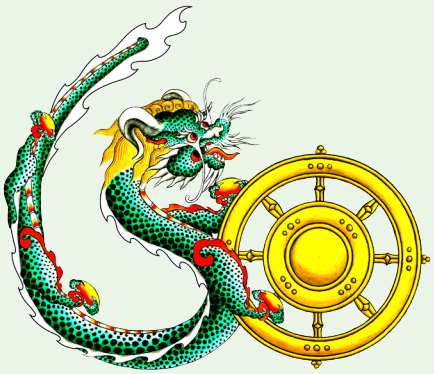
The history of the introduction and adoption of important food crops in Bhutan

Rice, maize, potato and chili



Dedicated to the Fourth Druk Gyalpo
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National Biodiversity Centre
Ministry of Agriculture and Forests
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CONTENTS

FOREWORD

The early history of agriculture in Bhutan is vague since there has been very little documentation of earlier agricultural practices in the country. Nevertheless, we can find events associated with agricultural practices predicting the success of such events, mentioned in Bhutanese astrology indicating that agricultural practices existed since the origin of Bhutanese astrology. In rural Bhutan, farmers still recognize the importance of astrology in all aspects of their lives including agriculture even to this day.

Bhutan's medieval history seems to have better documentation of earlier agriculture practices through the biographies of Buddhist saints during the 8-9th century providing some evidence that agriculture was already a mainstay of Bhutanese society by then. Modern agricultural development in Bhutan commenced from the 1960s with the start of planned development programs in the country and is well documented.

The lack of knowledge and documentation on the early history of crops and traditional knowledge associated with traditional agriculture practices compelled this preliminary report on the history of four major crops, i.e., rice, maize, potato, and chili. This study is by no means complete, owing to time constraints but will be updated as and when additional information is found. Therefore, there is a need to put greater focus on this kind of studies in future.

I would like to commend the National Biodiversity Centre for this initiative and urge future researchers to build on it and document the evolution of agriculture and traditional farming systems in Bhutan.

Tashi Delek!

Yeshey Dorji
Minister of Agriculture and Forests

ACRONYMS

GRPI2	Genetic Resources Policy Initiatives phase 2
PGRFA	Plant Genetic Resources for Food and Agriculture
BNPP	Bhutan National Potato Programme
BPDP	Bhutan Potato Development Programme
CIMMYT	International Maize and Wheat Research Centre
CIP	International Potato Centre
CoRRB	Council of RNR Research of Bhutan
EIC	East India Company
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
MoAF	Ministry of Agriculture and Forests
NBC	National Biodiversity Centre

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1. INTRODUCTION

Since the earlier publications and documents describing early agricultural practices are limited, the history of agriculture in Bhutan is unclear. Some artifacts from the late Stone Age with a suggested date of 1500–2000 BC have been recorded but not much information on the history of crops has unfolded. Most of the records which could have served as a potential source of information seem to have been destroyed when fire ravaged the ancient capital, Punakha, in 1827.

In Bhutanese astrology, we find predictions associated with agriculture in the beginning of the year such as 'the year favors farmers with timely rainfall and flourishing crops, the *drunagu* (nine cereals) etc. There are predictions that covers animal husbandry too such as 'there will be no disease outbreak among livestock; rather it is expected to be a productive year for the animals, who will bear a good number of offspring' etc. If the predictions are not favorable, remedial measures are also prescribed to overcome the obstacles through various rituals. There are also daily predictions guiding agricultural events such as a good day for sowing seeds (*zhingkhar soen tapni*), a good day for planting plants and flowers (*keshing meto tsunii*), a good time to harvest (*Tho dunii*) etc.

In rural Bhutan, there are some "lead farmers" who start the agricultural events based on astrological predictions and other farmers follow the "lead farmers". This marrying of agriculture and Bhutanese astrology indicates the importance that was given to agriculture in early Bhutanese society and how long agriculture has been in existence in the country.

There are also references made to food or crops in some biographies of Buddhist saints and Masters who visited Bhutan during the introduction of Tibetan Buddhism in the 8th to 9th century.

Even today, there are songs widely sung by farmers specifically while planting seeds or while harvesting. Farmers also possess a wealth of traditional knowledge associated with traditional agricultural practices that include seed management, agronomic practices, pest and diseases management, weed management, harvesting and post-harvest handling

of harvested produce etc. that have been handed down from generation to generation.

Despite all these, what has been lacking is a proper documentation on the history of crops and traditional knowledge associated with agriculture practices in Bhutan. Thus, this attempt is a start on the process of documentation of the history and introduction of crops to Bhutan.

This study is part of a project titled "Strengthening national capacities to implement the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)"under the Genetic Resources Policy Initiatives, phase 2 (GRPI2) project funded by Bioversity International based in Rome.

The GRPI2 project includes five thematic areas of research. Component 1 of Theme 3 deals with"Mapping and measuring PGRFA flows and interdependence: the dynamics of the global crop commons" "Overview of food and forage crops and plant genetic resources."

This study focuses on the history of the introduction and adoption of important food and forage crops in Bhutan. Research questions for this study are:

- What are the major food and forage crops in the country?
- When and where were they originally domesticated?
- When and how were they introduced into the country (if they were not domesticated there)?
- When did those crops assume their current levels of importance to the national diet and economy?

2. OBJECTIVES OF THE STUDY

Although the goal of this component of theme 3 was to document the history of crops and their introduction into Bhutan, severe time limitations did not permit an in-depth study. Therefore, the objective was to produce a preliminary report on the history of four major crops, i.e. rice, maize, potato, and chili based on literature reviews and face-to-

face interviews. This report is a work in progress and will be updated as and when additional information is received.

3. METHODS

Literature reviews and personal interviews were conducted to address and answer the research questions.

3.1 Initial compilation of literature

Bioversity International carried out an initial compilation of reports related to the domestication and introduction of international crops. These references were placed in two folders in a common area of GRPI2 shared space:

- "Database_Crop_Domestication," an Excel database, is a listing of all the literature references, both general and crop specific, with links to corresponding PDF documents.
- "PDF folder" contains all references, both general and crop specific available in PDF format uploaded by Bioversity International; however, very few are related to Bhutan or the four crops of interest.

3.2 Selection of crops

Cereals are an important component of the Bhutanese diet,and maize and rice are the major crops cultivated in Bhutan. Other cultivated crops include wheat, barley, oil seeds, potato, and various vegetables. Among vegetables, chili and potato are most important. In addition, cash crops, such as apple, orange, and cardamom are cultivated and exported.

For the purposes of this study, in view of the limited time line and resources, only four major crops were selected: rice, maize, chili, and potato. This choice was based on such factors as level of production, area under cultivation, role in food and nutrition security, the importance of these crops in the Bhutanese diet, and their role in the livelihood of Bhutanese farming communities.

Although this study focuses on these four crops, information pertinent to other crops is included under "8. Overview of other crops."

3.3 Compilation of country-specific information

No literature has been found so far describing the history of crops and their introduction into Bhutan during the prehistoric period, early historic period, or the medieval period. Bhutan's medieval and modern history is better documented than its ancient history.

Ancient publications in English on the history of Bhutan, written by both international and national authors that we have found so far tell us virtually nothing about the history of crops in Bhutan. Books on archaeology, anthropology, plant genetic history, and other associated studies can often reveal information about crops, but such information could not be found. Thus, the only sources of information on the history of crops were biographies of important saints and other Bhutanese personalities, accounts of early European travelers to Bhutan and few other Bhutanese publications.

Interviews were also conducted with key individuals and institutions that would have information on the history of crops in Bhutan (see Appendix).

3.4 Literature review

The literature review was conducted at two levels:
Level 1:International literature — International literature was obtained through Bioversity International. This gave us access to 12 documents on rice, 7 on maize, and 7 on potato. No documents were found on chili.

Level 2: In-country literature— Documents describing early agricultural practices or socio-economic conditions in Bhutan are limited. Therefore, information has been amalgamated from three sources: biographies of important saints and other Bhutanese personalities; the writings of European travelers through Bhutan and other Bhutanese publications; and key personalities known to have some information on the subject.

3.5 Documentation

Information obtained from the literature review and face-to-face discussions with key people was compiled to produce this report. In most cases, the original text or an excerpt has been included to avoid distortion of messages.

Figure 1. Rice panicles in a paddy field in Punakha

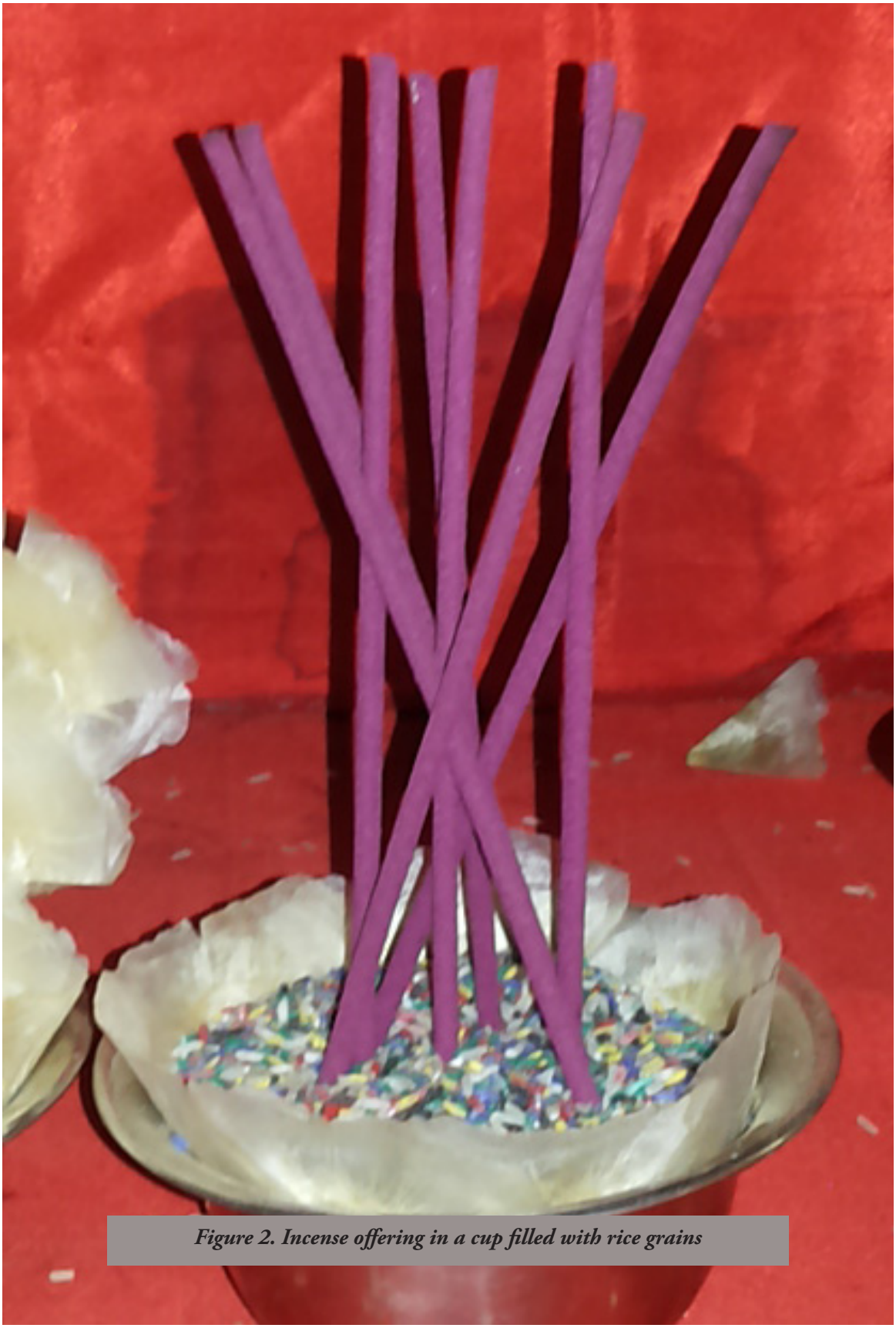

Figure 2. Incense offering in a cup filled with rice grains

4. RICE

4.1 Global Perspective

Oryza sativa ssp. *japonica* originated in Yangtze, China, 6000–9000 years ago and *Oryza sativa* ssp. *indica* originated in the Ganges region, 4500–8500 years ago (Purugganan and Fuller 2009).

4.2 Regional Perspective

A good number of stone adzes and other implements of prehistoric life can be found in Bhutanese households, some preserved by families for generations as heirlooms and others discovered by farmers by chance in their fields or forests.

Michael Aris, an historian, apparently had one of these adzes examined by Gale Sieveking of the British Museum who classified it as an artifact from the late Stone Age with a suggested date of 1500–2000BC (Phuntsho 2013). According to Sieveking, similar stone implements are commonly found in the regions of Myanmar, Yunnan, India (Assam, Bihar, and Orissa), Thailand, Vietnam, and Indonesia.

This allows us to surmise that some Bhutanese valleys were inhabited by people using lithic tools over 4000 years ago, and there may have been a Neolithic culture not very different from those that existed in these other Asian countries. Archaeological evidence suggests that Bhutan was inhabited as early as 1500–2000 BC by nomadic herders who lived in low-lying valleys in winter and moved their animals to high pastures in summer (Lonely Planet 2015). It is quite likely that agricultural practices in Bhutan, including cultivation of rice, maize, and millet, spread from southern China and northeastern India (Phuntsho 2013).

4.3 National Perspective

4.3.1 The nine cereals (*dru-na-gu*) and Avalokiteshvara

There are numerous accounts of the role that crops play in religion, tradition, livelihoods, and food security.

The Bhutanese refer to Tibetan Buddhism to explain origin and agricultural practices. According to this belief, once, human beings were able to subsist solely on the food of happiness. With the passage of time peoples' accumulated merit or *sonam* declined and, thus, the need for tangible, physical food arose(Choden2008). At that time, the bodhisattva Chenrezig or Avalokiteshvara gave humans the gift of grains and pulses, such as barley, wheat, peas, and buckwheat, which were scattered over the land and produced "annual crops without the need for cultivation" (Choden 2008). These crops were reaped as needed, and they simply grew again.

However, as time passed, people became greedy. They began to hoard grain, steal from each other, and quarrel over ownership. Because of this, the quality of the grain degenerated and the seeds developed husks. Over time, people began to resemble their modern counterparts who must sow and reap cereals annually and who live in complex societies and prone to violence (Choden 2008).

The crops gifted by Chenrezig still constitute the staple crops in many parts of the country. In Bhutan, any area is considered blessed if the conditions are favourable for the cultivation of the nine basic crops or *dru-na-gu:* rice, wheat, barley, peas, two kinds of buckwheat, millet, mustard, and soybeans. In fact, the Bhutanese term for agriculture is *sonam*, which can be translated as merit or blessing.

The Bhutanese believe that only the fortunate and the blessed can be farmers. They make frequent reference to the nine basic crops, but there appears to be some uncertainty over the species. The inclusion of maize is often disputed, as the *dru-na-gu* predates the coming of maize to Bhutan; however, if maize has partly replaced Job's Tears, this species was likely one of the nine original grains. It is also possible that the nine species differ in different regions. It is interesting that no mention is made of any root or tuber crop, although yam and taro must have been commonly used in the lower areas of Bhutan (Choden 2008).

In view of the association with religion and the fact that Bhutan is located at the intersection of the origins of both *indica* and *japonica* rice subspecies, this sets rice in the context of an ancient crop in Bhutan.

4.3.2 Early evidence of rice in Bhutan

In 747AD, Guru Rinpoche visited Bumthang to heal Sindhu Raja who was very sick and close to death. When the king was healed by Guru Rinpoche's mystic powers, he offered his healer wine at a festival to celebrate his recovery: "After this, with ceremonial vows, wine in golden cup was offered to Pemajungney by the King" (Olschak 1979).

After the festivities, Guru Rinpoche wanted to make peace between two enemy kings, Sindhu Raja and King Nahuche, who had been fighting each other. He traveled from Bumthang to King Nahuche's land where "Rice wine and grape wine, etc., were offered" (Olschak 1979). The two kings were united in friendship at Nabi Korphu Lhakhang, and they erected a stone pillar there to symbolize their friendship.

When Guru Rinpoche returned to Sindhu Raja's home, after a pilgrimage to Bodha Gaya, "Rice wine was offered [to him] in gold and silver bowls" (Olschak 1979).

The wine King Sindhu Raja offered Guru Rinpoche for healing him was very likely rice wine, as specified in the accounts of the later events described above. This evidence of the use of rice to make wine (*ara*) as early as the 8th century, indicates the existence of rice in the country at that time.

Longchenpa (1308–1364), the Tibetan philosopher saint who traveled across Bhutan, remarked that Mangde (Trongsa) is truly mangsde, the region of plenty. He added, "In the lower region of Mangde, rice, millet, peas and other cereals grow in plenty, as does a very good tea plant."Thus, it appears that rice was already a major crop in Trongsa in the 14th century.

Terton Pemalingpa (1450–1521), who was believed to be the reincarnation of Longchenpa, was born on the 15th day of the second month of the year of the Iron Horse. One of his favourite retreats was a small hermitage, which he had built in Bumthang valley. Once, when he was staying there, he was asked to come to Shong near Bumthang to conduct the "long life initiation."

During the ceremony, miraculous events occurred. Grain in the offering vase turned green during preparations, at the end of the refuge prayers it began to sprout, and by the time the ceremony was half over, the shoots had grown above the neck of the vase. By the end of the invocation to the gods, it had produced grain, at the initiation stage it was ripe, and by the completion of the ceremony it was ready to eat (Tshewanget al. 1995). The grain referred to here is most probably rice, which is usually the offering in religious ceremonies in Bhutan even today.

Zhabdrung Ngawang Namgyal (1594–1651) is credited with developing the customs, traditions, and ceremonies associated with Bhutan and Bhutanese culture, in a deliberate effort to establish a unique cultural identity for the country. He established an administrative as well as a legal system, including taxation. Taxes were paid in the form of wheat, buckwheat, rice, yak meat, butter, paper, timber, and clothing (Lonely Planet 2015).

On 4 October 1627, the Portuguese priests Estevao Cacella and Joao Cabral wrote to their superiors in South India describing Ngawang Namgyal, at the time a 33-year-old in retreat at Cheri. This king was known as a man of letters and revered as such by other high lamas; kings sent him gifts and he was much sought after by people in this area. At Cheri, he lived in a tent so that he could respond to the requests of people from various villages to visit them. In return, they gave him gifts of horses, cattle, rice, cloth, and other goods. Villagers from farther away brought such offerings to him (Phuntsho 2013). The impression from this report is that rice constituted an important offering to lamas and other significant figures.

The 1627 accounts of Cacella and Cabral provide details of the crops and fruits cultivated in the country at that time and also some insights into food customs (Baillie 2007). They described the valley of Paro as being"pleasant to look upon," with fields covered with wheat and rice crops. The report further said that"the land [Bhutan] produces an abundance of wheat, rice, meat, all very cheap — there is a variety of very good fruits, pears of different types, some very big, all good, excellent peaches, apples, nuts, quinces, everything in great abundance, and also

no shortage of rose apples from India; there are also peas and very good turnips, as well as other foods and indigenous fruits."

J.P. Tavernier who traveled to the Far East six times between 1631 and 1668 collecting news concerning the Kingdom of Bhutan, remarked that "The country [of Bhutan] is good, and produces corn, rice, vegetables and wine in abundance" (Olschak 1979).

From the remarks of Cacella and Cabral and J.P. Tavernier, one can surmise that Paro, Bhutan, produced an abundance of rice even in those days.

In 1772, when Tashichhodzong was destroyed by fire, the Zhabdrung earnestly undertook its swift reconstruction in "a new location in the rice fields near the river," i.e., the current location, which he acquired from local farmers. The inference is that the paddy fields, which we now see on the outskirts of Tashichhodzong must have been a prime rice growing area even in the 18th century.

In 1774 on reaching Thimphu, George Bogle remarked "the river Chinchu gallops by; the low ground near it being covered with rice" (Markham 1879). In addition, he mentions rice several times during his account of his stay at Tassiudon, as well as while he was traveling through Bhutan.

In 1778, when Gorkha troops from Nepal invaded Sikkim and occupied the capital, the sixth king,Tenzing Namgyal, and the royal family were forced into exile. They escaped to southern Tibet, where they went suffered a serious ordeal without enough food to eat (Phuntsho 2013). The Bhutanese sent humanitarian aid in the form of rice, tea, and 1200 silver coins, which temporarily eased the difficulties of the Sikkimese royal entourage (Phuntsho 2013). From this account, it seems Bhutan played an important role by providing this aid and rice was an important commodity in this situation.

In 1783, Captain Samuel Turner and his crew were on a mission from Calcutta to Bhutan and Tibet via Chichakotta (nowKhitokha) in the hills east of what is now Phuentsholing. On their arrival at Buxadewar

(also called Passaka), 20 miles from Chichakotta, he remarked, "All the Zeenkaubs, and officers in public stations, came to see us, each presenting a white pelong handkerchief, and offering copious draughts of tea, and a spirit extracted from rice, or wheat, by them called Chong" (Turner 1800). He also stated, "We were presented with a lighted rod of the perfumed composition, which we held in our hands....A cup full of rice was brought to us, with one of the lighted rods stuck upright in it" (Turner 1800), a tradition practiced by every Bhutanese.

In his endeavour to give a general idea of the Valley of Tassiudon and its crops, Turner (1800) wrote,"It was, upon our arrival, luxuriantly clothed with the most promising crops of rice, which, in defect of rain, all the springs of the surrounding mountains, are artificially conducted to fertilize." The inference is that rice was cultivated extensively in the Thimphu area in 1774 as remarked by George Bogle or in 1783 as remarked by Captain Samuel Turner.

On his arrival at Wandipore, Turner(1800) states, "After we had ascended the hill, extremely wearied with eleven hours of toilsome travel, we were conducted to a house near the castle, which we had scarcely entered, when a large pot of tea, accompanied with roasted rice, and many polite inquiries, were brought to us from the Daeb."

Jigmi Namgyal, who was born in 1825, was promoted from retainer or *tozen* to a senior courtier in 1845 and was soon promoted to be merchant of Tongsa. Like other state, district, and private merchants, his duty as district merchant was to trade local products, such as textiles, rice, and paper,for Tibetan products, including salt, wool, rugs, statues, etc., at the markets along the border with Tibet (Phuntsho 2013). Thus, rice was one of the commodities exported to Tibet in the mid-19th century.

On 17 December 1907, when Sir Ugyen Wangchuk was crowned as the hereditary monarch of Bhutan in Punakha, the main proceedings were followed by the Zhungdrel ceremony of inauguration during which"three kinds of tea, rice, and paan were each offered in turn."

All the above references underline the strong value of rice in Bhutanese traditions and rituals, which are an integral part of all important national and historic events.

4.3.3. The role of rice in planned development

In 1961, the third king, His Majesty Jigme Wangchuck (1929–1972) initiated planned development process. The first 5-year plan (Bhutan 1961) set Bhutan on the way to planned agriculture and animal husbandry along with basic infrastructure facilities, such as roads, power, communications system etc.. A budget of 20 lakhs for agriculture, 32 lakhs for forestry, and 15 lakhs for animal husbandry was approved.

The forest department took a number of measures to conserve forest wealth and regulate the exploitation of forest products. A department of animal husbandry was set up and many livestock and sheep breeding farms were established in various parts of the country (Bhutan 1961).

The Department of Agriculture was established on 1 October 1961. It created a number of model farms, seed multiplication facilities, agricultural research stations, and a system of extension workers. Research farms were set up at Lungthenphu and Bhur towards the end of 1963. A demonstration farm was also established at Tala. Training sessions began at Lungthenphu, Paro, and Bhur to train junior technicians for the department (Bhutan 1961). In addition, a Horticulture Research Station was built at Yusipang and two orchards were planted at Gasa and Bhumthang. Efforts were made to increase the area under fruit and vegetable cultivation. These initial establishments laid the foundation for rice research and development activities in the country.

The second 5-year plan, 1967–1971 (Bhutan 1967) included provisions for a third research farm/regional research station at Kanglung, Tashigang, to serve eastern Bhutan. Agricultural training classes were to be run at Bhur, Tashigang, Lungthenphu, and Yusipang and at a location in southern Bhutan. A horticulture research station was proposed for Bumthang. About 40 varieties of paddy were tested and high-yielding varieties suitable for different regions were determined at the research stations, particularly at Bhur. About 49 quintals of improved paddy seeds were distributed during 1969–1970. The scope of subsidies for irrigation works, which started in1964, was extended considerably during the second 5-year plan to increase rice production in the country.

Simultaneously, in 1968, the first new varieties of paddy were introduced for trial at the Bonday Farm, which was established by Dasho Keiji Nishioka in 1966. In 1969, tests for plant density, fertilizer dose, and variety introduction took place at Bonday Farm in Paro (Bonday Farm n.d.). Bonday Farm also participated in a resettlement project at Gelephug with bulldozer and paddy-line planting.

Under the third plan, 1972–1977 (Bhutan 1972), paddy varieties with cold weather resistance were collected from northern Japan, and trials were conducted over several years starting in 1975. Help from Indian Council of Agricultural Research project coordinators was projected to be needed for the expanding rice research activities. Bonday Farm recorded high paddy yields at a few localities, achieving up to 7–8 t/ha with paddy variety no. 11 in 1980.

The Centre for Agricultural Research Development (now Research Development Centre Bajo) at Wangdiphodrang was established during the latter half of the period covered by the fifth plan (Bhutan 1982). Progress was made in research on rice and rice-based farming systems with technical assistance from the International Rice Research Institute.

Initiated during the fifth 5-year plan, the National Agricultural Seeds and Plants Supply Programme was to be strengthened under the sixth plan (Bhutan 1987). New high-yielding varieties of rice were developed for each of the five agro-ecological zones and released for use. Farmers were beginning to adopt the new varieties, particularly under the Agricultural Development Projects (Bhutan 1992).

In 1992, Bhutan was 66% self-sufficient in cereal production; it was virtually self-sufficient in maize, barley, millet, and buckwheat, but only 52% in rice, 24% in wheat, and 20% in edible oils (unpublished data).Horticultural crops (oranges, apples, potatoes, cardamom, ginger, chili, vegetables, and processed fruit products) were exported to India, Bangladesh, Singapore, and Japan. In 1985, a "tray nursery system"for paddy was tried at Bonday Farm in Paro and proved successful, with yields of up to 7600kg/ha achieved by farmers (Bonday Farm n.d). In 1986, under the chairmanship of His Majesty the King, a seminar on

paddy cultivation for improvement of variety paddy no. 11 was held at Bonday Farm.

By 1994, Bhutan had achieved self-sufficiency in maize, barley, millet, and buckwheat, but it was still only 64% self-sufficient in rice and 65% in wheat (Bhutan 1997). During the eighth plan, there was an increase in rice imports due to rapid urbanization and an influx of expatriate workers whose staple diet was rice and a change in diet of most Bhutanese from other staples to rice. One of the targets set by the Renewable Natural Resources sector for the tenth 5-year plan, 2008–2013, was 65% self-sufficiency in rice (Bhutan 2008).

In 2009–2010, the Research Development Centre at Bajo introduced and evaluated over 200 lines or varieties of rice (DoA and MoAF 2011). As of 2006, 14 varieties of rice had been released in Bhutan (CoRRB 2009). As of 2014, the records of the Council for RNR Research of Bhutan (CoRRB) show that 24 varieties of rice have been released in Bhutan.

4.3.4. Current rice cultivation in Bhutan

Rice is grown in all agro-ecological zones of Bhutan, across all 20 Dzongkhags, except the alpine zone in the north. It is cultivated in humid subtropical zones at an elevation of 150m in the southern foothills as well as in warm temperate zones in the north at elevations up to 2800 m (the highest altitude at Bumthang). Rice is grown under both irrigated and rain-fed systems.

4.3.5. Cultural and socioeconomic importance of rice in Bhutan

Rice is indispensable to Bhutanese diets, culture, tradition, religion, and livelihoods. More than 69% of the population is engaged in farming, with rice as the main crop. Thus, rice production is essential to the livelihood of a vast majority of Bhutanese farmers. Based on agricultural statistics, about 28,930 households in Bhutan are engaged in rice production (CoRRB 2008). Although, rice is not the largest cereal crop produced in the country, it is the most widely consumed.

Rice grown in Bhutan is largely for domestic consumption, and production has not been able to meet the demand. Imported rice makes up the shortfall. In 2013, total rice consumption in Bhutan was 16,259 tonnes and the per capita consumption is 135.5kg/year (Food Balance Sheet, Policy and Planning Division, Ministry of Agriculture and Forests, in preparation).

There are more than 10 ways to cook rice, including boiled and steamed rice, sizzled rice (*zaw*), porridge (*thyup*), sweet rice (*desi, khir*), *chamray*, rice breads (*roti*), roasted and flattened rice (*sip, chewra*), rice pappad (*mekhu*), fermented rice drink (*changkay*), beer, etc. (National Biodiversity Centre 2008).Rice straw is used as cattle feed, for roofing material, and for mats, and rice bran is used as livestock feed. Rice is the most important component of *dru-na-gu* (the nine crops) for religious performances. It is used in rituals and religious functions in the form of *trashidru*. *Torma*(a cake-like food) is one such important rice form used in religious offerings.

In 2012, 78,014 tonnes of rice was produced in a cultivated area of 21,146 ha giving a yield of 3689kg/ha (MoAF2014). Production was highest at Samtse, Punakha, and Paro: 9844, 9351, and 7764 tonnes/ year, respectively. The largest cultivated areas are in Samtse, Punakha, and Sarpang: 2905, 2061, and 2045 ha, respectively (MoAF2014).

The most recent data (2013) show that 75228 tonnes of rice was produced in a cultivated area of 19571 ha giving a yield of 3869 kg/ha. Production was highest at Punakha, Paro, and Samtse: 11028, 9891, and 9891 tonnes/year, respectively. The largest cultivated areas are in Samtse, Punakha, and Wangdue: 2903, 2391, and 1802 ha, respectively (MoAF2015).

Figure 3. Maize field in Tsirang

Figure 4. Local popcorn varieties on display

5. MAIZE

5.1 Global perspective

Zea mays seems to have been first reported from Mesoamerica 7000–9000 years ago (Purugganan and Fuller 2009). When Columbus "discovered" America in 1492, maize was already being cultivated there, indicating its antiquity. However, before Columbus, it was unknown to the Old World. After European contact with the Americas in the late 15th and early 16th centuries, explorers and traders carried maize back to Europe and introduced it to other countries (Wikipedia 2015). Beginning about 2500 BC, the crop spread through much of the Americas (Wikipedia 2015).

5.2 Regional perspective

In India, temples with sculptures of corn cobs date back to the 12th or 13th century AD (Johannessen and Parker 1989). The common belief is that maize originated in Mexico and was brought to India in the 11th or 12th century. By the time temples were constructed there, maize would have been fairly common in India. In 1956 two Japanese scientists, Suto and Yoshida, referred to the statement recorded by the famous Chinese naturalist, Li Shih-Chen, that a pod-like corn was introduced to China from India via Tibet in 1368 (Thapa 1966). During this period, Buddhist missionaries, both Indians and Tibetans, traveled across the Himalayas, and commodities also moved from India to Tibet (National Biodiversity Centre 2008). From India, maize was introduced into China and later the Philippines and East Indies (Sikkim Agrisnetn.d.); however, some Chinese researchers claim that waxy or sticky maize originated in southwest China.

Agricultural practices in Bhutan, including the cultivation of rice, maize, and millet, likely spread from southern China and northeastern India. The existence of popcorn (*Murali* maize), which is considered to be a primitive maize, in Sikkim, Bhutan, and other northeastern states gave rise to another hypothesis pointing to this area as a secondary centre of origin of maize; however, recent evidence indicates the possibility of its

pre-Columbus introduction through the Atlantic–Arabian route (Sikkim Agrisnetn.d.). Until the mid-1970s, popcorn was found in abundance across Bhutan, and it is still found scattered across the country.

5.3 National perspective

Although rice featured in the legends surrounding the visits and lifetimes of Guru Rinpoche (747), Longchenpa(1308–1364), and Terton Pemalingpa(1450–1521), maize was not accounted for and, therefore, the nature of its introduction remains elusive. However, according to elderly farmers, an ceremony called *Nuangi*, where maize ears are offered to the deity before harvest has been commonly practiced in southern Bhutan from time immemorial.

Notwithstanding the origin of maize in the country, it has become a staple crop in eastern and some parts of southern Bhutan, and there is little recollection of what was grown before the introduction of maize.

Unlike rice, there are fewer accounts of maize in the documented history and traditions of Bhutan.

5.3.1 Nine cereals (*dru-na-gu*)

Although the Bhutanese make frequent reference to the nine basic crops (see 4.3.1 above), the inclusion of maize among them is often disputed, as the tradition of *dru-na-gu* predates the arrival of maize in Asia. There is a possibility that maize has replaced Job's Tears, which was most probably one of the nine original grains (Choden 2008).

5.3.2. Early evidence of maize in Bhutan

J.P. Tavernier, a frequent traveller to the far east between 1631 and 1668, makes specific reference to the abundance of corn and other crops in the country (Olschak 1979). Thus, one may infer that maize cultivation was well established in the 17th century, although this was the only written report of maize in the early literature on Bhutan.

In 1774, Bogle also noted the presence of Indian corn planted in patches with wheat and barley. From his report, we can speculate that the introduction of the Andean crops, maize and chili, to Bhutan may have preceded the potato (Markham 1979).

While travelling from Chukha after crossing Punugga in 1783, Captain Samuel Turner and his team "saw the Patchieu, as it comes round the mountains to the north-west, forming a junction with the Tehintchieu, which runs-on to receive the river Hatchieu, near Kepta. As we approached Nomnoo, the husbandmen were busied in the fields; the reapers were cutting down the corn with sickles, which others collected in handfuls, and bound up with a wisp of straw" (Turner 1800).

On reaching Thimphu, Turner referred to maize again, stating: "The banks of the river are lined with willows, and the surrounding mountains have some timber trees, intermixed with the fir and pine, as well as a great variety of flowering shrubs; whilst a number of single houses, and some monasteries, having orchards and hanging fields of corn about them, ornament the finely romantic views, with which we were delighted from every-part of this valley" (Turner 1800).

The frequent references to maize in the 18th century strengthen the theory that maize had already made its mark in Bhutanese cuisine by this early time.

5.3.4. The role of maize in planned development

The institutional and infrastructure establishments initiated under the first 5-year plan (1961–1966; see 4.3.3 above) apply similarly to maize and lay the foundation for its development in the country (Bhutan 1961).

During the second 5-year plan (1967–1971), further advances in research and development were initiated to build on the achievements under the first plan (Bhutan 1967). In 1969–1970, improved maize seeds were distributed.

In the late 1980s, preliminary discussions took place on a collaborative program to improve maize and wheat production with technical assistance from the International Maize and Wheat Research Centre (CIMMYT); Bhutan 1987). The potential for maize to become a dominant cereal that could contribute substantially to food self-sufficiency was recognized (FNPP 2006). New maize, wheat and oil seed varieties were also ready for release by the end of the sixth 5-year plan period.

In 2001, Bhutan began collaborating on maize research with CIMMYT-Nepal, Nepal's National Maize Research Program, and the Hill Maize Research Project funded by the Swiss Agency for Development and Cooperation in Nepal (CIMMYT 2008).

5.3.5. Current maize cultivation in Bhutan

In Bhutan, maize is grown at altitudes ranging from less than 300 m up to 3000 m above sea level. Planting time varies widely with altitude. Generally planting of the main crop starts by end of February or the beginning of the first Bhutanese month and harvesting begins by the end of August. In some environments, the second crop is sown in early September and harvested in December. Dry-land agriculture is the most dominant land-use system for agricultural production in the country. Maize is predominantly a dry-land crop and is entirely rain-fed.

5.3.6. Cultural and socioeconomic importance of maize

Maize is a major food crop in Bhutan and one of the major components of *dru-na-gu* (the nine basic crops). It is cultivated across the country and it ranks first among the food crops in terms of area cultivated and production volume, and the country is self-sufficient in maize. Over 70% of households cultivate maize, mainly for subsistence and this cereal plays a critical role in household food security.

Maize is consumed mainly in the form of *kharang* (grits), *tengma* (roasted and pounded maize), and *ashommungnang* (a local term for popcorn). It is also brewed into *bangchang* and *ara* (local drinks), which are indispensable for religious rituals and traditional chores. Maize grits are

also consumed mixed with rice. Fresh, immature cobs are eaten boiled or roasted. Corn flour and other residues are excellent feed for cattle. The husk is used as a raw material to make mats. Young green maize stalks are used as fodder for cattle. Green stover(thinnings, leaf strippings, plant tops) is an excellent source of food for cattle during the critical winter months when feed is in short supply. Maize flour has a special use as a burnt offering to appease spirits (sur) and as a substitute for wheat and barley flour for making *torma*(a ritual figure).

As of 2014, five varieties of maize were released in Bhutan (CoRRB 2014).

Trends in maize cultivation include the availability of a surplus for sale; semi-mechanized processing of *tengma*; and the adoption of modern technologies (FNPP 2006).With the planting of Yangtsipa, an improved maize variety derived from Suwan-1, which was introduced through CIMMYT's former regional maize program in Thailand, there has been a real improvement in maize yields (CIMMYT 2008). In 2012, maize production was at 73024tonnes. The highest production was reported from Mongar, Trashigang, and Sarpang with 10420, 9113, and 6890 tonnes, respectively. Monger, Samtse, and Sarpang have the largest areas under maize cultivation: 3432, 2700, and 2666 ha, respectively (MoAF 2014).

The latest data from the Ministry of Agriculture and Forests (MoAF 2015) show maize production at 735715 tonnes. The highest production was reported from Mongar, Dagana, and Trashigang with 14 767, 7655, and 7071 tonnes, respectively. Monger, Dagana, and Samdrupjongkhar have the largest areas under maize cultivation: 3437, 2599, and 2211 ha, respectively.

Figure 5. Different potato varieties being maintained at the National Plant Gene Bank at NBC

6. POTATO

6.1 Global perspective

Solanum tuberosum seems to have been domesticated originally 8000 years ago in the central, mid-altitude Andes (Purugganan and Fuller 2009).

6.2 Regional perspective

John Freyer, traveling in India from 1672 to 1681, mentioned potato twice (Laufer 1938).Thus, in a remarkably short interval after its discovery in America, the potato had been conveyed to India. Other sources claim that good crops of potato could be found in northern India as early as 1617 (Nayaret al. 1987).

Thomson (1852) described potato production around Simla and its supply to lower areas: potatoes harvested in October are "supplying not only the station of Simla, but being dispatched in great quantities to the plains of India, where the potato is only cultivated as a winter crop."The potato was introduced to the Khasia in Assam around 1830 by a Mr. Inglis, and "they have increased so rapidly that the Calcutta market is now supplied by their produce"(Hooker 1891, p. 487).

The introduction of the potato into the Himalayan region and farther northward may be connected with the administration of Warren Hastings, Governor of the British India Company (Nunn and Qian 2011). When Hastings sent George Bogle on the memorable mission to Bhutan and Tibet in 1774, he instructed his emissary to plant some potatoes at every halting place, in order that a valuable new product might be introduced into Bhutan. It is quite certain that potatoes were known in India in the 18th century, as Hastings was much interested in their propagation (Nunn and Qian 2011).

A description of agriculture practices in Hooghly (west Bengal) in 1850–1891 noted a high demand for potato and its widespread cultivation in Hooghly and Burdwan district (Kelly 1981). According to the same

author, potato at that time replaced the traditional yam and colocasia species cultivation to a large extent.

6.3 National perspective

There are fewer historical accounts of the potato compared with the number for rice.

6.3.1 Early evidence of potato in Bhutan

Potato was believed to have been introduced into India in the 16th century, and good crops were reportedly seen in northern India as early as 1617 (Roderet al. 2008). From there, it may have reached some parts of Bhutan in the 17th century. Markham (1879) provides the earliest documented evidence of the introduction of potatoes in Bhutan. As noted above, Bogle seems to have planted potato as he traveled from Buxa Duar through Chhapcha to Thimphu in 1774. After reaching Jaigugu, Bogle reported, "I planted ten potatoes"in an area that must have been about a mile from Pachu–Chinchu (Thimchu) in 1774 (Markham 1879).He also reports planting 15 potatoes on arrival at Muri-jong (which Turner called Murichom), which was 18 miles from Chukha. However, it is quite possible that potato may have reached parts of Bhutan earlier, as it was already widely cultivated in northern India.

The tuber grew fairly easily and the Bhutanese took an immediate liking to it, so that in 1776 the Dzongpon of Punakha even asked Bogle to send more as they had eaten the whole harvest without saving any seeds. The Dzongpon sent Bhutanese pears to Bogle as a gift (Phuntsho 2013).It is widely believed that potato spread gradually through most parts of the country in the 18th and 19th centuries (Joshi and Gurung 2009).

The records of Captain Samuel Turner, who passed through Bhutan nine years after Bogle, made reference to the potato again: "The gardener brought me a handful of lettuce, weak and bitter; and also a few cabbage leaves, equally degenerate with a small specimen of potatoes not bigger than a boy's marble.... Mr. Bogle had formed great hopes from the introduction of this vegetable and they had been taught to call it by

his name; but either from ignorance or idleness, they had failed in the cultivation of this valuable root and the stock is now almost exhausted" (Turner 1800).

A more recent account is given by Steel, describing lunches in Bumthang in the spring of 1967: "This meal rarely varied: a pile rice, some potato fried in butter, occasionally with spring onions"(Roderet al. 2007). He also observed: "in the palace garden [Wangdicholing] a good crop of potato as being grown."

However, the modern era of Bhutanese potato production dates back roughly to the fifth decade of the 20th century, when the farmers around Chhapcha first started regularly planting and exporting potatoes to India (Joshi and Gurung 2009).

6.3.2 The role of the potato under planned development

The area under potato cultivation and yields both increased dramatically in Bhutan after the establishment of the Department of Agriculture in 1961 (Joshi and Gurung 2009). In the late 1970s, production accelerated when agricultural areas gained access to the Indian markets.

During the second 5-year plan (1966–1971), it was proposed to augment the staff in Yusipang with the appointment of an assistant horticulturist specializing in potato growing and to start applied research on fruit, potato, vegetable, and flower seed production (Bhutan 1967).

In 1975, under the third 5-year plan (1971–1976), Lhapchethanka Farm at an elevation of 2743 m was purchased for potato seed multiplication (Bhutan 1972). European varieties of potatoes were introduced through a Swiss project in Bumthang and remain important to date (Bonday Farm n.d.). In 1977, intensive potato cultivation as a second crop became popular in villages, resulting in the marketing of potatoes in June/July, still practiced now.

Under the fifth 5-year plan, the Potato Development Programme was to continue to conduct adaptive research on potatoes in collaboration with

the International Potato Centre (CIP) and Helvetas (Bhutan 1981). A Rural Development Project at Bumthang dealt mainly with activities related to germplasm introduction and testing, seed production, mechanized planting, and weeding. There was also a dramatic increase in production from 1965 to 1980, due to the construction of access roads starting in 1961.

Under the sixth 5-year plan (Bhutan 1987), the CIP country program continued with further introduction of germ plasm and testing, seed multiplication, marketing studies, and training. The work of the Bhutan National Potato Programme(BNPP) focused mainly on germplasm introduction, seed multiplication, and training.

This period also saw the commencement of the Food Corporation of Bhutan's managed auction yard system. Horticultural crops, such as oranges, apples, potatoes, cardamom, ginger, chilies, vegetables, and processed fruit products, were exported to India, Bangladesh, Singapore, and Japan. The recent increase in these exports has resulted in a surplus in agricultural trade (excluding livestock products) (Bhutan 1992). In 1985, Bonday Farm produced 250 kg of tissue-cultured pre-basic potato seed and sold it to Bhutan National Potato Program (BNPP) (Bonday Farm n.d.).

Especially in the 1980s and 1990s, the potato crop became important as a reliable cash crop for farming communities. In 2004, the Bhutan Potato Development Programme (BPDP) was initiated.

6.3.3 Current potato cultivation in Bhutan

Potatoes are grown in all Dzongkhags of Bhutan; although widely consumed locally, most of the crop is grown for the export market. Potatoes are produced by many farmers, from small landholders to tenant and large farmers, by high-altitude yak herders, and by farmers of the sub-tropics. They are consumed by the general population, regardless of age and income status. Potatoes are cooked in many ways in combination with meat and cheese, and they are highly compatible with chili, an essential ingredient in most Bhutanese dishes. Furthermore, potatoes can

be easily stored. This is especially important for high-altitude dwellers where it is one of the few fresh vegetables available during the winter months, in addition to radishes and turnips (Joshi and Gurung 2009).

Potatoes are mostly produced under rain-fed conditions at elevations of 2000–3500 m. Most households grow potatoes in less than 1 ha of land, and commercial production is limited to areas within 1–5km of a road(Roderet al. 2008).

As of 2014, four varieties of potato were released in Bhutan (CoRRB 2014).

6.3.4 The cultural and socioeconomic importance of potatoes

In Bhutan, the potato ranks first in terms of volume of agricultural trade and second in terms of value of export (next to oranges). The crop is ideally suited to the environmental and climatic conditions of Bhutan. The high-yield potential, affordability, nutritional value, and consumer preference for potatoes has resulted in a tremendous impact on the rural population through income and employment generation (Nidupet al. 2007). Foremost high-altitude farming communities, potato is the only cash crop available for both local and export markets (Joshi and Gurung 2009).

Potato varieties commonly grown in Bhutan are Desiree, Kufrijyoti, Khangmakaap and Yusikaap. Desiree, a Dutch variety introduced for cultivation in the 1970s, is currently the only red-skinned variety grown in the country; it covers almost 90% of the total area under potato cultivation. Of the three white-skinned varieties, Kufrijyoti (an Indianvariety) and Yusikaap (an Argentinean variety) were both released for cultivation in1988. Khangmakaap (a CIP clone) is the latest variety released, in 2002 (Nidupet al. 2007). The old German variety Cosima and the Dutch hybrid Maritta were also introduced into the country in the 1970s (Scott 1983).

Today, potatoes have become the most extensively cultivated crop, grown by over 20% of households in Bhutan (Roderet al. 2007). Average

annual potato consumption is estimated at 40 kg per person compared to 17 kg per person in India and about 24 kg per person in Asia. Potato consumption in Bhutan is still on the rise and per capita consumption is higher in urban settlements than in rural areas (Roderet al., 2008).

In 2012, the total potato production was 43000 tonnes. Trashigang, Wangdue, and Chukha Dzongkhags had the highest production rates at 8331, 7822, and 4162 tonnes, respectively, while Trashigang, Wangdue, and Mongar Dzongkhags had the greatest area under potato crops: 913, 663, and 647 ha, respectively (MoAF 2014).

According to the latest data (for 2013), total production was 43000 tonnes. Highest production was in Wangdue, Trashigang, and Chukha Dzongkhags with 14,165, 6400, and 5378 tonnes, respectively, and Wangdue, Mongar, and Trashigang Dzongkhags had the largest areas under production: 904, 876, and 778 ha, respectively (MoAF 2015).

Figure 6. Chili on sale at the vegetable market

7. CHILI

7.1 Global perspective

Linguistic, ecological, archaeological, and genetic evidence show that the domesticated chili pepper, *Capsicum annuum,* originated in central-east Mexico more than 6500 years ago (Kraft et al. 2014). In his search for spices, Christopher Columbus landed in South America where he found that the inhabitants used chili. Columbus named the fruit "peppers" because they were similar in taste to black pepper. After the discovery of the spice, chili replaced black pepper as the prime spice in the culinary world (Chilly.in n.d.).

7.2 Regional and national perspective

From Spain, chili spread to the rest of Europe and to South Asian countries, such as India and China. Chili was introduced into India by the Portuguese explorer, Vasco-da-Gama who arrived there on 20 May 1498. From China, chili spread further to Japan and was soon accepted as an important spice in the local cuisine (Chilly.in n.d.). Some sources say that Portuguese traders introduced chili to India in the 16th century, but, according to Gupta, the chili pepper (Capsicum annuum Linn.) is mentioned in the Siva and Varmana Puranas, circa 6–8th centuries AD (McCulloch 1998-99).

7.3 National perspective

Only scanty information is available on chili in Bhutan leaving little room for inferences on its introduction.

7.3.1 Early history of chili in Bhutan

J.P. Tavernier, who traveled to Bhutan in the mid-1600s (Olschak 1979) mentions chilies, among other commodities that were traded internationally.

In 1774, Bogle also described a dish, *gegeow*, as "well-seasoned with

red peppers" (Markham 1879), indicating that chili was part of the Bhutanese cuisine.

In 1783, Samuel Turner seems to have described the valley below Wandpore: "In the hollow below the castle, on the eastern side, was a large garden; a situation judiciously chosen for its uncommonly fine shelter. We found orange, citron, pomegranate, peach, apple, and even mango trees, thriving extremely well of culinary vegetables, it boasted no great variety: there were, however, cucumbers, bangun, chili and it was much overrun with weeds" (Turner 1800).

7.3.2 Current chili cultivation in Bhutan

In 1967, the first crop of vegetables produced at Bonday Farm comprised capsicum along with radish, cabbage, Chinese cabbage, tomato, cauliflower, eggplant, and peas. It was shipped to Bhutan's capital, Thimphu, for trial marketing and to generate interest among farmers in vegetable cultivation and marketing. Since then, chilies have come a long way and are now an indispensable spice in all Bhutanese homes. They are eaten as vegetables, which is probably unique to Bhutan, and also used to flavour curries.

Chili is cultivated in all Dzongkhags in Bhutan. It is a favoured cash crop for most farmers, as the potential returns are high and a profit can be achieved in one season. Until recently, chilies were mainly grown at a kitchen-garden scale with little or no external inputs. However, now farmers in such areas as Thimphu, Punakha, Paro, and Wangdue have started growing chilies on a commercial scale.

Species of chili cultivated in Bhutan include *Capsicum annuum, Capsicum frutescens, Capsicum pubescens,* and *Capsicum baccatum.* As of 2014, there were five released varieties (CoRRB 2014).

7.3.3 Cultural and socioeconomic importance of chili

Chili is one of the most important components of in the Bhutanese diet. Although it is grown widely throughout Bhutan, a substantial amount

is still imported from India, particularly during the winter. A must-have ingredient for the Bhutanese palate, chili is the main farm produce and cash crop at gewogs, such as Kangpara Gewog *(Kangpara solo)*, Nubi Gewog (*Nubi Ema*),Wangdi Sha(*Sha Ema*), etc.

Excess production is preserved for both consumption and sale. For example *emakaap* or *shurkam* consists of fresh green chilies blanched in hot water and dried. White chilies or *horkam* are immature green chilies sliced in half and dried. By the end of October or the beginning of November, chilies begin to turn red and are dried on rooftops and in the fields; they are also strung on a rope and hung in windows. Dried chilies are not only easier to carry, but they also fetch a better price than green chilies, because of their taste and long shelf-life.

Bhutan's most popular dish, *emadatsi*, is a mixture of chilies and cheese and is enjoyed by the whole country.

In 2012, total chili production was 7726 tonnes. Paro Dzongkhag had the highest production of chili with 1429 tonnes, followed by Wangdue with 848 tonnes and Punakha with 788 tonnes. In terms of area cultivated, Trashigang ranked highest with 414 ha, followed by Trashiyangtse with 308 ha and Mongar with 275 ha (MoAF 2014).

According to the latest information (for 2013), total chili production is 8321 tonnes. Paro Dzongkhag had the highest production with 1963 tonnes, followed by Mongar with 829 tonnes and Trashigang with 815 tonnes. In terms of area cultivated, Paro ranked highest with 333 ha, followed by Trashigang with 237 ha and Mongar with 221 ha (MoAF 2015).

Figure 7. Buckwheat field in Bumthang

Figure 8. Religious offering made from wheat flour with butter

8. OVERVIEW OF OTHER CROPS

According to Longchenpa (1308–1364), the Tibetan philosopher saint who traveled across Bhutan, Bumthang was a heavenly paradise with people living in great prosperity (Phuntsho 2013). The people of Bumthang seemed to have cultivated crops such as wheat, barley, bitter and sweet buckwheat, and various kinds of vegetables and fruit. The district was vast, with nine types of crops cultivated there. In The Flower Garden: A Profile of Bumthang the Celestial Hidden Land (written in 1355 in Tharpaling), Longchenpa, described Bumthang in central Bhutan as the valleys are wide and filled with flowers and fruits and speaking about Ura, wrote, "the grass is highly nourishing here and hence livestock thrives more than other place.... The trees bear good fruits and the forests are marvelous.... Medicinal herbs, flowers and fruits grow in abundance.... Whenever a popular religious figure visited the villages, the bulk of the offering was grains, heaped as high as houses on some occasions" (Phuntsho 2013). These notes indicate that agriculture was flourishing in this region of the country in the 14th century and formed the backbone of the economy in ancient times.

8.1 Buckwheat

Longchenpa's view of Bumthang as an abundant region is further supported by Pemalingpa, whose autobiography describes the peaceful and prosperous way of life in Bumthang's valleys. The long list of local dishes, including *puta, jangmuli* and *khurw*a, in his biography gives a considerable amount of information on agriculture and the ethno-gastronomic culture of the people of Bumthang in the 15th century (Phuntsho 2013). Many of these dishes are still known in Bumthang and are considered local delicacies (Phuntsho 2013).

Furthermore, one can infer that the diet of flour and honey on which Terton Pemalingpa was raised for three years by his grandfather Yonten (Tshewanget al. 1995)must have been buckwheat flour, as buckwheat was a major crop in Bumthang even then. According to Tshewang et al. (1995), people in the Bumthang region ate mainly buckwheat or bread made from sweet buckwheat flour.

Jigmi Namgyal, the father of the first king of Bhutan, who was born in 1825, embarked on a journey to Tongsa, purportedly triggered by a dream (Phuntsho 2013). Crossing over the Rudongla pass, he reached the Tang valley and spent a few months herding cattle and sheep for the family of the village chief in a place called Naru. Later, when he became the Trongsa Ponlop, and the chief came to seek an audience, he is said to have asked if the pot in which they prepared the skimpy buckwheat broth was still in use.

8.2 Wheat and barley

In 1774, on his arrival at the palace of Tassiudon, the capital of Bhutan, George Bogle commented, "The least steep places produce wheat" (Markham 1879), indicating the presence and cultivation of wheat in Bhutan.

In 1783, when Captain Samuel Turner and his team reached Buxadewar (present day Passaka) 20 miles from Chichakotta, they had a long wait for a letter from Daeb Raja before moving on to Murichom. There, Turner (1800) remarked, "We saw many spots of land cleared in the same manner, on the surrounding eminences; which, in general, seemed to produce thriving crops of barley and wheat, and a small grain of which they make a fermented liquor to drink" (Turner 1800). Murichom appears to be 18 miles from Chukha Chazam.

When they departed from Chukha, they noted: "Near Punugga there was a very fine crop of barley almost fit for reaping" (Turner 1800).

In 1815, disputes arose regarding Bhutan's frontier boundaries and a native official named Kishenkant Bose was send to the court of Dharama and Daeb Raja to look into the issue. On his return, he mentioned wheat stating "whatever rice they grow is taken almost entirely for revenue by the government, and they are also obliged to deliver the grass and straw; of wheat, they retain a large portion" (Eden 2005).

8.3 Peas

Historic accounts reveal that the previous incarnation of Terton Pemaling pa (1450–1521) was killed at the age of seven by someone who threw a stone at him when he was stealing peas from that person's field near Tharpaling in Bumthang (Aris 1988). According to verbal communication with some key Bhutanese personalities, peas are also one of the important ingredients used during cremation ceremonies.

8.4 Tea

Around 1776, Hastings and Bogle tried to grow tea in Bhutan, although the project was not successful (Phuntsho 2013). When Bogle showed the seeds to the Pagsam Drungpa in 1780, the Bhutanese official got up and danced around them in sheer joy, as this could save the huge amount of money that Bhutan paid for tea brought overland from China. It was with remarkable foresight that Hastings attempted to grow tea some 50 years before tea plantations in India were established. Tea was one of the most important items of merchandise for the East India Company (EIC); thus, providing seeds to Bhutan not only gained favour for the company there, but might also have freed the EIC from its dependence on Chinese tea (Phuntsho 2013). This probably explains the source of the few patches of tea that have been seen in kitchen gardens in southern Bhutan in the past. However, commercial cultivation of tea was initiated in Trongsa in 2009.

8.5 Mustard

Saint Drukpa Kunley (1455–1529), is directly associated with this crop. According to an oral tradition, he came up to the Pele La pass,which divides the country into east and west, but did not continue his journey eastward as the signs were not auspicious. However, the saint did not go back without giving a gift to the area that lay in front of him. He scattered a fistful of mustard seeds and commanded them to grow abundantly. This is the reason why mustard grows without sowing in Rukubji (Wangdue) and areas of Trongsa district. Many older people still tell the story of this gift, their gratitude and appreciation still obvious,

although this mustard variety grows slowly, taking a year to ripen, and has a low yield (Aris 1988). We still see this crop in farmers' fields and on barren land to this day.

8.6 Fruit crops

Captain Samuel Turner and his team remarked, "Here we found two large peach trees, some lime and orange trees, and raspberry bushes," when they were 12 miles from Buxadewar on their way to Murichom in 1783 (Turner 1800).

On reaching a place called Nomno, Turner (1800) mentioned, "I visited an orchard in the neighborhood, and found it well stored 'with walnut, apple, peach, pear, apricot, and barberry trees." This shed light on how long ago apples were cultivated in the country.

During an audience with the Daeb Raja, Turner (1800) indicates, "Trays of fruit were placed before us, consisting of orange, dried apples, walnuts,vegetables, and some preserved fruits of China and Cashmeer." While in Tassiudon in Thimphu, he reports, "We had often met with strawberries and raspberries growing wild, in great abundance; and had seen apple, walnut, pear, peach, and apricot trees."

In Punukka, Turner (1800) wrote about a garden: "gaining access to the gardens which were extensive, and well stocked; containing the orange; sweet and sour; lemon, lime, citron, pomegranate, peach, apple, pear, and walnut trees, loaded with unripe fruit."

9. CONCLUSION

This document is the first of its kind to shed some light on the history of crops in Bhutan. Because of the limited time frame, the information provided here is preliminary and the subject warrants further study and investigation to build on this base and fill gaps. Nevertheless, this study provides a glimpse of Bhutan's crop history and highlights the interdependence of food crops and nutritional security.

Figure 9. Traditional dishes made from rice, maize, potato and chili

10. ACKNOWLEDGEMENT

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44. APPENDIX: INSTITUTIONS AND KEY INDIVIDUALS CONSULTED

Institutions consulted

Bhutan Alpine Seeds, Paro
National Centre for Animal Nutrition, Jakar
National Seed Centre, Paro
Renewable Natural Resources Research and Development Centre,Bajo
Renewable Natural Resources Research and Development Centre, Bhur
Renewable Natural Resources Research and Development Centre, Jakar
Renewable Natural Resources Research and Development Centre, Wengkhar

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