Other feeds like peanut and soyabean should be given to supplement protein requirements.

Positive attributes

- High biomass production.
- Perennial crop.
- The entire biomass produced during the growing season is available during the dry season. Besides tree fodder, no other presently recommended species has this advantage
- The juice can be used as feed for pigs.
- The remaining stalks after juice extract can make acceptable fodder for cattle.
- Familiar to the farmers

Negative attributes

- Low protein content
- Can be grown only in subtropical areas having at least 1200 mm of annual rainfall.

Recommendations

- For elevations below 1200 m, sugarcane is recommended as the most promising winter fodder.
- For winter fodder purpose, farmers should plant about 0.02 acre per productive animal.
- For used as fodder throughout the year, then the cultivation area may be increased to 0.1 acre per animal.





Tips

Top Working: A method to improve fruit trees

Source: RDC-Wengkhhar

Q:What is top working?

A:Top working is a method of fruit tree development where standing fruit trees of inferior quality are grafted with scions (a plant shoot cut for grafting) from superior or improved cultivars. Top working is an option for rehabilitation of orchards.

Q:What fruits can be top worked?

A:Top working can be generally done on any fruit trees except for old ones. Fruit trees such as peach, plum, apricot, pear, persimmon, walnut, apples, orange and avocados can be top worked.

Q:When is the time of year to top work fruit trees?

A:Top working is done during the onset of spring when the rootstock has completed dormancy and sap flow has just begun. This is indicated by sap exude on the cut surface; dormant trees with less sap exude, burst bud and the bark peeling easily.

However, scion wood should still be dormant. They could be collected in January and February and top working can be done in March or April depending on the altitude.

Q:What are the different tools used for top working?

A: Proper tools and equipments are required in top working. The most common ones are:

- Pruning saw
- Secateurs
- Budding knife
- Scissors
- Plastic sheets
- Rubber tubes can also be used for large stems.

Q:What are the different steps in top working of fruit trees?

A:There are four steps in top working. They are as follows:

I. Scion wood collection and preparation:

The preferred time for scion collection is during the dormant stage (winter) or at the time of pruning.



The cuttings from one-year-old shoots, preferably from the centre or 2/3 portion from basal shoots of mature plants (which had come into flowering in the past) are best for scion wood.

Scion woods collected are then cut to size of 9-12 cm long and having 2-3 buds.

- Cut pieces are waxed properly by dipping in melted candle preferably at a constant temperature of 70°-80° C.
- Wax at higher temperatures will damage the scion while low temperatures flakes off quickly and can lead to desiccation (drying out of moisture) of scions.
- All scions collected should be packed in poly sheets and stored in a cool place preferably under refrigeration at 3°-4° C until grafting.



2. Root stock preparation:

- Root stock can be the trunk of the tree or the lateral branches (3-15 cm diameter). Cut it at a preferred height depending on tree (height of 120-150 cm from the ground). If branches are selected, they should be well distributed around the trunk.
- Cut or saw-off trunk or branch perpendicular to central axis.
- Using a sharp knife, make a vertical and parallel cut depending on the size of the scion, 3-4 cm long through the bark and split the bark open (do not damage the cambium).
- Using a sharp grafting knife peel 2-3 cm of bark from the scion wood on one side without damaging the cambium and a slant cut of 1-1.5 cm on the opposite side.

3. Insertion of scion wood on rootstock:

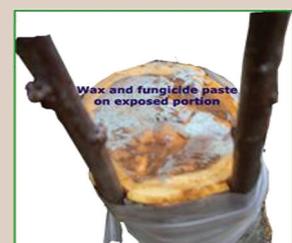
- The scion wood is then carefully placed between the bark and the cambium layer of the rootstock with longer cut facing inward.
- Cover the short wedge cut portion of the scion wood with the flap of the bark. The graft point is then tied firmly with grafting tape or other materials such as clean plastic sheets, rubber tubes.



- The exposed portion of the root stock should be immediately covered with wax or with a paste of fungicides to prevent infection and desiccation of stem.
- Any buds or shoots on the rootstock should be rubbed off gently to prevent water shoots or suckers.

4. After care of top worked plants:

- Inspect all top worked trees after a week to observe scion wood growth.
- In most cases, multiple scion woods are grafted to ensure successful top working. If all scion wood sprouts, it is advisable to remove the weak ones leaving one to two healthy ones after two years.
- All cut portions should be waxed or applied with fungicide paste.
- Top working involves removal of foliar shoots which can cause sun burn of the trunk. White washing the trunk can prevent this.



Are your cabbage heads splitting?

By Prem Dan Limbu and Indra Bdr Raika, Dagana

Here's how to prevent cabbage heads from splitting:

Heads of some cabbage will split when they mature. It's an indication of either excessive watering, growth spurt caused by water after a long dry period, over maturity or unsuitable soil. Some of the recommendations are as follows:

- Splitting is caused by the pressure of excessive water taken up after the heads are solid. Harvest before it fully matures. Check that it is tightly firm when pressed.
- Cracking or slitting of cabbage head should be prevented because it leads to improper shape and size and becomes unmarketable. This happened in Dagana.
- The only option then is to harvest split cabbage heads as soon as possible before the open surface allows diseases to enter the heads and worsen their quality.

In order to prevent splitting:

- Choose a variety of cabbage that does not normally split.
- Keep the cabbages well and evenly watered. Mulch the cabbage so that rain is slowly released to the soil.
- After rain, either cut the roots by pushing a spade down either side of the cabbage so that it cannot take up too much water, or lift the head and twist to one side so that the roots break. But the cabbage will have to be harvested soon after this.

Most including Elisa cabbage, have good standing which means they stay in this firm state for many weeks. Even though Elisa is not generally prone to splitting, the long period of dry weather when the heads mature, followed by a heavy downpour, causes the cabbage to crack and split wide open.

To harvest the cabbage:

- Twist the entire head of the cabbage to disengage



it from the large stem. The cabbage will be ready to harvest as soon as the head is fully formed and feels solid to the touch.

- If there is a sudden heavy rain, the cabbage heads might crack or split. If the heads are split, harvest and salvage them as soon as you can to prevent loss of the crop.
- If you harvest the mature heads of the cabbage planted in the spring, small heads often start to develop on the cut stump of the cabbage.
- These sprouts can be harvested later, leaving the outer leaves intact. The sprouts will develop from two to four inches in diameter. They should be harvested as soon as they are firm.

Cabbage heads, like all vegetable heads, grow from inside out. If yours start to crack, this probably means that the cabbages are growing too fast in the centre. (This condition is frequently caused by heavy-handed fertilising.) If you let the cracking continue, the head will split wide open and send up a seed stalk.

If you see a crack:

- Hold the head and twist the whole plant halfway around, like turning a faucet.
- Grab the plant and twist it halfway around. This breaks off many of the roots and that slows the inner top growth of the plant.
- Give the plant another quarter turn in a few days if the cracking continues.

Cutting the roots (spading on two sides of the plant) or breaking the roots (lifting and twisting the head to one side) can often reduce excessive splitting or bursting, but it also damages the plant and requires that the head be harvested soon.