

Bhutan

# Agricultural sector review

Volume 2  
Working papers



FAO INVESTMENT CENTRE

COUNTRY HIGHLIGHTS





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### COUNTRY HIGHLIGHTS

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**Exchange rate (March 2011)**

USD 1 = 45.3 Ngultrum (Nu)

[The Ngultrum is maintained on par with the Indian Rupee (Rp.)]



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The main authors of this report are Garry Neil Christensen, Senior Agricultural Economist; Turi Fileccia, Senior Agronomist and Aidan Gulliver, Senior Economist, both from FAO's Investment Centre Division.

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This publication is composed of two volumes. Volume 1 looks at the issues, institutions and policies involved in the agricultural sector of Bhutan (Author: Garry Christensen); whereas Volume 2 consists of two working papers that review the marketing and labour situation (Author: Aidan Gulliver) as well as the research, extension and input supply systems (Author: Turi Fileccia) of the RNR sector.



# ACRONYMS

AMC	Agricultural Machinery Centre
BAFRA	Bhutan Agriculture and Food Regulatory Authority
BDFC	Bhutan Development Finance Corporation
BEA	Bhutan Exporters' Association
BFC	Bhutan Food Corporation
CAs	Commission Agents
CoRRB	Council for RNR Research of Bhutan
CPS	Country Partnership Strategy
DAMC	Department of Agricultural Marketing and Cooperatives
DOC	Day old chicks
DSC	Druk Seed Corporation
EAs	Extension Agents
FCB	Food Corporation of Bhutan
FCPI	Food Consumer Price Index
FFS	Farmer Field School
FYP	Five-Year Plan
HRD	Human Resources Development
m.a.s.l.	metres above sea level
MD	Managing Director
MHV	Mountain Hazelnut Venture
MoAF	Ministry of Agriculture and Forests
MT	Metric Tonne(s)
MWHS	Ministry of Works and Human Settlement
NASEPP	National Seed and Plant Programme
NLFS	National Labour Force Survey
NSC	National Seed Centre
PHC	Population and Housing Census
PPD	Policy and Planning Department
RC/RDC	Research Centre/Research and Development Centre
RGoB	Royal Government of Bhutan
RNR	Renewable Natural Resources
SRI	System of Rice Intensification
WFP	World Food Programme





# Introduction

The World Bank, in the framework of its latest Country Partnership Strategy (CPS) for Bhutan (2011-2014), foresees including a Renewable Natural Resources (RNR) sector-related lending operation.

A RNR sector analytical work is a preliminary activity to identify the main issues facing the sector and a pre-requisite for undertaking further discussions with the Royal Government of Bhutan (RGoB) on the areas towards which direct a future investment. Working paper 1 deals with the preliminary review of the marketing and labour situation within the sector. Working paper 2 looks at the research, extension and input supply systems of the RNR sector.

# Working paper 1

Agricultural markets and labour

# ||||| Agricultural marketing systems development

## Background

Bhutan faces serious challenges but also opportunities in the development of markets and marketing systems for its agricultural production. On the one hand, Bhutan's relatively small and dispersed rural population, the ruggedness of the terrain, and the heavily subsistence-based production system predominant in most areas, all render the development of competitive production and market systems difficult. At the domestic level, market related infrastructure and wholesale systems are largely absent.

Yet Bhutan enjoys strong seasonal climatic advantages compared with its neighbour to the south, India, allowing it to produce temperate zone crops (typically fruits and vegetables) during the May to October monsoon period in India, when temperatures at lower latitudes are generally too high for these crops. The country also benefits from an almost completely open trade regime with its two major neighbours (India and Bangladesh), although this policy also means that horticultural production in Bhutan during the period November to April has no protection from lower cost imports and Indian imports dominate the market during this period.

## Domestic markets and marketing patterns

Most agricultural production in Bhutan is not sold into the marketplace, but instead consumed at the point of production. A Ministry of Agriculture and Forests (MoAF) study published in 2010 estimates from RNR Census data that less than one quarter of all production was marketed in 2000 and that this rate had changed little by the time of the RNR Census of 2008.

The study also indicates that the value share of cereals and vegetables marketed in Bhutan has increased over the period 2000 to 2008, while that of fruit has declined. Marketed cereal values almost

doubled over this period (from a low initial level), while the change in the share of vegetables has been relatively small.

Despite these changes, cereal sales still accounted for less than 3% of total production value in 2008. The proportion of production entering the market was higher for vegetables (approximately one third) but only in the case of fruit did the majority (two thirds) of the harvested product enter the market.

The same study states that crop prices rose in nominal terms by an average of 30.8% over the period 2003 to 2008. However, when adjusted for the Food Consumer Price Index (FCPI) it would appear that prices for most major crops did not keep pace with overall food prices during this period (see table below).

Only rice prices increased significantly in real terms over the period. The real price of oranges declined by almost one half, and maize and apples also suffered major declines.

Also of note from the study was the finding that the average number of crops sold per geog in 2008 had declined from the levels recorded in 2000 (14.6 and 17.1, respectively). This decline occurred across all regions of the country. However, in terms of value, some expansion of the very limited role of non-export crops does seem

## Adjust price of major agricultural commodities in Bhutan

Commodity	2003		2008		Change	
	Nom price	Adj price <sup>1</sup>	Nom price	Adj price	Nom price	Adj price
Wheat	9.0	9.0	12.8	9.1	42.2%	1.3%
Rice	20.8	20.8	35.4	25.2	70.2%	21.2%
Maize	9.3	9.3	10.3	7.3	10.8%	-21.2%
Potatoes	8.8	8.8	11.6	8.3	31.8%	-6.1%
Vegetables	23.9	23.9	31.0	22.1	29.7%	-7.6%
Apples	45.4	45.4	49.7	35.4	9.5%	-22.0%
Oranges	35.8	35.8	26.3	18.7	-26.5%	-47.7%

1/ Adjusted by Food Consumer Price Index (3rd Qtr 2003 = 100, 3rd Qtr 2008 = 140.3  
Source: PPD/MoAF, 2010; Consumer price Index Bulletin, national Statistic Bureau

to have occurred. In 2000, only 4% of the value of marketed output was comprised of products other than fruits or vegetables. By 2008 this had risen to 9%. Similarly, in 2000, 77% of the value of total crop sales was accounted for by just three crops - oranges, apples and potatoes – all key export crops (see below). By 2008, this had declined to 64%.

In terms of the marketing patterns by size of producer, the 2010 MoAF study shows that in 2008, the smallest 20% of farm holdings (averaging 0.23 ha each) generated an average of only Nu. 5,083 (USD 118) per household from crop sales, with fruit accounting for almost 70% of this total and vegetables a further 30%. However, in addition, sales of live animals and livestock products earned the smallest farm holdings an average of Nu. 6,415 (USD 149)<sup>1</sup>.

By contrast, the largest fifth of farmers (averaging 3.5 ha/household), earned an average of Nu. 68,936 (USD 1,603) from crop sales and a further Nu. 11,874 (USD 276) from livestock and livestock product sales per household. Some 60% of crop income derived from fruit and a further 30% from vegetables. Most of the remaining 10% of large farmers' crop income arose from sales of paddy. It is worth noting that, across all farm sizes, sales of maize (accounting for almost 28% of harvested area, or 0.44 ha/household) are recorded as an average level of zero. Maize is thus essentially not a traded commodity in Bhutan.

In addition to the predominantly subsistence pattern of production, key factors in constraining the development of domestic markets have been the interdependent factors of poor physical access to production areas, dispersed and small scale production, the scarcity of existing market traders and wholesalers, and the widespread absence of market infrastructure. Perhaps the most important of these factors is the absence of physical access to production areas. A recent study (Tobgay and McCullough, 2008) found that a one hour decrease in walking time to the nearest road point corresponded with a 33% increase in the probability of selling farm output.

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<sup>2</sup> The smallest quintile of farm holdings held 77% of all yaks, but less than 9% of cattle, 9% of poultry and 7% of small ruminants.

## International trade

As shown in annexes 1-6, Bhutan imported a wide variety of agricultural and food products in 2009, amounting to Nu. 3.9 billion (USD 80m), or 15% of all imports by value. Rice was the most important agricultural import (and the 4th most important overall), accounting for Nu. 722 million (USD 15m) and supplying approximately one half of all national consumption needs. Next in importance were dairy products (primarily fresh milk), accounting for approximately USD 10m, and beer, which accounted for almost USD 5m. This broad pattern of imports has not changed since 2004.

Agricultural and food exports from Bhutan are far more concentrated in terms of products, with only five items (potatoes, oranges, fruit juice, apples and cardamom) representing over 75% of total agricultural export value in 2009. As for imports, this pattern is largely unchanged since 2004, with two exceptions: cardamom exports in 2009 had lost one third of their real value (largely due to disease problems in production) and exports of cordyceps sinensis<sup>3</sup> (Chinese caterpillar), which was not even recorded in 2004, had risen rapidly to assume a total value of over USD 1.5m in 2009.

Overall, the change in international trade over the period 2004-2009 has been characterized by a diversification of geographical export markets but a concentration of geographical import sources. In 2004, almost 10% of exports and 15% of agricultural imports (by value) were to and from countries other than India respectively. By 2009, however, the comparable figures were 37% of exports and only 4% of imports to and from countries other than India.

When agricultural trade values are deflated by the FCPI (annex 6), it is clear that exports, which showed a 47% nominal increase over the 2004 to 2009 period, have actually suffered a marginal decline in value since 2004, compared with the cost of all food products while imports, which experienced a nominal increase of 75% over the period 2004 to 2009, increased by 17% when deflated by the FCPI.

Assessing the competitive strength of individual commodities, in

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<sup>3</sup> Used widely in East Asia as a medicinal product when infected by a parasitic fungus.

terms of trends in real prices, is more difficult. In a number of cases, unit import prices calculated from 2004 data are so high as not to be credible (for example, rice is recorded at around USD 7/kg in that year as opposed to USD 0.25/kg in 2009), but in general the data appears to show that most imported food and agricultural items have declined in price, while most exports have increased in price. This would suggest that the relative weakness of agricultural exports does not arise from declining gross margins for producers.

In addition to constraints imposed by the highly seasonal demand in neighbouring country markets, export marketing is also heavily affected by high rates of post-harvest losses, particularly for fruits. The Bhutan Exporters' Association (BEA) estimated that packing losses for oranges commonly reached 40%, of which some 10% was due to poor transport, while the remainder derived from poor on-farm selection of produce.

## Market related institutions

### **Department of Agricultural Marketing and Cooperatives (DAMC)**

Created in 1994 as a section under the MoAF Planning and Policy Division, the DAMC was expanded to a full department of the Ministry in 2009, with the amendment and implementation of the Cooperatives Act in that year. Its principal mandate is to increase the linkage between producers and the marketing system, including the promotion of marketing infrastructure and support for the development of cooperative associations. According to the Director of DAMC, eight commodities have been prioritized for support, comprising apple, orange, pomegranate, asparagus, mushroom, potato, passion fruit and rice.

Despite its nationwide responsibilities for both marketing and cooperative development, DAMC has an approved staff strength of only 40 persons, with 10 of these in the field (in the regional office in Mongar). The rest of the staff is based in Thimphu<sup>4</sup>. Of the total current staff, only four are educated to MSc/MA level and a further two to BSc level; the remainder are diploma level graduates. With no field staff except in Mongar, DAMC is not directly involved in

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<sup>4</sup> By contrast, the livestock and forestry departments each have more than 1,000 staff and the agriculture department more than 700.

agricultural market management except in Thimphu. Thus the key export markets for oranges, apples and potatoes are not operated or supervised by DAMC.

Much of the recent thrust of DAMC's work has been in the organization of farmer groups in order to achieve economies of scale in both input/output marketing and services delivery by government agencies. As of early 2011, 28 cooperatives had been registered, although the target is to reach 500 by the end of 2013. Given the lack of field staff, however, DAMC has to rely on administrative staff belonging to other departments (district level) or ministries (geog level) to register new cooperatives. Cooperative members will receive technical and management training from MoAF and preference in loan financing through the Bhutan Development Finance Corporation (BDFC).

One of the initiatives being promoted by DAMC (together with the Agriculture Department) is that of one-stop shops (OSS), which handle the marketing of both agricultural inputs and outputs. Approved candidates receive facilities on a rent-free basis for a number of years, and are provided with Nu. 50 000 in initial stock. To date, only three OSS have been created, but others are planned.

DAMC has also promoted the development of contract farming in Bhutan. This is discussed in a subsequent section of this report.

### **Bhutan Food Corporation (BFC)**

FCB was established in 1973 primarily as a centralized grains procurement agency for RGoB, but was delinked from the civil service in 1992 as part of the decentralization process at that time and all staff (currently 181) had to resign from government service. FCB now falls under the Companies Act, although the Managing Director (MD) has been seconded from Government since that time. The current MD will be the last to act in this capacity, however.

Although still 100% government owned, FCB receives no government budget allocation and pays dividends and business tax on its operations. FCB undertakes a wide range of roles, including distributing supplies for the World Food Programme (WFP), supplying the police force, selling at wholesale and retail level, managing



auction markets in five border locations and providing training in marketing, storage and post-harvest operations. In addition to potatoes (the principal item traded) the five auction markets handle such items as ginger, areca, peas, cauliflower, cabbage, carrots, beetroot and chilli. Throughput of the auction yards in 2009 was 30 000 metric tonnes (MT), although this declined to 24 000 MT in 2010, with trading heavily concentrated in the September to October period when off-season horticultural products are most in demand in India. FCB is considering expanding the Phuentsholing auction site capacity.

FCB maintains shops or outlets in 21 districts, as well as warehouses for rice, oil and sugar in seven locations, which act as both distribution centres and strategic reserves. The range of products handled by FCB has expanded over the years and in addition to such food products as tea and dairy, it now also distributes and sells household items, including soap, toothpaste etc. FCB estimates that it handles 20% of the national rice trade, on which it loses money<sup>5</sup>, but profits on the auction sites permit FCB to maintain an overall profit. The strategic reserves maintained by FCB are estimated to include 1,400 MT of rice, 160 MT of wheat, 58 MT of vegetable oil and 200 MT of sugar. All stocks are procured in India. Previous efforts to procure supplies nationally have proven too expensive due to the dispersed nature of production and the lack of standard grades.

FCB used to maintain its own fleet of trucks for transport and distribution, but now most transport is undertaken by contractors under annual contracts<sup>6</sup>. It has also attempted to establish a wholesaling operation in Thimphu, but this was abandoned as the operation suffered operating losses. In addition to a 60 MT cold store operated by MoAF in Paro, FCB has its own cold storage facilities in Phuentsholing, on the Indian border<sup>7</sup> but most of the space is under renovation or currently not in use. There are currently no refrigerated trucks operating in Bhutan.

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5 Rice trading losses are currently estimated at Nu. 4-5 million per annum.

6 Road transport within Bhutan is appreciably more expensive than in India, due to lower haulage volumes (most trucks in Bhutan will not handle more than 6 MT in a load, while Indian trucks reach 15 MT, or 20 MT with a trailer), as well as higher fuel and maintenance costs for vehicles operating in the mountains. FCB pays rates of Nu. 5.1/MT/km for lowland transport and Nu. 5.4/MT/km for most transport in Bhutan.

7 One 100 MT Freon-based cold store, primarily for butter, and one 500 MT ammonia-based cold store, designed for apples and potatoes.

The mix of both government (e.g. maintenance of strategic stocks, supply of cereals at below cost) and commercial (e.g. sale of food stuffs and household goods) objectives is a source for concern in FCB operations, and may become even more contentious once the MD is recruited directly from the private sector.

### **Bhutan Agriculture and Food Regulatory Authority (BAFRA)**

BAFRA was established in 2000 and is tasked with quality and regulatory aspects related to the marketing of food and agricultural products, including implementing legislation related to food quality and safety and meeting international commitments in this sector. It maintains plant, livestock and food inspectors in each district of the country and operates border quarantine facilities. It also regulates agricultural inputs and issues phyto-sanitary certificates, but is not responsible for certificates of national origin (although it has been requested by the Ministry of Trade to take responsibility for this task). It is not yet active in traceability recording for foodstuffs or organic certification. Human resource development (HRD) and inadequate laboratory facilities are stated as its two most pressing problems. It is currently unable to conduct analyses in most districts but operates a National Quality Control Laboratory Complex close to Thimphu where food, seed, animal feed and veterinary testing is carried out.

### **Bhutan Exporters Association (BEA)**

Established in 2003, the BEA provides a bridge between exporters and RGoB. Its members (including both companies and cooperatives) are involved in the export of minerals, cash crops, herbs and spices, steel billets and industrial products. Potatoes are generally sold through the FCB's auction system, however, and BEA is not involved. There are 125 registered corporate members of BEA and 60 cooperatives. Membership costs are Nu. 3,000 per annum, or Nu. 10,000 for lifetime status, plus 0.25% of the value of the export shipment.

BEA services to members include organizing trade fairs, maintaining a register of known buyers of export items, including importers and hotels, contacts with the Indian and Bangladeshi Chambers of Commerce and assisting members in export licensing procedures.

## Private sector participation

With the exception of the quasi-commercial FCB, Bhutan lacks any domestic level commercial wholesaling function (only export oriented wholesale markets exist, all on or close to border crossing points into India), commercial storage operations, or refrigerated transport, and the role of the private sector in agricultural output marketing is very limited. Retail agricultural markets do exist, usually in larger centres and along main transport routes, but they are generally supplied by nearby producers and any purchase at such markets for urban resale in small scale, at best. Given the very low cash incomes of most rural households, sale of any but the most basic of foodstuffs (e.g. rice, sugar, tea and cooking oil) in such areas are very small and probably could not justify full-time commercial involvement at present. In Thimphu, Phuentsholing and similar urban centres, much of the agricultural produce on sale is sourced from India, although there are local suppliers in the market in Thimphu.

Contract farming is a relatively new innovation in Bhutan; in part because the agricultural sector was only opened to foreign direct investment in 2009, although direct control of land is not a feature of all contract farming operations. The new Land Act permits leasehold of land by foreign companies for a period of up to 30 years, with the possibility of renewal. No internal or export taxes are levied on agricultural production, all agricultural inputs are free of tax and agricultural income is not subject to income tax.

The first major investment in contract farming in Bhutan has occurred in hazelnut production. The Mountain Hazelnut Venture (MHV) is commencing operations in the east of the country, but plans to expand to central areas over time. The Memorandum of Understanding for the project was signed with RGoB in 2009 and in early 2011 the company was employing 50 staff (due to expand to over 100 by the end of 2011), however extensive use is also being made of MoAF field staff to support operations. No financing or other preferential treatment is being provided by RGoB to the project.

Under the model being developed, the company supplies hazelnut seedlings to contracted growers for planting primarily on degraded, slope or fallow land. MHV guarantees to buy all production from its contractees at a floor price established in consultation with MoAF.

A gross income for farmers of over USD 1 000 per acre is projected once full production is achieved. Eventually, the company anticipates that as many as 15% of all rural households in the country will be involved in hazelnut production.

The current plan is to establish ten million trees over the five years to 2015, using genetic material sourced from MHV facilities in China. The seedlings will all be fast fruiting varieties with first harvest at 3 years and full production by five years of age. Average expected yields are 7-8 kg per tree per annum, although a figure of 5 kg is being used for the financial calculations. The output of the project – estimated at 40 000 MT per annum when all 10 million trees are in full production - will be sold initially to China and later to Europe, but MHV estimates that this will account for only 3% of global trade in hazelnuts. Initial sales will be in shell, requiring only a grading and packing plant in Gelephu, 40 km from the nearest Indian railhead, but a shelling plant is scheduled for development subsequently. Some 25% of project profits will be placed in a trust fund for eastern Bhutan, managed in conjunction with MoAF.

A minimum commitment of 50 trees per contractee is required, based on an estimated planting density of 450-500 trees per acre. Trees will remain the property of MHV and a signed agreement with growers is required. Trees will be coppiced in year seven and are expected to have an economic life of 50 years. No irrigation is required. A penalty of Nu. 50/tree will be levied in case of negligent loss of trees. While distance from the field to the nearest road is a criterion in the selection of farmers, the project is relying heavily on the current rural roads programme of RGoB to ensure access and will establish 100 collection centres throughout eastern Bhutan. Altitude of production is also a criterion, with the project accepting plantings in the range of 1 600-3 000 MASL, although the 1 800-2 800 metre band is preferred. A key production risk anticipated is animal damage to young trees. While problems are anticipated with wild animals (wild boar, deer and monkey), domestic animals are considered an even higher risk. Fencing has been sought by many interested producers but the costs would be too high to justify in most cases.

Contract production at a much smaller scale is also underway through Bio-Bhutan, a company established in 2005 to market lemon grass, using a soft loan from the Swiss development agency Helvetas. The

programme now covers four districts in the east of the country and provides organic certification, but the quantities involved are small, totalling only four MT in the current season. Bio-Bhutan also handles honey, spices and tea, and is trying to enter the marketing of bio-soaps and cordyceps, but in all cases the volume of these products handled is very limited.

Other potential contract farming arrangements are currently under discussion between potential investors and MoAF, including for coffee production, targeting 500-1 000 acres in the south-central region of the country.

# ||||| Agricultural labour markets and migration

A severe shortage of rural labour, arising primarily from out-migration, is often cited as a key underlying constraint to agricultural sector growth. However, reliable data is limited and sometimes appears contradictory.

## Migration

A number of studies and periodic surveys have been carried out which provide some information on migration patterns in Bhutan, including one specifically considering rural-urban migration, conducted by the MoAF in 2004 (MoAF 2006). A National Labour Force Survey (NLFS) is conducted in most years (and is currently available from 2001 to 2010) but provides only limited relevant data.

There is little doubt that rural-urban migration in Bhutan has had a profound impact on society as a whole and on the agricultural sector in particular over the last few decades. In 2004 a reported 72% of the national urban population had been born in rural areas and 47% of rural households reported one or more family members having migrated (MoAF, 2006). Urban population growth averaged 7.3% per annum from 2000-2005 (MWHS, 2008), compared to a national average of 1.3%. Moreover, with nearly 60% of migrants being male (MoAF 2006), the impact of outmigration has been not only to reduce rural populations, but also to distort the gender balance in both urban and rural areas.

The Population and Housing Census of 2005 (PHC 2006) showed that internal migration has overwhelmingly involved a movement of population towards the west and south-west from the eastern part of the country. More than 17% of the total national population had in-migrated to the western region and even after accounting for out-migration, the net gain was almost 10%. Nevertheless, a number of geogs in the west and south-west of the country are among the poorest in the country, suggesting that the east-west pattern of migration will not be evenly spread. Unfortunately, existing migration data is not detailed enough to allow for an analysis of geog by geog movements.

Surprisingly, perhaps, the driving force for rural-urban migration does not appear to have been primarily economic, despite the lower average incomes in rural areas (income data is only collected in bands, so no specific income figures are possible). Almost half (46%) of migrants surveyed moved for educational reasons and all factors related to agriculture together accounted for less than one fifth of the reasons cited for migration (small land holdings were the most important at 7%). The educational levels and subsequent professions of migrants also indicate that they are disproportionately wealthier; only 2% of migrants to urban areas were working as labourers, whereas 31% were employed as civil servants.

By 2010, however, it appears that net rural to urban migration had slowed considerably, amounting to less than 0.5% per annum, with urban-to-rural migration running at almost half of the rate of rural-to-urban. By contrast, rural to rural migration was 0.6%.

The most important perceived negative effect of rural-urban migration has been the reduction in available agricultural manpower, cited by 47% of rural households and 30% of rural (Geog) administrations surveyed. However, urban-rural remittances were seen as having an important offsetting positive effect, with 54% of urban migrants reporting sending a proportion of their income to their rural relatives. Some 59% of Geog administrations also cited urban-rural remittances as the principal positive factor arising from out-migration.

## Bhutan Migration Statistics 2010

Migration direction	Number	%
Rural to rural migration	3,000	0.6
Rural to urban migration	4,100	0.85
Urban to urban migration	7,800	1.6
Urban to rural migration	2,000	0.4

Source: Labour Force Survey Report 2010, Table 21.1.

## Agricultural labour

In part as a result of the relatively high past rates of rural-urban migration, the availability of agricultural labour is widely perceived as one of the most important constraints to the development of the agricultural sector in Bhutan (see above)<sup>8</sup>. Yet the available data does not fully support this view.

While the total economically active population in Bhutan increased by 43%, to 332,000, over the period 2001-2010 (see Attachment 7), the annual NLFS indicates that the agricultural work force has increased much more rapidly – by almost 80% over the same period. By 2010, the agricultural workforce accounted for 51% of the total work force, up from 41% a decade earlier.

The explanation for the seeming contradiction between out-migration and an expanded agricultural work force may lie in an offsetting increase in labour force participation rates in rural areas. While the urban participation rate has remained largely unchanged at 67% over the years 2001-2010, the rural rate has increased from 52% to 69% over the same period. This increased participation has arisen largely from the increase of female participation in rural areas; presumably as a response to the loss of men as a result of migration. While the proportion of the rural male population (over 14 years of age) active in agriculture has risen from 22 to 37%, that of women has jumped from 21 to 65%. This rate is now considerably higher than for female participation in urban areas, where it has declined from 62 to 52% over the same period.

A further potentially important factor in characterizing the status of agricultural labour is proportion of paid employment within the sector. Over the last ten years, the absolute number of paid agricultural employees<sup>9</sup> has increased from 3 368 to 5 000 (see annex 7), but has declined as a proportion of the total agricultural labour force, falling from 3.6 to 2.6%. Furthermore, the number of permanent paid workers has declined both absolutely and relatively, from 2 584 (2.7%) to 2 100 (1.1%). Any shortage of agricultural workers has not, therefore, resulted in significant increases in paid employment within the sector.

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<sup>8</sup> Other major perceived constraints, particularly those relating to wildlife damage to crops, may also indirectly arise from a rural labour shortage.

<sup>9</sup> Including owner/managers, permanent staff, piece workers and paid apprentices.



Why this should be the case is not yet clear. While it is possible that the common perception of an agricultural labour shortage is simply incorrect, a more plausible explanation is that many smallholders simply lack the financial resources to employ workers on more than an occasional or casual basis, or to compete with urban wage rates. The Director General of the Department of Labour estimated that rural wages are higher than urban rates (citing figures of around Nu. 220/day for rural labour when the provision of food and drink are taken into account, compared with rates in the region of Nu. 150-200/day in urban areas). However, no reliable information is available on agricultural wage rates, so it is not possible to determine whether these rates have maintained their relationship with urban wages over this period<sup>10</sup>.

Additionally, if the increased labour force participation of women has occurred as a response to the out-migration of men, women may not be available for more than occasional paid employment due to responsibilities on their home landholding. This supposition appears to be supported by the available data: female employment has increased substantially, more than tripling over the period 2001 to 2010, while male employment has remained almost unchanged. However, permanent female employment has increased by only 31%, while female casual labour has risen by nearly 1,000% (from 136 to 1,400 persons)

A further factor often affected by rural out-migration is that of the age distribution of the working population remaining in the agricultural sector. This appears to have occurred in the case of Bhutan. As shown in annex 7, only 2.2% of those engaged in agriculture in 2001 were over 60 years of age, in contrast to a national average of 4.9%. By 2010, while the proportion of the population over 60 had increased to 9.2%, the proportion among the agricultural workforce had climbed to almost 11%.

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<sup>10</sup> By contrast, minimum wage rates in West Bengal are estimated at R.60-65/day. It is estimated that there are 37,000 foreign workers in Bhutan (mostly unskilled or semi-skilled Indian staff), primarily engaged in construction and road building where rates are estimated at Nu. 150/day. Foreign labour is not permitted in agriculture, although it is said to occur in the southern areas of Bhutan.

It should also be noted that a number of the production technologies and cropping patterns which are being promoted by MoAF in order to increase productivity and incomes in rural areas may exacerbate labour problems. The System of Rice Intensification (SRI) which is starting to be adopted in some areas of Bhutan can significantly increase yields but requires a higher level of labour input, in particular for transplanting. Similarly, the continuing expansion of horticultural production results in a similar higher income/greater labour trade-off. While the increased use of mechanization (also supported by MoAF) may alleviate this constraint<sup>11</sup>, mechanization will not only require access to capital to cover purchase costs, but also the availability of cash for fuel, maintenance and other operating costs. This may present a serious constraint for many smallholder producers who currently earn little cash income.

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<sup>11</sup> Studies undertaken in Bhutan have indicated a potential reduction in labour for rice from 90 days/acre to 20 days/acre if a power tiller with complete set of tools is used.

## ||||| Conclusions and recommendations

The effective development of both the rural labour supply and agricultural marketing systems in Bhutan are closely interrelated, and both in turn are linked to the expansion of rural infrastructure and services. While there are clear indications that market-based production is increasing in importance in Bhutan, particularly in vegetables and dairy, available evidence suggests that only a very small percentage of producers have yet made the transition.

Agricultural market development is currently constrained by several key factors:

- The predominance of a subsistence mode of production for many crops in Bhutan results in only limited quantities of product reaching the market, and a consequent lack of cash income for use by smallholders to purchase inputs such as seed, labour, fuel and fertilizers;
- The dispersed nature of production, coupled with a lack of an accessible road network in many regions, renders collection of agricultural output difficult and expensive, raising costs and deterring participants from developing necessary market support infrastructure (e.g. storage, grading and packaging lines, refrigerated transport); and
- The absence of an existing marketing system for all but some fruits and vegetables produced near main roads discourages producers from using scarce resources to target cash crop production.

Rural labour faces a similar set of circular constraints, arising from the absence of available markets in which to sell output and the extremely low cash income earnings of farmers. Although interviews with producers and agricultural officers in several rural areas clearly indicated that there is a widespread perception of rural labour shortages, it is considered likely that few opportunities have existed in the past for paid employment beyond occasional short term labour during peak demand periods (e.g. land preparation,

harvest). However, it appears likely rural labour supplies have also been strongly affected by the out-migration of wealthier and better-educated members of rural society seeking improved access to services generally available only in towns and cities, especially education. This exodus may not only have led many of these families to give lower priority to the economic development of their holdings, but has also left rural women to bear the responsibility of managing the land holding, reducing their ability to seek outside employment.

Several potential routes exist under which these constraints could be tackled, but it should be stressed that the very limited knowledge currently available on issues such as rural wage rates, reasons for seeking or not seeking paid employment, sources and destinations of rural migration on a geog-by-geog basis and the real availability of rural labour, all render any proposed solutions necessarily tentative in nature. The Planning and Policy Development Division of MoAF is currently in discussions with the International Fund for Agricultural Development (IFAD) concerning the financing of a new rural-urban migration study which could resolve some of these uncertainties. It is strongly suggested that, should these discussions be fruitful, the opportunity offered by the presence of rural survey teams collecting data on migration should be taken advantage of to also verify existing assumptions on rural labour.

Given that resources available are limited, it is considered essential that priority be given to those actions and areas best able to generate short term results. Should the assumptions contained in this document be supported by additional field information, it is recommended that the following priorities be considered:

- Given the limited amount of paid rural employment now evident, greater on-farm cash incomes can be expected to lead to higher rates of rural employment. Thus, limitations on rural employment are seen as likely to be a symptom, rather than a cause, of limited market development and would best be addressed indirectly, through market related initiatives;
- A focus on initially expanding market-oriented production in areas which are easily accessible by road and within less than one day's transport from major markets (either export auction sites or major urban centres) would appear to offer the best opportunity for growth. Farmers in these areas will have the

greatest incentives to seek cash income from product sales, will have better access to inputs and will, in addition, be the easiest for MoAF field staff and private sector traders to reach;

- In light of the importance of road access for market development (already fully recognized by MoAF), a stronger and more explicit linkage of road construction priorities to production areas which are most likely to benefit would appear beneficial. In these areas, relatively short lengths of access roads could open up significant production potential. This may mean giving lower priority, at least initially, to road construction in the more remote areas of the country and focusing on 'market corridors' which can provide the impetus for market development;
- The role of an expanded private sector presence in agricultural marketing is seen as critical; possibly through decoupling the social mandate of FCB from its commercial trading activities, as well as through the promotion of market infrastructure development in promising areas using mechanisms such as concessionary investment financing and increased technical support to marketing companies. The success of the OSS should be closely monitored;
- The use of agricultural associations and cooperatives to generate economies of scale in purchasing and sale of inputs and outputs is seen as beneficial, as long as priority is given to those areas with the greatest potential and DAMC is provided with enough resources to undertake the task successfully;
- Contract-based farming, where feasible, provides a vertical integration mechanism which may prove to be of considerable importance in Bhutan, given the current lack of many elements related to the agricultural marketing system. For contract farming to be mutually beneficial to investors and producers, however, the focus on ensuring that small producers are protected from exploitation and the avoidance of financial incentives and legislative protection to potential entrants will be important.



# ANNEX 1

## Bhutan - Agricultural trade with India, 2004

Exchange rate - Nu/USD (mid-2009): 45.94

SITC Chapter(s)	Import Category/Item	Value		Value	
		(Nu000)	(USD000)	(Nu000)	(USD000)
<b>Ch. 1-5</b>	<b>Animal products</b>			<b>460,502</b>	<b>10,024.0</b>
	Dairy products	236,863	5,155.9		
	Birds eggs	66,699	1,451.9		
	Meat & offal	68,527	1,491.7		
	Fish, crustaceans & seafood	50,976	1,109.6		
<b>Ch. 6-7</b>	<b>Vegetable products</b>			<b>645,944</b>	<b>14,060.6</b>
	Potatoes	9,878	215.0		
	Tomatoes	9,007	196.1		
	Onions	13,167	286.6		
	Chillies, fresh	9,966	216.9		
	Lentils	17,761	386.6		
	Other vegetables	21,103	459.4		
<b>Ch. 8-9</b>	<b>Fruits, nuts, tea &amp; spices</b>			<b>50,629</b>	<b>1,102.1</b>
	Betel nuts	5,486	119.4		
	Pineapple	3,895	84.8		
	Mango	4,863	105.9		
	Tea	16,866	367.1		
	Chillies, dried & ground	7,900	172.0		
<b>Ch. 10-11</b>	<b>Cereals &amp; milled products</b>			<b>495,808</b>	<b>10,792.5</b>
	Rice <sup>1</sup>	309,315	6,733.0		
	Wheat	134,377	2,925.1		
	Milled products (malt, starches, gluten etc.)	33,836	736.5		
<b>Ch. 12-14</b>	<b>Oil seeds, seeds &amp; materials</b>			<b>18,349</b>	<b>399.4</b>
	Mustard seed	1,992	43.4		
	Betel leaves	3,159	68.8		
	Sugar beet	4,968	108.1		
	Bamboo	4,338	94.4		

— Export Category/Item	Value		Value	
	(Nu000)	(USD000)	(Nu000)	(USD000)
			103	2.2
			286,413	6,234.5
Potatoes	113,136	2,462.7		
			78,925	1,718.0
Oranges (mandarin)	12,852	279.8		
Apples	8,667	188.7		
Cardamom	46,614	1,014.7		
Ginger	7,805	169.9		
			78,892	1,717.3
Milled products (wheat and maize)	78,655	1,712.1		
			6,298	137.1

SITC Chapter(s)	Import Category/Item	Value		Value	
		(Nu000)	(USD000)	(Nu000)	(USD000)
<b>Ch. 15</b>	<b>Animal &amp; vegetable fats, oils</b>			<b>165,280</b>	<b>3,597.7</b>
	Soya bean oil	37,105	807.7		
	Mustard oil	58,916	1,282.5		
<b>Ch. 16-19</b>	<b>Prepared foodstuffs</b>			<b>258,427</b>	<b>5,625.3</b>
	Prepared foodstuffs	4,111	89.5		
	Sugar	112,864	2,456.8		
	Chewing gum & sugar confectionary	52,598	1,144.9		
	Preparations of cereals	88,431	1,924.9		
<b>Ch.20</b>	<b>Preparations of fruits, nuts etc.</b>			<b>34,559</b>	<b>752.3</b>
	Potatoes	5,589	121.7		
	Mango juice	20,046	436.4		
<b>Ch.21-22</b>	<b>Beverages, spirits, vinegar &amp; sauces</b>			<b>310,704</b>	<b>6,763.3</b>
	Sauces	10,260	223.3		
	Malt beer	240,726	5,240.0		
	Ethyl alcohol	42,945	934.8		
<b>Ch. 23</b>	<b>Other</b>			<b>20,765</b>	<b>452.0</b>
	Oil cake	11,488	250.1		
	<b>Total agricultural imports from India</b>			<b>1,871,866</b>	<b>40,745.9</b>
	Total all imports from India			10,193,900	221,896.0
<b>Earlier Yrs:</b>	All Imports (2003)			10,228,520	222,649.5
	All Imports (2002)			7,573,570	164,857.9
	All Imports (2001)			6,988,780	152,128.4

1/ Rice was 6th biggest import item in 2004 by value

2/ India accounted for 55% of all imports and 94% of exports by value in 2004



Export Category/Item	Value		Value	
	(Nu000)	(USD000)	(Nu000)	(USD000)
			33	0.7
			495	10.8
			99,949	2,175.6
			295,103	6,423.7
			12,250	266.7
<b>Total agricultural exports to India</b>			<b>694,346</b>	<b>15,114.2</b>
Total all exports to India			7,761,560	168,949.9
All Exports (2003)			3,322,400	72,320.4
All Exports (2002)			2,789,640	60,723.6
All Exports (2001)			4,700,470	102,317.6



## ANNEX 2

### Bhutan - Agricultural trade with countries other than India, 2004

Exchange rate - Nu/USD (mid-2009): 45.94

Country	Import Items over Nu. 0.5m	Value	
		(Nu000)	(USD000)
Australia	Distilled grape spirits	2,195	47.8
Bangladesh	Garlic, fresh or chilled	1,770	38.5
	Soyabean oil	89,201	1,941.7
	Palm oil	1,700	37.0
	Mustard oil	17,786	387.2
	Other mustard, rape & colza oil	2,240	48.8
	Vegetable fats & oils	12,194	265.4
	Baked goods	20,127	438.1
Denmark	Dried peas	5,526	120.3
	Durum wheat	6,218	135.4
	Sausages & preserved meats	1,111	24.2
	Distilled grape spirits	6,456	140.5
Germany	Dried chickpeas	1,726	37.6
	Vegetable fats & oils	6,770	147.4
Japan			
Malaysia	Palm oil	1,590	34.6
	Other mustard, rape & colza oil	564	12.3
	Vegetable fats & oils	9,964	216.9
	Sweet biscuits	4,846	105.5
Nepal	Pasta	32,007	696.7
	Baked goods	965	21.0
Norway	Prepared or preserved fish	55,317	1,204.1
Philippines	Malt beer	822	17.9



Country	Import Items over Nu. 0.5m	Value		
		(Nu000)	(USD000)	
Singapore	Soyabean oil	1,059	23.1	
	Palm oil	1,134	24.7	
	Pasta	2,651	57.7	
	Malt beer	5,565	121.1	
Taiwan	Malt beer	513	11.2	
Thailand	Rice	701	15.3	
	Prepared or preserved fish	435	9.5	
	Pasta	733	16.0	
	Bread, pastry and baked goods	1,122	24.4	
	Jam & jellies	357	7.8	
	Fruit juices	392	8.5	
	Non-alcoholic beverage	296	6.4	
	UK	Liquor	6,650	144.8
USA	Lentils	2,627	57.2	
	Rice	8,063	175.5	
	Corn starch	1,215	26.4	
327,080	Soya bean flour	4,025	87.6	
	Other mustard, rape & colza oil	2,839	61.8	
	Breakfast cereals and other prepared grains	5,608	122.1	
	TOTAL AGRIC IMPORTS	332,994	7,248.5	
	TOTAL ALL IMPORTS	8,445,590	183,839.6	
	Earlier Years:	All Imports (2003)	1,338,400	29,133.7
		All Imports (2002)	2,472,570	53,821.7
All Imports (2001)		2,001,420	43,566.0	

1/ Oranges were 10th biggest export item in 2004 by value

Export Items over Nu. 0.5m	Value	
	(Nu000)	(USD000)
Mushrooms	357	7.8
Mushrooms, fresh	19	0.4
Mushrooms, pickled	981	21.4
Medicinal/pharmacy plants	140	3.0
Lemon grass	2,470	53.8
Rice	4,682	101.9
TOTAL AGRIC EXPORTS	308,340	6,711.8
TOTAL ALL EXPORTS	509,590	11,092.5
All Exports (2003)	264,230	5,751.6
All Exports (2002)	341,540	7,434.5
All Exports (2001)	294,280	6,405.7



# ANNEX 3

## Bhutan - Agricultural trade with India, 2009

Exchange rate - Nu/USD (mid-2009): 48.37

SITC Category	Import Category/Item	Value		Value	
		(Nu000)	(USD000)	(Nu000)	(USD000)
<b>Ch. 1-5</b>	<b>Animal products</b>			<b>984,932</b>	<b>20,362.5</b>
	Dairy products	465,769	9,629.3		
	Birds eggs	34,135	705.7		
	Meat & offal	367,501	7,597.7		
	Fish, crustaceans & seafood	114,593	2,369.1		
<b>Ch. 6-7</b>	<b>Vegetable products</b>			<b>180,365</b>	<b>3,728.9</b>
	Potatoes	23,405	483.9		
	Tomatoes	19,580	404.8		
	Onions	27,853	575.8		
	Lettuce	7,177	148.4		
	Chilli, fresh	17,541	362.6		
	Lentils	49,606	1,025.6		
	Other vegetables	35,203	727.8		
<b>Ch. 8-9</b>	<b>Fruits, nuts, tea &amp; spices</b>			<b>98,388</b>	<b>2,034.1</b>
	Betel nuts	13,784	285.0		
	Pineapple	3,650	75.5		
	Mango	9,232	190.9		
	Tea	32,838	678.9		
	Chilli, dried & ground	15,230	314.9		
<b>Ch. 10-11</b>	<b>Cereals &amp; milled products</b>			<b>964,077</b>	<b>19,931.3</b>
	Rice <sup>1</sup>	721,658	14,919.5		
	Wheat	52,581	1,087.1		
	Maize (grains and other)	41,925	866.8		
	Milled products (malt, starches, gluten etc.)	99,015	2,047.0		
<b>Ch. 12-14</b>	<b>Oil seeds, seeds &amp; materials</b>			<b>86,958</b>	<b>1,797.8</b>
	Mustard seed	1,861	38.5		
	Soya bean flour	16,887	349.1		

Export Category/Item	Value		Value	
	(Nu000)	(USD000)	(Nu000)	(USD000)
			4,928	101.9
			412,225	8,522.3
Potatoes	401,880	8,308.5		
Lettuce	3,436	71.0		
			170,097	3,516.6
Betel nuts	10,708	221.4		
Oranges (mandarin)	34,629	715.9		
Apples	61,130	1,263.8		
Cardamom	40,535	838.0		
Ginger	22,428	463.7		
			22,918	473.8
Milled products (wheat, maize)	22,175	458.4		
			1,503	31.1

SITC Category	Import Category/Item	Value		Value	
		(Nu000)	(USD000)	(Nu000)	(USD000)
	Betel leaves	13,089	270.6		
	Bamboo	46,379	958.8		
<b>Ch. 15</b>	<b>Animal &amp; vegetable fats, oils</b>			<b>407,708</b>	<b>8,428.9</b>
	Soya bean oil	239,825	4,958.1		
	Mustard oil	64,506	1,333.6		
<b>Ch. 16-19</b>	<b>Prepared foodstuffs</b>			<b>529,532</b>	<b>10,947.5</b>
	Prepared foodstuffs	2,673	55.3		
	Sugar	169,864	3,511.8		
	Chewing gum & sugar confectionary	82,164	1,698.7		
	Preparations of cereals	273,754	5,659.6		
<b>Ch.20</b>	<b>Preparations of fruits, nuts etc.</b>			<b>Nd</b>	
	Potatoes	19,667	406.6		
	Mango juice	nd			
<b>Ch.21-22</b>	<b>Beverages, spirits, vinegar &amp; sauces</b>			<b>360,996</b>	<b>7,463.2</b>
	Sauces	nd			
	Malt beer	233,066	4,818.4		
	Ethyl alcohol	65,702	1,358.3		
<b>Ch. 23</b>	<b>Other</b>			<b>39,549</b>	<b>817.6</b>
	Oil cake	17,594	363.7		
	Other feed	8,622	178.3		
	<b>TOTAL AGRICULTURAL IMPORTS</b>			<b>3,692,783</b>	<b>76,344.5</b>
	<b>TOTAL ALL IMPORTS</b>			<b>19,840,756</b>	<b>410,187.2</b>

1/ Rice was 4th biggest import item in 2009 by value

2/ India accounted for 55% of all imports and 94% of exports by value in 2004



Export Category/Item	Value		Value	
	(Nu000)	(USD000)	(Nu000)	(USD000)
			3,922	81.1
			14	0.3
			139,261	2,879.1
Citrus puree, jam	4,192	86.7		
Fruit juices	134,195	2,774.3		
			173,669	3,590.4
Water	118,906	2,458.3		
Malt beer	44,157	912.9		
Liquor (whisky, rum etc.)	9,986	206.5		
			5,296	109.5
TOTAL AGRICULTURAL EXPORTS			933,833	19,306.0
TOTAL ALL EXPORTS			5,682,166	117,472.9

1/ Potatoes were the 9th biggest export item in 2009 by value (excluding electricity)

2/ Oranges were the 10th biggest export item in 2009 by value (excl electricity)



## ANNEX 4

### Bhutan - Agricultural trade with countries other than India, 2009

Exchange rate - Nu/USD (mid-2009): 48.37

Country	Import Items over Nu. 0.5m	Value	
		(Nu000)	(USD000)
Australia	Pineapples	3,352	69.3
	Distilled grape spirits	2,610	54.0
Bangladesh	Fruit juices	42,070	869.8
	Baked goods	12,453	257.5
Belgium			
Canada	Dried Peas	1,648	34.1
China			
Denmark	Ethyl alcohol, nes	6,698	138.5
	Distilled grape spirits	4,356	90.1
Hong Kong			
Japan			
Malaysia	Palm oil	5,323	110.0
	Baked goods	7,849	162.3
Nepal	Birds' eggs	2,750	56.9
	Pasta	13,709	283.4
	Baked goods	1,303	26.9
Netherlands	Ethyl alcohol, incl. spirits & liquors	10,924	225.8
New Zealand	Live poultry	1,373	28.4
Singapore	Pasta	10,795	223.2
	Malt beer	4,858	100.4
	Ethyl alcohol and wines	7,145	147.7

Export Items over Nu. 0.5m	Value	
	(Nu000)	(USD000)
Rice	988	20.4
Oranges (mandarin)/1	352,182	7,281.0
Fruit juices	4,328	89.5
Apples	32,722	676.5
Cardamom	50,000	1,033.7
Lemon grass	2,031	42.0
Cordyceps sinensis <sup>2</sup>	1,507	31.2
Cordyceps sinensis	58,298	1,205.3
Mushrooms, fresh	2,637	54.5
Cordyceps sinensis	2,002	41.4
Cordyceps sinensis	2,206	45.6
Water	2,646	54.7
Cordyceps sinensis	8,055	166.5
Wheat flour and meal	519	10.7

Country	Import Items over Nu. 0.5m	Value	
		(Nu000)	(USD000)
South Korea			
Switzerland	Plant seeds	556	11.5
Thailand	Prepared or frozen fish	1,217	25.2
	Chocolate or cocoa	934	19.3
	Pasta	753	15.6
	Baked goods	1,763	36.4
	Vegetables, fruits nuts pres. in sugar	506	10.5
	Fruit juices	2,582	53.4
	Non-dairy milk powder	995	20.6
	Sparkling wine & vermouth	2,981	61.6
United Arab Emirates	Wine and ethyl alcohol	2,353	48.6
UK	Liquor	7,328	151.5
USA	Liquor	1,013	20.9
	TOTAL AGRICULTURAL IMPORTS	170,681	3,528.7
	TOTAL ALL IMPORTS	5,682,166	117,472.9

1/ Oranges were the 10th most important export by value in 2009

2/ Total cordyceps exports (other than India) Nu. 74,448,000 (USD 1.54m)

Export Items over Nu. 0.5m	Value	
	(Nu000)	(USD000)
Mushrooms, fresh	1,013	20.9
Cordyceps sinensis	1,931	39.9
Rice, red	7,109	147.0
Lemon grass	609	12.6
TOTAL AGRIC EXPORTS	535,707	11,075.2
TOTAL ALL EXPORTS	1,558,355	32,217.4



## ANNEX 5

### Bhutan - Agricultural trade with countries other than India, 2009 (summary)

Exchange rate - Nu/USD (mid-2009): 48.37

#### Imports

	Sitc chapter(s)	Nu. 000	Usd 000
Ch. 1-5	Animal products	7,832	161.9
Ch. 6-7	Vegetable products	2,050	42.4
Ch. 8-9	Fruits, nuts, tea & spices	1,430	29.6
Ch. 10-11	Cereals & milled products	973	20.1
Ch. 12-14	Oil seeds, seeds & materials	784	16.2
Ch. 15	Animal & vegetable fats, oils	6,351	131.3
Ch. 16-19	Prepared foodstuffs	51,241	1,059.4
Ch.20	Preparations of fruits, nuts etc.	49,120	1,015.5
Ch.21-22	Beverages, spirits, vinegar & sauces	50,842	1,051.1
Ch. 23	Other	58	1.2
	Total	170,681	3,528.7

Exports

Sitc chapter(s)	Nu. 000	Usd 000
Animal products	5,125	106.0
Vegetable products	78,170	1,616.1
Fruits, nuts, tea & spices	433,973	8,971.9
Cereals & milled products	8,616	178.1
Oil seeds, seeds & materials	2,737	56.6
Animal & vegetable fats, oils	-	-
Prepared foodstuffs	-	-
Preparations of fruits, nuts etc.	4,359	90.1
Beverages, spirits, vinegar & sauces	2,727	56.4
Other	-	-
Total	535,707	11,075.2

## ANNEX 6

### Bhutan - Changes in trade and unit prices, 2004-2009 Adjusted for consumer price inflation

	Current Value (Nu 000)		Change
	2004	2009	
Total Exports (excl electricity)	8,271,150	13,902,020	68%
Total Imports	18,639,486	25,522,922	37%
Exports (Non-India)	509,590	1,558,355	206%
Imports (Non-India)	8,445,590	5,682,166	-33%
Total Agricultural Exports	1,002,686	1,469,540	47%
Total Agricultural Imports	2,204,860	3,863,464	75%
Agricultural Exports (Non-India)	308,340	535,707	74%
Agricultural Imports (Non-India)	332,994	170,681	-49%
<b>Selected Key Imports</b>			
Dairy Products	236,863	465,769	97%
Soyabean oil	127,365	239,825	88%
Rice	317,378	721,658	127%
Wheat Flour	140,595	52,581	-63%
Cane Sugar	112,864	169,864	51%
<b>Selected Key Exports</b>			
Potato	113,136	401,880	255%
Orange (mandarin)	220,039	386,811	76%
Apple	43,528	93,852	116%
Cardamom	88,175	90,535	3%
Fruit juice	6,007	138,523	2206%
Cordyce sinensis	-	74,448	

1/ Consumer Price Index (CPI) used for 3rd quarter in the relevant year with 3rd Qtr.2003 = 100  
 Total CPI (used for all imports and exports and price deflation): 2004 -104.55; 2009 - 138.67  
 Food CPI (used for agricultural imports and exports): 2004 - 102.85; 2009 - 154.21

2/ Import and export prices for Indian trade



Value Deflated by CPI <sup>1</sup>		Change	Unit Prices/Kg <sup>2</sup>		Price Deflated by CPI <sup>1</sup>		Change
2004	2009		2004	2009	2004	2009	
7,911,191	10,025,254	27%					
17,828,298	18,405,511	3%					
487,413	1,123,787	131%					
8,078,039	4,097,617	-49%					
974,901	952,947	-2%					
2,143,763	2,505,327	17%					
299,796	347,388	16%					
323,767	110,681	-66%					
230,299	302,036	31%	165.1	126.5	160.5	123.0	-23%
123,836	155,518	26%	45.8	48.9	44.5	47.5	7%
308,583	467,971	52%	311.0	13.5	302.4	13.1	-96%
136,699	34,097	-75%	293.0	13.6	284.9	13.2	-95%
109,737	110,151	0%	128.6	21.5	125.0	20.9	-83%
110,000.97	260,605.67	137%	6.4	16.4	6.2	15.9	156%
213,941.66	250,833.93	17%	6.5	9.8	6.3	9.5	51%
42,321.83	60,859.87	44%	8.2	10.5	8.0	10.2	28%
85,731.65	58,708.90	-32%	117.1	184.3	113.9	179.2	57%
5,840.54	89,827.51	1438%	25.3	5.5	24.6	5.3	-78%
-	48,277.02						



## ANNEX 7

### Adjusted price of major agricultural commodities in Bhutan

Commodity	2003		2008		Change	
	Nom Price	Adj Price <sup>1</sup>	Nom Price	Adj Price	Nom Price	Adj Price
Wheat	9.0	9.0	12.8	9.1	42.2%	1.3%
Rice	20.8	20.8	35.4	25.2	70.2%	21.2%
Maize	9.3	9.3	10.3	7.3	10.8%	-21.1%
Potato	8.8	8.8	11.6	8.3	31.8%	-6.1%
Vegetables	23.9	23.9	31.0	22.1	29.7%	-7.6%
Apples	45.4	45.4	49.7	35.4	9.5%	-22.0%
Oranges	35.8	35.8	26.3	18.7	-26.5%	-47.7%

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# Working paper 2

Research, extension and input supply systems

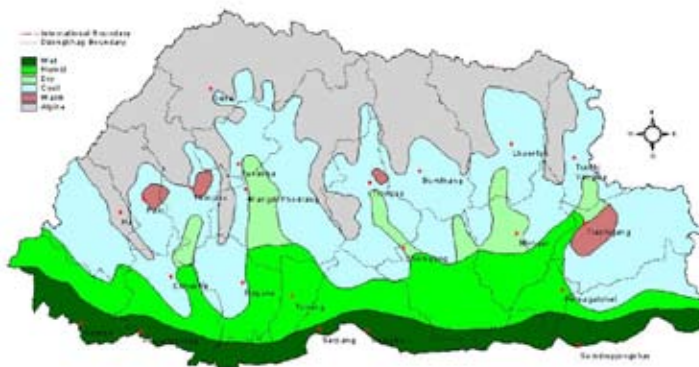
## Research

### Background and set-up

The RNR Research system of the Ministry of Agriculture and Forestry (MoAF, see Annex 1) has a considerable network and infrastructure in place that is tuned to the agro-ecological diversities of Bhutan (see Figure 1). Its mission is to generate appropriate and innovative technologies for increasing productivity and profitability contributing to the enhancement of food security and rural income through sustainable use of RNR.

The current organizational structure includes a coordinating Council for RNR Research of Bhutan (CoRRB) in Thimphu's MoAF headquarters organized around three divisions: Research (Field Crops, Horticulture, Livestock, and Forest), Research Communication (Extension Support, Technology Packaging, Information Communication, School Agriculture) and Farming Systems (Climate Change and Agro-meteorology, Water and Soil Management, Socio Economics).

**Figure 1. Agro-ecological zones of Buthan**



Source: MoAF/ISNAR, 1992

There are four regional research centres (RCs) each with a core national and regional farming systems-related mandate and sub-centre implement research activities (see also Figure 2):

Yusipang RC, located in Thimpu district and covering the five western Dzongkhags (Thimpu, Paro, Ha, Samtse, Chukha); the national mandate is for forest research including a regional mandate for horticulture, livestock and field crops. A research sub-station is located in Darla, Chukha. Yusipang operates under the Department of Forest and Park Services of MoAF.

Bajo RC, located at Wanguphodarang (Wangdue), covering the five western central Dzongkhags (Wangdue, Gasa, Punaka, Daga Tsirang). Its national mandate is for field crops research, and the regional mandate is for forest, livestock and horticulture. A Research sub-station is located in Mithun, Tsirang. Bajo operates under the Department of Agriculture of MoAF.

Jakar RC, located in Bumthang covers four east-central Dzongkhags (Trongsa, Bumthang, Zhemang, Sarpang). Livestock is the national research mandate while it regionally caters for field crops, horticulture and forest. A research sub-station is located in Bhur, Sarpang. Jakar operates under the Department of Livestock of MoAF.

**Figure 2. Land cover map of Bhutan**



Wengkhar RC, located in Mongar, covers six eastern Dzongkhags (Mongar, Lhuentse, Trashi Yangtse, Trashingang, Pemagatshel, Sandrup Jonkar). Its national mandate is for horticulture research and its regional research mandate is for livestock, forest and field crops. There are two research sub-stations located in Lingmithang, Mongar and in Khangma, Trashingang. Wengkhar operates under the Department of Agriculture of MoAF.

As of 2010, total staff includes 368 persons (Council and the 4 RCs). Actual research and technical work is carried out by 29 staff with M.Sc. and above degree; 30 with B.Sc. degree, and 62 with Diplomas. Estimated requirements in terms of additional researchers and scientists for activities to be carried out during the 10th five-year plan (FYP) amount to 180 persons.

According to the 10th FYP (see Annex 1), out of a total of Nu. 761.8 million<sup>1</sup> and including Nu. 541.4 million for recurrent expenditures, the budget made available for capital cost expenditures to the research system over the 2008-2013 period amounts to Nu. 219.85 (or about 6% of overall capital expenditures for the 29 MoAF programmes under the 10th FYP) as shown in the table below.

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1 Nu.: Ngultrum; currency unit of Bhutan. In January 2011, USD 1 = 44.7 Nu.

**Table 1. MoAF 10th FYP Programme # 25: RNR Research**

Commodity	2004		2009		% Change
	Value (US\$'000)	% India	Value (US\$'000)	% India	2004-2009 (US\$'000)
<b>EXPORTS</b>					
Oranges	4,789.7	5.8%	7,996.9	9.0%	67.0%
Potatoes	2,462.7	100.0%	8,308.5	100.0%	237.4%
Apples	947.5	19.9%	1,940.3	65.1%	104.8%
Cardamom	1,919.4	52.9%	1,871.7	44.8%	-2.5%
Ginger	169.9	100.0%	463.7	100.0%	172.9%
Areca Nuts	n.a.	n.a.	221.4	100.0%	n.a.
Cordyceps	n.a.	n.a.	1,529.9	0.0%	n.a.
Total Ag. Exports	21,826.0	69.2%	30,381.2	63.5%	39.2%
Main 5 commodities <sup>a/</sup> as % Ag. Exports	47.1%		67.7%		
Ag. Exports as % Total Exports	12.1%		20.3%		
<b>IMPORTS</b>					
Cereal products	10,792.5	100.0%	19,351.4	99.9%	79.3%
Rice	6,923.8	97.2%	14,919.5	100.0%	115.5%
Wheat	3,060.5	95.6%	1,087.1	100.0%	-64.5%
Maize	0		866.8	100.0%	n.a.
Animal products	10,024.0	100.0%	20,524.4	99.2%	104.8%
Dairy	5,155.9	100.0%	9,649.9	99.8%	87.2%
Eggs	1,451.9	100.0%	762.6	92.5%	-47.5%
Meat	1,491.7	100.0%	7,559.7	100.0%	409.5%
Processed Food	6,910.8	81.4%	12,006.9	91.2%	73.7%
Total ag imports	47,994.4	84.9%	79,873.2	95,6%	66.4%
Main 5 commodities <sup>b/</sup> as % ag imports	37.7%		42.6%		
Ag imports as % total imports	11.8%		15.1%		

a/ Potatoes, Oranges, Apples, Cardamom, Ginger.

b/ Rice, Wheat, Dairy products, Eggs, Meat.

Source: Bhutan Trade Statistics 2004 and 2009. Department of Revenue and Custom. Ministry of Finance.



With regard to research agenda formation, the current system foresees:

- National Research Coordination and Extension Meetings (under CoRRB coordination) that are sector specific (Forestry/Agriculture/Livestock) to annually finalize priorities and set the research agenda and implementation planning. Such meetings last three days and bring together the main stakeholders (30-40) of the sector (departmental; programmes; national centres; non-MoAF stakeholders). Staff from a selected number of Dzongkhags participate (generally those that are within the regional mandate of the given RC).
- Regional Review and Planning Meetings (under RCs and thus respective Department coordination) to be held before the National Meetings, with an annual schedule. Therein all different sectoral and district-specific research needs are discussed and prioritized. All relative districts participate together with departmental representations (programmes, centres, etc.).

## Major achievements

According to CoRRB publications, the major research system achievements (during 9th FYP) include:

### Forestry

Forest fire risk mapping; sustainable management and conservation of *Cordyceps sinensis*; study of the gradational forest change; study on shifting cultivation (Tseri).

### Field crops

Impact assessment of maize and rice research (showing that modern varieties are grown respectively over 50% and 35% of the total area); 30 improved RNR technologies packaged and distributed.

### Livestock

Reporting on domestic animal genetic resources; milk protein analyses quantifying influence of the Mithun cattle breed; alternative pasture mixtures; suitable tree and fodder legumes; fodder seed production technology and eight sub-tropical and five temperate grass species released.

## Horticulture

Established several fruit cultivars; released several vegetables varieties; established demonstration orchards.

Overall, 15 Rice, 3 Maize, 3 Wheat, 6 Mustard, and 3 Soybean varieties have been released; 9 Apple, 4 Potato, 16 different Fruits and 73 assorted vegetables varieties have also been released. Forest area achievements have included main conifer species characterisation and silviculture; lemon-grass/bamboo/ and cattle grazing systems within a forestry area socio-economic production framework and their impact; important non-wood forestry products (NWFP) resource identification and assessment. Livestock key achievements include: 21 fodder varieties released and animal genetic resources studies. Twenty-nine varieties (field crops and vegetables) have been in the meantime denotified by the Variety Release Committee.

In addition, the School Agriculture programme has attempted to expand the integrated agriculture concept in 125 schools of Bhutan and developed basic infrastructure (for dairy, piggery and poultry animals) in 88 schools; enhanced teachers' technical capacity; developed technical guide books; and incorporated farming in school curricula. Technical skills of extension agents (EAs) have been enhanced around orchard management, temperate fruit crop management, Nursery production, and vegetable and citrus production technology. Five hundred and fifty farmers have received special training through study tours and field days.

CoRRB had an Agromet Office that has collected, inputted in electronic format and analysed weather and climate data on a daily basis for dissemination to end users. The network is made of 84 stations located in the 20 Dzongkhags, which collect temperature, humidity, rainfall, wind speed and direction, sunshine, and evaporation data. Not all stations collect all types of data but temperature, rainfall and humidity are available in all stations. The historical series available is from 1994 to 2009. This function has been recently moved to the Energy Department of the Ministry of Economic Affairs.

As a result of the 10th FYP mid-term report (MTR) process, the RNR research programme (#25) is now realigned around three major outcomes (and five related outputs):

**Outcome 1:** Improved varieties for cereal crops, cash crops and fodder developed to enhance food security and cash income.

**Outcome 2:** Sustainable management practices and technologies developed to enhance productivity.

**Outcome 3:** Enhanced access to RNR information to improve agriculture production and service delivery.

However, in practice and because of resource limitations, the RCs have indicated their intention to mostly concentrate research focus on: forestry (silviculture, broadleaf species monitoring), livestock (productivity; feeding; health; and yak herding), field crops (varietal selection for productivity and resistance/tolerance to different stresses); horticulture (varietal selection of temperate fruit/apples, and subtropical fruit/citrus; pest/disease resistance potato/chilli varieties), and sustainable management practices (silvicultural conifer practices; organic farming; SRI technology).

## A long and incomplete reform process

Agricultural research in Bhutan started in the mid-sixties with the support of the Government of India. In 1991, the International Service for National Agricultural Research (ISNAR) undertook a major review of the research system in the country. Eventually, the agricultural research system was organized under a specific Department of Research and Development Services of the MoAF, and four research centres at four different regions of the country were created. However, an MTR of the 8th FYP, the system's shortcomings were identified as due to a lack of a development focus. In 2003 the CoRRB was created. It was meant to act as a coordinating and supporting body of agricultural research and extension activities to satisfy the technological needs of the farming population. The other Departments of MoAF continued to perceive disconnect between their respective development mandates and the work being carried out by the research system, and in particular of the RCs at regional level. In addition, the technology transfer function of the RCs was considered to be ineffective, and research outputs as unresponsive to the actual needs of the farming community.

Starting in December 2009, an institutional realignment was proposed (HRD/MoAF/SEC/1/3195) with a view to include a 'development' mandate to the RCs. A decision was also taken to attach the "Development" denomination to that of "Research" to the RCs, which were from thereon thus to be called "RDCs". A series of regional workshops was held during 2010 to define the two mandates and to formulate the Terms of Reference (TORs) tied to each. In addition, from the institutional and accountability point of view, while coordination of research activities was to be kept with CoRRB, the development function but also the research functions of the RDCs were intended implemented under the respective departments. To this end, the four RDCs were made answerable (including the financial budget) to the Departments depending on their national mandates (see para. 5); and the research agenda formation and priority setting was to be coordinated and under the ultimate responsibility of CoRRB.

In reality, the 'Development TORs' discussed during the above mentioned workshops included a mix of technology transfer (e.g. technology promotion to farming community, seeds and planting material transfer, and plant protection-soil nutrient-water management services) and proper development functions (e.g. support to OGTP<sup>2</sup> and programme<sup>3</sup> implementation, development proposals and farm enterprise promotion, etc.). It is easily understood - as it is openly stated by all the different stakeholders - that the system's restructuring is far from complete and that while the major issues that induced the changes still remain to be fully resolved, further concerns and problems have now arisen.

One key area of concern is the lack of clarity on actual roles and responsibilities to be shared between the stakeholders (mainly CoRRB and Departments), which appear to be too interconnected and often overlapping in their oversight of the same operating units (the RDCs). The legitimate aspiration of the Departments and Dzonkhags to use the best available resources and infrastructure available at regional level, is at odds with the current understaffing and the unsuitable (to proper development needs) capacity of the RDC staff. As a result, what is being observed is that the researchers are being overwhelmingly charged to carry out tasks for

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<sup>2</sup> OGTP: the One Geog Three Products programme attached to the 10<sup>th</sup> FYP.

<sup>3</sup> In the ongoing 10<sup>th</sup> FYP, the RNR sector is guided by 29 Development Programmes including the one (# 25) for RNR research.

which they have little training and aptitude, and that actual research work (as well as transfer of the technology that is being generated) is being deferred or neglected. There is thus a high risk of double-default. Accountability in such conditions is also unreliable: it is not viable to have a research agenda prioritized under one responsibility (CoRRB) and the AWP&B operated under another (Departments).

A clear separation of the two functions (research and development) is warranted as is shown by worldwide best practices. Should policy continue to dictate that the functions be continued jointly within the same 'house' (the regional RDCs) it should also require that the two agendas are set individually (with all due interconnections) but with separated staffing and coordination, as well as through differentiated planning and budgeting.

### System weaknesses to be addressed

MoAF's and the GNH Commission's confidence in the return to research investment is still high in relative terms (investment has doubled from the 9th to the 10th FYP). However such investment still represents only 6% of the overall capital expenditure shared by the 29 RNR programmes (10th FYP). It is also low by international standards as it is equal only to about 0.7% of the total RNR GDP contribution. The fact is that the RNR research system does not seem to be addressing adequately the major issues facing the sector. The reasons which have led to a unanimously demanded system change can be summarized as due to:

- low capacity to transfer generated technologies (because of poor research to extension linkages) resulting in insufficient adoption rates of the major achievements by the farming community;
- outdated technologies many of which are inadequately responsive to the current needs of the farmers; and
- resource allocation and efforts too skewed on research topics of academic value.

Agricultural productivity is indeed low, if not in terms of yields (the latest Agriculture Census<sup>4</sup> has shown for example that average national paddy yield is a respectable 3.99 t/ha) but certainly in terms

4 The RNR Census 2009, MoAF August 2010; Vol. 1, p. 46.

## Box 1: Wildlife crop damage prevention pilots

Crop raid by wild animals (especially wild boars, monkeys, deer, and porcupines as well as by wild elephants in the southern dzongkhags) is a major issue for almost all farmers in Bhutan. Electric fencing is considered to be an immediate mitigation method to control most species of crop raiding animals without harming humans and the animals when implemented properly. The Wengkharr RC has developed low cost energizers and fencing materials from locally available materials. Also the National Post Harvest Centre (NPHC) in Paro has worked on this issue and has developed a prototype based on intermittent production of simultaneous shrill sound and bright light. Both such wild animal repellent systems have proven effective on on-farm experimental basis. Bay and catch dogs have been used to hunt boars since ancient times. Bay dogs include breeds such as the Leopard Cur, Rhodesian Ridgeback, Blackmouth Cur, Blue Lacy, Catahoula. Catch dogs are typically breeds such as the American Bulldog, American Pit Bull Terrier, Staffordshire Bull Terrier and other molossers such as the Boxer, Dogo Argentino, Cane Corso and smaller Mastiff crosses including the Tibetan Mastiff.

IFAD's MAGIP will provide resources for the trial on an adequate scale of the three above mentioned systems in the six Eastern Dzongkhags. Apart from Wengkharr RC and the NPHC, the dog biological control system is expected to be trialed in collaboration with the Jakar RC.

of marketable results (e.g. as much as 40% of the citrus delivered for export is rejected by traders)<sup>5</sup> and from a commodity competitiveness point of view with neighbouring countries (e.g. breakeven farm gate prices for in-season vegetables are double those of Indian origin)<sup>6</sup>. According to the census, crop wildlife damages and crop losses due to pests and diseases are ranked as the highest priorities by farming households (indicated by 56 and 22% of households respectively). Moreover, 36% of the households claim that they need to leave land fallow due to wildlife incursions. The amount of land left fallow (in a country which has only 7% of arable land), has reached the prohibitive figure of 26.3% of the total land holding area (2008).

Based on rough calculations, the cereal (paddy and maize) losses by farmers due to wildlife damage is in the order of USD 4-5 million per year. However, more severe appear to be the calculated annual lost output values<sup>7</sup> from the land left fallow: some USD 13 million

<sup>5</sup> Personal communication of the BEA (Phuentsholing, January 2011).

<sup>6</sup> Personal calculations during field interviews in the eastern region of Bhutan; November 2010.

<sup>7</sup> Calculations are based on RNR Census (2009) data for land left fallow and for average paddy and maize yields. Output prices are farmgate, 2010 (May-November); exchange rate is 44.7 Nu = USD 1.

(paddy equivalent) in wetlands and about USD 44 million (maize equivalent) in drylands.

These issues and others have been confirmed by a recent review undertaken with IFPRI's assistance<sup>8</sup>. The low use of technologies and inputs is highlighted as a key reason for the relatively low agricultural productivity<sup>9</sup>. Interestingly, adoption rates and agricultural productivity are also low even in geogs that are well-connected showing the multifaceted nature of the issues which appear to be related to overall system inefficiency. This analysis also shows that smaller-scale farmers achieve much higher land productivity (up to three times) than larger-scale farmers; indicating the need for more targeted approaches to service delivery.

The research system of Bhutan has operated for a long time through a 'regional' perspective with very few links with the International Agricultural Research System (IARS)<sup>10</sup>. The fact that the Bhutanese research system has not joined the global partnership of CGIAR is in this sense, revealing. No linkages appear to have been made with Biodiversity International and with the Centre for International Forestry Research, notwithstanding Bhutan's prominence in both areas. A wealth of collaborative networks and programmes has perhaps been neglected by the country's research system.

Numerically, the number of staff attached to the research system may appear significant. However, fewer than 17% have a degree and only about 8% of staff hold a Masters or higher qualification. Staff requirements which have been highlighted by CoRRB to face the challenges of the 10th FYP would indicate a three-fold increase

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<sup>8</sup> Technology adoption, agricultural productivity, and road infrastructure in Bhutan. Policy and Planning Division of MoAF; IFPRI; and Swiss Agency for Development Cooperation, August 2010.

<sup>9</sup> The same report also argues about spatial patterns whereas the western and west-central parts of the country appear to perform better as compared to the eastern (more due to wildlife and pest damage) and southern part land shortage/size and irrigation issues).

<sup>10</sup> The linkages with International Organizations include: ICAR (India, <http://www.icar.org.in/>) CIMMYT (<http://www.cimmyt.org/>), WMO (<http://www.wmo.int/>), IRRI (<http://irri.org/>), CIMOD (<http://www.icimod.org/>), FAO (<http://www.fao.org/>), NARC (Nepal, <http://www.narc.org.np/>), JICA (<http://www.jica.go.jp/>), Helvetas (<http://www.helvetas.ch/>), SDC (<http://www.sdc.admin.ch/>), SNV (<http://www.snvworld.org/>) ACB (<http://www.acb.at/>) and CORET (<http://globalhand.org/>), CIRAD (<http://www.cirad.fr/>), WWF (<http://www.wwf.org/>), and WFP (<http://www.wfp.org/>). Work agreements have been entered also with CIP (<http://www.cipotato.org/>) and IFPRI See: Innovating, Inventing and Disseminating "Research for Development", CoRRB, Sept. 2008 (<http://www.ifpri.org/>).

in the need for researchers and scientists. An HRD assessment is beyond the scope of this preliminary review but the need to improve the organization and capacity of the research system's human resources appears quite evident. For instance, one area for which there is no expertise whatsoever, at any level, is economics and socio-economics<sup>11</sup>. Given that system productivity and competitiveness is a major issue in Bhutan, this is certainly an area requiring urgent attention. In addition, the call for 'development' functions is another area that requires further analyses and better understanding. There are national centres and programmes which carry out important research work but which in some cases appear to operate separately and with little, if any, links to the research system. One example is the work being carried out on wildlife damage mitigation measures. The work appears to be carried out in an informal, disconnected fashion (e.g. by the RC of Wengkhari and by the National Post Harvest Centre (NPHC) in Paro<sup>12</sup>. Another area which would require improved coordination and a collaborative framework (and additional resources) is that of Citrus HLB (Greening) being carried out by the National Plant Protection Centre (NPPC)<sup>13</sup>. To this specific end, CoRRB should seek interaction with EMBRAPA (Brazilian Agricultural Research Corporation) in Brazil where interesting progress is being made on HLB sweet orange resistant mutants<sup>14</sup>. There thus appears to be scope for harmonization and organizational adjustments.

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11 See Impact Assessment of Horticultural Research in Bhutan; RNR RC Wengkhari, June 2009. An interesting attempt to show the impact of vegetable, fruit and mushroom growing in the country. The lack of socio-economic expertise is evident both from the methodological and analytical view points.

12 In reality, some form of collaboration exists between the two directly involved scientists (Tshering Penjor RC – Wengkhari and Pema Dakpa Chief Engineer of NPHC in Paro). However this is only on a voluntary basis because of the friend relationship between the two.

13 Citrus Greening Disease (CGD) - also known as Huanglongbing (HLB) or yellow dragon disease - causes trees to produce predominantly greened (worthless) fruit which fails to ripen as well as inducing a bitter-salty flavour when processed. CGD is caused by a bacterium yet unnamed. The vector is the Asian citrus psyllid (AsCP), *Diaphorina citri* Kuwayama. There is no cure for citrus greening; infected trees must be cut down. Effective biological control measures of the vector are yet to find a scientifically acknowledged protocol. All species of citrus are susceptible, regardless of rootstock and scion variety. According to NPPC, out of 160 Geogs where citrus is grown, 28 are seriously HLB affected and in 50 are considered as psyllid affected. The NPPC is gearing action towards vector control via pesticide treatment, which is a costly operation. The RC of Wengkhari is otherwise trying to expand Citrus cultivation zones 'upwards' and between 1000 to 1700 m.a.s.l.. The psyllid is in fact considered to be less active above 900 meters; at least for the time being.

14 Brazilian research is making progress on genetic improvement on crops, including Citrus, by irradiation induced mutation. About 2000 irradiated plants of Tobias sweet orange are currently under field evaluation for mutants resistant to HLB (see FAO-IAEA Plant Mutation Reports Vol. 2, No. 3, April 2011).



## A draft policy requiring improvements

MoAF has undertaken a policy review of the research system of the country. A draft document<sup>15</sup> has been recently finalized with FAO's support and assistance<sup>16</sup> and Cabinet-level discussions are now underway.

The draft policy document is certainly a commendable attempt to identify and categorize the different entities at stake. It provides a broad but quite objective situation analysis and indicates the underpinning guiding principles that are in line with Bhutan's GNH philosophy. The vision, mission and goals set therein appear sound. The objectives of strengthening relationships with the IARS and increasing partnerships with the private sector; and the envisaged funding mechanisms are all positive endeavours. However, the document also includes a number of 'policy objectives and statements' which would require a broader and less specific value at times; and more straightforward definitions at others.

For instance, the Policy objectives (5.11.1-7)<sup>17</sup> embrace aspects more suitable to a time-bound 'research agenda'. More specifically,

15 RNR Research Policy of Bhutan. Final Draft 6.5, January 2011.

16 This exercise was undertaken by a government Task-Force, including MoAF and the Gross National Happiness Commission. Mr Samm Musoke, Economist, consultant to FAO with Maniram Moktan, a PhD scientist of CoRRB, have assisted in preparing the current final draft.

17 Policy Statement Objectives from Renewable Natural Resources (RNR) Research Policy of Bhutan (Draft December 2010, RGOB, MoAF):

(5.1.1) Field Crop Research: develop, adapt and introduce suitable technologies and generate and disseminate information and knowledge to ensure critical levels of food self-sufficiency in cereals at the household and national levels.

(5.1.2) Horticulture Crops Research: introduce, adapt and develop suitable technologies and generate and disseminate information and knowledge to increase production, and enhance post-harvest handling, processing, and marketing of horticulture crops.

(5.1.3) Veterinary and Livestock Research: generate and disseminate knowledge and information to improve the health, quality, productivity and value livestock so as to increase the production and availability of livestock and dairy products.

(5.1.4) Biodiversity Research: to collect data, analyse it and generate information and knowledge that will promote conservation and sustainable use of biological resources and facilitate effective decision-making to improve livelihood and commercial opportunities.

(5.1.5) Forest Research: to generate and disseminate science-based information and knowledge to support better ways of forest management, forest utilization, and conservation of Bhutan's rich biodiversity

(5.1.6) Integrated Natural Resource Management Systems Research: to generate and disseminate information and knowledge to improve management and conservation of the environment and common resources, and to facilitate Bhutan's response and adjustment to climate change.

(5.1.7) Streamline and strengthen institutional mandates and capacities of central agencies for coordinating, planning and prioritizing RNR research.

5.1.1 is geared at generating technologies “to achieve critical levels of food self-sufficiency for cereals and legumes” instead of aiming at a broader concept of food security and productivity. The policy statement (5.2.1 and 5.2.2)<sup>18</sup>, which is related to system effectiveness and efficiency, roles and mandates of the different players, and to the research agenda planning mechanisms, and which is otherwise a key point of the entire policy, appears too congested and lacks clarity. It appears that the discussion among the different stakeholders (CoRRB, MoAF Departments, Programmes and National Centres, and RCs) on ‘who’ is actually responsible for ‘what’ and primarily on respective borderlines, complementarities and integration between research and development work has not reached a consensus yet<sup>19</sup>. The policy statement regarding research and extension linkages is also too broad to explain how extension and research should be interrelated, and makes no reference to the need to have an Extension policy in place that is integrated with the Research policy. Finally, objective 5.2.<sup>20</sup> on HRD fails to highlight the need to include economics/econometrics/ socio-economy as a specific area for development.

Over and above, it will be essential to clarify the rationale behind the policy decision to convert the former RCs into the new RDCs. Should the ‘development’ function of the RDC go beyond the more traditional (for a research system) role to include ‘technology transfer’ work and imply instead actually implementing development programmes of MoAF at regional level, this would also entail a complete but difficult and costly reorganization of the centres, particularly in terms of human resources (to integrate researchers with development workers); financial means and infrastructural network-assets (distinguished for the two different spheres); and ad hoc planning/decision making mechanisms. Otherwise, a traditional technology transfer function of the RCs may be adequately enhanced by improved coordination and integrated planning with the work to be carried out under the responsibility of departmental development programmes and national centres. It is however risky

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18 Policy Statement Objectives from RNR Research Policy of Bhutan (Draft December 2010, RGOB, MoAF):

(5.2.1) Streamline and strengthen institutional mandates and capacities of central agencies for coordinating, planning and prioritizing RNR research.

(5.2.2) Streamline and strengthen capacities of RNR-RDCs to conduct RNR research activities.

19 This was apparent throughout the discussions during mission work and emerged also during the wrap-up meeting held in MoAF’s Conference Hall on 28 January 2011.

20 Policy Statement Objectives from RNR Research Policy of Bhutan (Draft December 2010, RGOB, MoAF):

(5.2.7) Strengthen human resource development for RNR research.

from the accountability point of view to have shared responsibilities between CoRRB (undertaking overall coordination of screening, prioritization and evaluation of all RNR research initiatives) and the Departments (responsible for implementation of the research activities and to which the RDC are now answerable). A decision on overall responsibility borne by one single-entity is advisable.

It is hoped that the on-going review process of the draft policy document will aim at clarity and allow useful integrations that may include:

- fine-tuning of roles and responsibilities of the different stakeholders;
- definition of the 'development' versus the 'research' functions, whereas R&D should be connected but distinguished at Research and Development Centres' level;
- considering complementary staffing of the RDCs with developmental professional capacity (and/or linkages with programmes and centres);
- provide guidelines on how a client-oriented and sector priorities' responsive agenda is formed (but not include a specific agenda) and how AWPBs operate; and
- indicate mechanisms through which effective research-extension linkages are activated for technology transfer.

### Resource allocation (suggested) priorities

Although a proper evaluation of research outputs and achievements is not available, the weakness of the system in addressing the main problem areas of the farming sector is also widely acknowledged. As highlighted in the draft policy paper, a careful prioritisation of limited resources allocation needs to be made. Below the key issues facing the agricultural sector which would require highest research attention and priority for allocation of human, financial and infrastructural resources are indicated (and ranked):

- addressing wildlife damages<sup>21</sup>;
- resolving pest, disease and post harvest related losses;
- understanding and mitigating the fallow land issue;
- packaging (including socio-economic research) more efficient production systems and practices (for labour, water, input saving and for animal feeding and health) of major cash earning commodities; and
- ensuring concrete productivity gains and improved food security in the poverty pockets of the country.

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21 A good starting point is considered The Human Wildlife Conflicts Strategy (<http://www.MoAF.gov.bt/MoAF/downloads/downloadFiles/MoAFDownload5lv1595os.pdf>), developed in 2007 which has a number of valid provisions. This strategy was supposed to be implemented within the 10<sup>th</sup> FYP. However, none of the 29 RNR programmes seem to cater for its actual implementation.

## ||||| Extension

### System set-up

In rural areas, agricultural production systems and rural living standards are influenced heavily by Bhutan's mountainous landscape, sparse population and limited physical infrastructure. Access to agricultural extension and farm inputs are known to be weak in such areas (World Bank CPS, 2010).

There are 205 geogs in the 20 Dzongkhags of Bhutan. The RGoB has made an enormous effort to locate an RNR centre at each geog, generally tied to the administrative headquarters' office (Gup) that is staffed almost universally with one EA per sector,<sup>20</sup> who operates under district-level sector coordinators. Office and housing infrastructure and staff mobility have been improved at many locations (partially through donor support<sup>21</sup>) but more investment is required. Notably, the EAs interact more frequently with farmers located in geogs and villages which are better served by the farm roads' network, and are the best equipped with service infrastructure (e.g. RNR office, research sub-stations, etc.)<sup>22</sup>. Vicinity to major urban centres is another thrust for development and the emergence of commercial agricultural undertakings.

Extension activities are intended to be coordinated separately by each Department but a MoAF operational focal point at headquarters is not available. Instead, an Extension Coordination Committee (ECC)<sup>23</sup>, chaired by CoRRB, has been instituted with

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20 As of January 2011, the Extension staff (Dzongkhag and Geog) is reported to be: 393 (DOL); 282 (DOA); and 238 (DOFPS). Details on District staff distribution are not available but each Geog is nominally equipped with one EA per sector, who are answerable to their respective District sectoral (Agriculture, Livestock and Forestry) heads. The latter are functionally under the related MoAF Departments but administratively positioned under the District local government office and head.

21 E.g. the World Bank's Decentralized Rural Development Project has also supported this process. Although detailed records are not available there are to date some 100 renovated RNR centres.

23 The ECC meets twice a year (plus on need basis). It includes the following members: CoRRB director (chair); NSC, DOA, DOL, DLO-Thimpu, DOFPS, DFO-Paro, DAMC, PPD, ICS, BAFRA, HRMD, AFD, CNR, and secretary from CoRRB.

the mandate to coordinate cross-cutting extension related policies, strategies, methodologies, and programmes amongst various departments/agencies of MoAF.

The EAs are the core staff through which the MoAF development programmes and the district RNR plans are supposed to be implemented within the farming community. The 10th FYP process took place between the GNH Commission (GNHC) and the Dzongkhags level planning institutions. However, the main central level technical and policy backstopping institutions, including MoAF, have not been engaged strongly in this process. In order to fill the gaps and foster closer linkage between the central plans (the 29 national programmes, detailed in the second volume of the 10th FYP, include the required technical, institutional and financial support for their implementation); harmonize the local plans with national policies; and align central programme resources and inputs with local plans, the RNR sector carried out Dzongkhag level technical discussions with the field level RNR sector staff.

The attempt to align or at least link (but without a specific budget) the RNR programme with the more specific commodity development needs of the Districts is contained in the third volume of the RNR 10th FYP: one geog three products (OGTP)<sup>24</sup>. The OGTP was aimed at identifying from one to three products to be emphasized in each geog depending upon market availability, potential for production and possibility for linking markets to production areas. As for the RNR programmes, the EAs are supposed to be the implementers of the OGTP as well. This exercise came in at a late stage of the 10th plan preparation process and its implementation progress is still to be measured. The ongoing MTR activity has reviewed all the 29 programmes, and it is foreseen that during the discussions with the local governments, the MTR of the OGTP will also take place. However, it is well known that the RNR programme at District level is overwhelmingly skewed from the budget point of view (over 90%), towards the implementation of farm roads and little is left to cater to other development activities.

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24 See a summary table in annex 2.

## A MoAF recent assessment

An assessment of the present state of extension services has been carried-out by MoAF and published in CoRRB's latest journal<sup>25</sup>. Therein, the need to synchronize research and extension professions under the same line of command is identified. An appropriate institutional functional mechanism would reduce duplication of efforts, improve coordination, and compare technology generation to increased adoption rates. However, where such line of command should be located is not indicated.

Among the several issues that are flagged in the document, those that are most acknowledged include the continuing disconnect between the five-year planned programmes and any extension related programmes required for their implementation; that coordination mechanisms are uncertain (and with low accountability); that specific fund/resources allocation for extension is insignificant as compared to its mandate and required activities; that the one (per sector) extension worker – one geog policy is an outdated systemic approach; that extension workers are multi-tasked, thus impeding their focus on action; and that the technologies generated are seldom in line with the actual needs, capacity, and that the appropriateness of the technologies for existing farming system - in particular for the smaller and resource-poor farmers, is often poor.

It is also recognized that information flow and linkage mechanisms between the extension service and the central level (programmes, centres) is inadequate and that appropriate ICT investment and systems should be developed. Extension coordination, monitoring and back up services should be engineered and established with the RCs. Lastly, the extension service should have its own specific HRD plan.

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25 BN Bhattarai, Principal Extension Officer, DOA; in Journal of RNR Bhutan, CoRRB, June 2010.

## Policy in the making

An Extension policy has been under preparation for some time<sup>26</sup>. The latest draft strategy paper<sup>27</sup> appears inspired by modern principles and international best practices (which are also indicated in the 10th FYP): client orientation and participation; decentralization of service delivery; outsourcing of service delivery; and co-financing by beneficiaries.

The perspective on extension is one in which it is no longer a supply-driven public service but more of a multi-institutional network of knowledge and information support for rural people aimed at helping farmers help themselves. It fully recognizes the need for a more sophisticated and differentiated set of services tailored to the particular needs of the Bhutanese diverse farming communities. The policy also reflects the recent focus on decentralisation and geog development.

The system comprises frontline extension staff based in the geogs and Dzongkhags and the institutional support structure, including research and other knowledge and input centres. The mission of such a system is to create an enabling environment for enhancing production, accessibility and marketing in a sustainable manner through relevant, efficient and timely extension service delivery. The overall goal is to alleviate poverty, increase incomes, and improve livelihoods and farm productivity/returns to farming through appropriate strategies by addressing the following constraints:

- low productivity of labour, land, forest and livestock,
- high losses during the growing season due to pests,
- high losses in post harvest handling, and
- the lack of incentives to produce beyond subsistence levels, particularly in remote areas.

The principal approach to extension service delivery is farmer-centred, demand driven and participatory. The system foresees using an ensemble of tools and approaches including the geog Extension Centres; Focus villages; Farmer Groups, Farmer Field Schools (FFS), Volunteer Extensionists; and Commodity-based Extension.

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<sup>26</sup> There is a National Extension Policy dated 1995. Since 2003 several strategy papers have been circulated among stakeholders.

<sup>27</sup> National RNR Extension Strategy, Working Draft; CoRRB (EEC), undated (2010).



## Recommendations

The recommendations included in the MoAF assessment are by and large considered appropriate. An operational and permanent coordination mechanism in MoAF that links together extension-related activities and needs of the Departments; RNR-MoAF programmes; National Centres, RNR-District programmes, and the RCs, is warranted beyond the present ECC. This committee, as unanimously acknowledged by all stakeholders, has in fact not been able to ensure the required coordination.

It is advisable that the finalization of the Extension policy piece be sped up and that it occur at the same time of that of the Research system. Complementarities would have to be sought particularly on research-extension linkages; roles and responsibilities; farmers-extension feedback mechanisms and modalities; research and development agenda formation and priority setting. Extension services, R(D)Cs, departments/divisions, and central programmes should also align roles to address farming issues with appropriate linkage mechanisms and taking into account farm economics as part of the technology package.

Given the importance of the extension manpower in RNR programmes' implementation, the entire planning and implementation programming process of national programmes, National Centres, R(D)Cs technology transfer, as well as of RNR programmes of the local governments will require alignment and instituted coordination mechanisms for the extension services delivery, which would need consideration also in the policy/strategy.

Investment is required to enhance the extension service capacity. Prioritized and targeted infrastructural improvement should be planned, including appropriate ICT solutions. Over and above, specific operational resources would have to be allocated to ensure extension services delivery.

The blanket policy of one geog – three EAs should be re-visited. Staffing capacity, positioning, deployment and facilities should be assessed and re-organized based on actual programmes' implementation needs.

Extension outreach needs broadening particularly in the remote areas. To this end, a workable and sustainable option is to enhance direct farmer involvement. A number of FFS interventions have been carried out since the '90s. Forthcoming development projects (e.g. IFAD's supported Market Access and Growth Intensification Project, or 'MAGIP') are advocating further use of this system. A stocktaking exercise is due and it appears to be time to see how the approach, which caters for a greater involvement of farmers as a means to upscale knowledge and development outreach, can be better integrated<sup>28</sup>.

The majority of the RNR EA staff is young, motivated and interacting as best they can with the farming community. Many have a College of National Resources (CNR) degree, while others have a diploma. The importance of these persons as a development resource is evident to all (see also ABSD). There is a need to heavily invest in HRD and capacity building of these staff. However, capacity building needs to be targeted to specific areas of highest priority, which can be indicated as follows:

- pests, diseases and wildlife damage management;
- mitigation of post-harvest losses;
- priority technologies and practices (resulting from RC packages and technology development);
- sustainable land management and climate change adaptation/mitigation (SLM);
- contract farming<sup>29</sup>;
- farm level business and enterprise management;
- groups and cooperative organization;
- irrigation and water management; and
- resource-poor farmers' specific approaches.

Importantly, a needs assessment and training programme should be carried out also taking into account the overall development priorities and relevant farmers' needs.

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<sup>28</sup> See details on the FFS approach and experiences in annex 3.

<sup>29</sup> Contract farming is a strategy embraced by MoAF to move ahead the commercialisation process of a growing portion of the farming community that is becoming protagonist of horticultural exports. A major undertaking in this direction is the MHV that over a five-year period will plant 10 million hazelnut trees over some 22 000 acres involving 10-15 000 households.

## Input supply system

### Public sector system

The input supply system of the RNR sector is at present essentially a public sector undertaking. The National Seed Centre (NSC), located in Paro, is responsible for seed and seedling multiplication and provision to farmers. It is also responsible for fertilizer and rice herbicide distribution. The RCs are responsible for plant breeding seed and planting material maintenance and provision to NSC. The National Plant Protection Centre (NPPC) in Thimpu (Semthoka) is mandated to make pesticides and herbicides (other than rice-specific) available to farmers. The Agricultural Machinery Centre (AMC) in Paro assists in mechanization. MoAF has a number of breeding farms which offer animal breeding stock and Artificial Insemination (A.I.) services and material to the farming community. A regulatory system that governs the input supply system is guaranteed through the Bhutan Agriculture and Food Regulatory Authority (BAFRA).

With respect to inputs provision, farmers' demand for seed, fertilizers and pesticide/herbicides are essentially determined by the EAs, reported to the District sector coordinators and accordingly, orders are placed with the responsible agencies. Seeds and fertilizers are then distributed (with transport costs borne by MoAF) to a network of commission agents (CAs), who on-sell the inputs on a 'cost plus fee' basis (a flat 10% charge) to farmers. Pesticides and herbicides do not pass through the CAs but are delivered directly to the Dzongkhags and made available to farmers by the EAs. A similar system applies for animal breeding stock and AI services. With respect to pesticide and herbicides, the system is kept under tight control by MoAF (through NPPC) in order to avoid misuse and to guarantee adequate safeguard measures. On top of the CA system, which is made of two to three small private entrepreneurs (generally all-kind retail shops) per Dzongkhag, MoAF is trying to launch a new input marketing system with the DAMC known through OSS.

## Box 2: One-stop shop system

The system foresees the establishment of OSS for selling community agricultural input requirements, and for renting equipment required for cultivation (power tiller, thresher, etc) and labour reduction (rice/flour mill, oil press, etc). The concept involves establishing and managing such shops as a business unit through a full time Manager. Locations for each establishment will be selected and prioritized by DAMC. Managers will be selected and working relationship with DAMC will be established. The OSS would be organized with necessary infrastructure, equipment and stock of inputs.

A revolving fund with DAMC will also be established to provide a stock of agricultural inputs to the OSS managers on credit with the cost of inputs recovered after sale. The charges to be levied for services rendered by the OSS, including equipment hire charges and the mark-up for sale of agricultural inputs, remains to be defined. The revenue sharing pattern between geog Administration and OSS representative is also still to be worked out.

Three management options are being tested as to the operation of these outlets: (i) youths; (ii) farmer groups; and (iii) small entrepreneurs. Infrastructure is provided on an (initially) rent-free basis by RGoB. A three-year Memorandum of Understanding is signed with the agent, who is also provided with start-up seed capital to purchase a stock of inputs. Pilots<sup>30</sup> have been recently established a three different locations and their performance is being monitored by DAMC.

### Seed and planting material

CoRRB's research division has the mandate to develop seeds and planting material quality standards, and to release bred or adapted varieties (see Attachment 4) through the Technology Release Committee<sup>31</sup>. In terms of variety release, the pace has been slow: the leading varieties of rice (IR 64) and maize (Yangtsipa) were released 23 and 19 years ago, respectively. For field crops, out 28 varieties released (see Attachment 4) the latest was in 2006; eight date from 2002; seven have been listed since 1999; and 12 since

30 In Kaling with a Commission Agent; in Shemang with a Farmers' Group; and in Mongar with a youth couple; investment amounts to about USD 1,500 per each pilot.

31 The former Variety Release Committee. Besides variety release (agriculture, livestock and forestry) the committee also screens other technologies (e.g. production packages). The committee is also responsible for de-notification of obsolete varieties from production at breeder stage.

1994 or before (1988). Similarly, vegetable varieties are also quite dated: only 9 out of 72 varieties were released in 2006 (and one in 2007); the remaining includes releases from 2004 and 2002, and a long list from the 1990s. Otherwise, with respect to fruit varieties, the vast majority have been released between 2002 and 2006-7. As regards to feed and fodder crops, all 24 releases have been developed during either 2001-2004 with only one more recent, released in 2007. The RCs should also ensure regular production and supply of breeders' seeds to seed production units for further multiplication (foundation, and registered seeds under close technical supervision). The breeders' seed must be of the best possible varietal (genetic) purity so that subsequent multiplications have minimum loss of purity. However, in recent years such arrangements have been very irregular which has had an adverse impact on the quality of certified seeds sold to farmers.

Seed production and marketing started through a National Seed and Plant Programme (NASEPP), established in 1984 by MoAF. NASEPP had access to significant seed production capacity and had good conditioning infrastructure; it successfully supplied high quality seeds and planting material of superior varieties to a good number of producers in Bhutan, and was even able to export seeds to India. In 1995, MoAF decided to create the Druk Seed Corporation (DSC) out of NASEPP so that it could work independently and sustain its operation from the revenue it earned. The financial performance of DSC has however been always negative; the company never had a systematic workplan nor a high profile network of seed producers (disrupting the one available with NASEPP); its quality assurance mechanism was insufficient, and the overall management system was unconstructive. As of 2006<sup>32</sup>, the use rate by farmers of seed of high yielding varieties and of quality planting material was disturbingly low. Only 0.9% of the area was reported planted to certified seeds of paddy. The situation with maize and potato appeared better but not satisfactory (respectively, 2.6 and 2.2%). The entire seed production system established during NASEPP has progressively deteriorated. NASEPP had assessed its market to be equal to about 10% of the total seed requirement of the country.

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32 "Strengthening National Seed Programme for Food security and Poverty Alleviation";  
FAO Seed Sector Review, January 2008.

In 2010, MoAF decided to discontinue DSC; to reinstitute a public sector function and has to this end, created the National Seed Centre (NSC). However, to return even to the capacity of NASEPP will be an enormous and costly challenge. The re-activation of farm production, seed processing capacity and human resources skills upgrading will be a daunting task. NSC is at present aiming only at re-establishing the low profile production capacity which was available during the latest years of DSC<sup>33</sup>. For instance, paddy certified seed would be produced on its own farms and through seed growers to satisfy a planting area of only about 500 ha (about 2.5% of the total paddy area, or 10-12% with a 4-5 years replacement rate). As for seed potato, production capacity is at present reported to be equal to about 7% of the total potato growing area of Bhutan.

MoAF needs to formally take a strategic decision on the future role and position of NSC. Its farm production, laboratory and seed processing infrastructure is reported to be dysfunctional to a large extent. Staff capacity also requires substantial upgrading. Most of all, it will be necessary to reestablish a trusted farmers' system on which producers can increasingly place their demand for quality seed and plants of modern varieties which are capable of attaining higher yields and farm productivity increases. This would require a pluralistic system with registered seed (and nursery) growers, and collaboration with the private sector.

### Fertilizers, herbicides and pesticides

Use of inorganic fertilizers in Bhutan is low by any standards: 4.6 kg N; 0.5 kg P; and 0.7 kg K per ha (DSC, 2005 unpublished). In total, some 37% of households consume only about 2 600 tons of fertilizers<sup>34</sup> (Agriculture Census, 2009 but above 3 000 tons according to DSC data). The remaining holdings consume no chemical fertilizer at all. However, over 65% of households use about 78 000 tons of organic fertilizers (mainly FYM), or about 0.8 tons in average, per cultivated hectare. Undoubtedly, the main factor for nutrient replenishment is FYM and it is noted that some farmers provide up to 2-3 tons of FYM/ha (in particular on wetlands<sup>35</sup>). Without

33 See also Attachment 5. The note prepared by NSC shows a limited market (and of its potential) ambition.

34 For type availability and prices see Attachment 6.

35 A basket of 7-10kg of FYM applied every 25 m<sup>2</sup>.

these inputs it would not be possible to maintain the current yield levels (Agriculture census, 2009: Paddy, 3.99 t/ha; Maize, 2.45 t/ha; Potato, 9.5 t/ha; Mustard 1.8 t/ha; Chilli 1.9 t/ha; and Citrus 34 t/ha [calculated]). All chemical fertilizers are imported from India by NSC and by few authorized dealers<sup>36</sup>. Due to the very small purchases by Bhutanese farmers relative to Indian consumption, they are able to take advantage of the subsidized prices offered in India (see also Attachment 5). It is however unlikely that this state of affairs could continue were import levels grow significantly, as it is expected to be with the expansion of vegetable and fruit orchards in Bhutan.

Only Butachlor and Borax, both herbicides used in paddy fields, are distributed to farmers through NSC; all other herbicides, as well as pesticides<sup>37</sup>, are ordered by the NPPC and distributed through the District Agriculture Officers and the EAs to the farmers. Almost 20% of farmers use pesticides, amounting to some 700 tons per year. It is noted that MoAF is trying through NPPC, with FAO and European Union assistance (since 7th FYP), to spread Integrated Pest Management (IPM) technology among farmers, mainly horticulture producers. This is in line with the Bhutanese thrust for organic farming. While there is scope to further enhance IPM technology use and skills among farmers there is at the same time need to strengthen plant protection knowledge and measures through continued but targeted research work. For instance, NPPC, the RCs and the extension services need to come together with more resources<sup>38</sup> or improved surveillance and protection efforts against Citrus HLB; blast diseases in rice, and late blight control in potatoes, to name the most important cases.

## Animal breeding stock

MoAF has a number of farms that cater to production of animal breeding stock to be distributed to farmers:

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36 BAFRA reports to be issuing annual import permits to private dealers (based on NSC requests). It appears that the imported fertilizers are then on-sold to NSC who caters for Dzongkhag-level distribution (transportation costs are borne by MoAF).

37 *Ibidem*, for type availability and prices see Attachment 6.

38 To this end, the foreseen integration of the World Bank supported DRDP would provide resources to: (a) develop and strengthen pest surveillance system; (b) capacity development of EAs in IPM implementation; and (c) identification of specific crop protection issues in three commodities (potato, rice, and maize).

- 3 Pig farms (Thimpu (Yusipang); Geliphu; and Limitangt (Mongar);
- 3 Poultry farms (Paro; Sarpang; and Limitang);
- 2 Jersey-cattle farms (Samtshe; Bumthang);
- 2 Mithun-cattle farms (Shemang; Sandrup Jonkar);
- 1 local breeds cattle farm (Trashingang); and
- 2 fish farms (Geliphu-Sarpang, Ha).

Current production capacity for Day-old chicks (DOCs) is of the order 50 000 per day. Pig farms produce 500 piglets each day. This capacity has reached its maximum and expansion can be made only through involvement of the private sector. The National Livestock Breeding Programme (10th FYP) is responsible also for the AI sub-programme. It collects bull semen which is then distributed to farmers through the EA and Community Workers. However, the AI programme is not yet efficient and would require improved farmer participation in oestrous synchronization and increased mobile AI services. The Community workers' programme is promising but it has only recently started and only one worker per Dzongkhag is now available. There are 35 registered farmer groups and about 70 non-registered. Each group would ideally need to be served with AI facilities.

## Mechanization

The AMC and programme was established in the early eighties and has continued till date with uninterrupted support from the Government of Japan. Japanese support to AMC is however winding up and the future of this bilateral aid is still unclear<sup>39</sup>. The programme has undoubtedly been instrumental in alleviating drudgery and in allowing the current level of mechanization in Bhutan. Given the sizes and topography which prevail in Bhutanese farms, power tillers have been shown to be the best substitute for the traditionally used bullocks. Some 2 500 power tillers have been made available to farmers over the years. In few cases a complete rice mechanization package has been provided including transplanters, weeding implements and power reapers for mechanized harvesting. Case studies have shown that compared to traditional cultivation methods (bullocks plus manual), savings on cost of production from mechanization amount to around 50%

<sup>39</sup> JICA information; in the late years the support has been in the order of USD 2 million per year. AMC's yearly budget for capital and recurrent costs amounts to 54 million Nu.



but actual labour input is reduced to only one quarter or even one fifth of previous levels<sup>40</sup>. In collaboration with the NPHC, AMC has also worked on a number of small processing enterprises (about 6 000, grouping some 25 households each) for oil seeds and rice mills, rice threshers, maize shellers, vegetables and fruit dryers, etc. A major side effect of the use of power tillers has been the improved mobility and transportation capacity of farmers through the attachment of wheel carts; in particular where farm roads have created a link to the markets.

According to latest data (A. Census, 2009), only about 7% of farmers use exclusively power tillers, another 2% use a mix of bullocks and tillers but the vast majority utilize only draught animals for land operations. Rates of machinery adoption have been highest in the western districts (mainly in Paro at about 30%, where AMC's headquarters is located). Elsewhere, the main problems have been related to the availability of spare parts and repair services, which are offered more easily by AMC's workshops in the vicinity of its headquarters in Bondey, Paro or of its regional centres in Wangdue (Bajo), Trahingang (Khangma), and Sarpang (Bhur). Farmer training and backstopping services are also an issue. A quality and safety programme has just started.

While the benefits are evident and the selected means (power tillers) appear to be appropriate (particularly on wetlands<sup>41</sup>), the issue for MoAF has been, and continues to be, the way to increase significantly and sustainably farmers' access to mechanization. Until recently, power tillers have been made available to farmers through heavy subsidies (about 60-70%)<sup>42</sup>. Dzongkhag allotment of power tillers has followed a somewhat supply-driven approach, with some account taken also of district coordinators/EA requests. The amount paid by farmers can be financed by the Bhutan Development Finance Corporation (BDFC) through a loan (2-7 years at 12% interest rate). An interesting market effect is that power tillers of Indian make are starting to be available in the marketplace (through a very few importers) at a price that is not too far from what farmers pay for the subsidized Japanese machinery. Similarly, transplanters

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40 AMC unpublished data.

41 Power tiller use is spreading also on drylands wherever the slopes allow for its use. Apart from topography, here the challenge also regards intercropping (mainly potato and maize) land use practices.

42 Actual price paid by farmers is equal to some 140 000 Nu while real price of the Kubota power tiller is about 450 000 Nu.

and reapers from Viet Nam, India and Thailand can also be found at affordable prices.

Recently, MoAF has started to trial group mechanization schemes through DAMC. Given the scarcity of resources, and as a way to increase the efficient use of machinery over a larger number of farmers, group schemes are intended to allow a single machine to be used by the group members as well as for service provision (on a rental basis) to neighbouring colleagues. Although MoAF is confident that this system will be successful, there are not yet sufficient M&E data to make any reliable assessment. According to AMC, however, there is a general perception among farmers that power tiller hiring services are expensive. In reality, the cost is less than half that of hiring bullocks and operators<sup>43</sup> for an equivalent piece of work. The market for machinery hiring services appears to be still immature with issues not only of supply constraints, but also of irregular demand. With regard to training, AMC seeks to involve the CNR and include and upgrade mechanization curricula in the EA courses.

### Private sector input supply

With growing requirements coming from the commercial farming segment the input supply marketing system is evolving; and private sector involvement is increasing at a pace that depends on related sub-sector demand. Three areas in particular are expanding:

(i) The capacity of the public sector to provide DOC, pullets and also piglets to the increasing number of poultry farmers and small piggeries (in the southern districts) is overstretched. Big private hatcheries<sup>44</sup> are already satisfying some 2-5% of the DOC demand (1 000-2 500 per day); while a growing number of medium size poultry farms scattered around the country are entering the same market.

(ii) In the seed and seedlings production sector, a private entity (Bhutan Alpine Seed)<sup>45</sup> in Bondey (Paro) is taking over the production of vegetable seeds. The company has a small acreage

43 See also Survey on Farm Mechanization in Bhutan; AMC, 2010.

44 E.g., SATARA in Geliphu (Sarpang) is a hatchery of 30 000 birds; and GURU in Pasakha (Chukka), which runs a 20 000 birds' enterprise.

45 Established in 2000; it is the first private seed company of Bhutan, specializing in production and marketing of vegetable seeds, horticultural planting material and ornamental flower seeds and plants.

that is used to maintain parent material (also sourced through the RCs) of vegetable Open Pollinated Varieties (OPV). Production is based on a network of 60-70 trusted growers while seed processing and germination trials are performed at Bondey headquarters, including inspection and certification (through BAFRA). Demand from vegetable growers is reported mainly but not exclusively, in the areas of Paro, Wangdi, Trongsa, Mongar, Trashingang, Sandrup Jonkar and Tsirang. Although vegetable types for all-year-round growing are produced, the main demand is for off-season varieties for export to India (summer vegetables). Some 30% of marketed seeds are imported from India while the bulk is produced in-country. However, the quota of imported seed is decreasing rapidly and the intention is to phase it out; export plans are also being considered. Current marketed capacity is 250 000 packets (in average 10 grams each) per year. Such capacity is able to satisfy a vegetable production area of about 2 500 acres. Expansion is possible by increasing the number of growers but the company wants to phase its growth based on actual demand. It is noted that DSC originally had a capacity that was double this level: 500 000 packets per year (approximately 5 000 acres of vegetable area); but it is unclear whether NSC will be able to re-instate the production capacity of DSC. Selected seed growers attached to the company utilize on average about 0.5 acres in their farms for vegetable seed multiplication. The arrangement is of an 'outgrower' type with seed, other inputs and technical assistance provided by the company. Payments are made after germination trials at headquarters, and are generally settled within 15 days of seed delivery. Average gross income is a respectable 50 000 Nu per farmer per cycle. Retailers are either the CA or even market vegetable sellers. The company has announced its interest to buy-in the public sector's vegetable seed production capacity.

(iii) Bhutan has one source for animal feed, which is located near Phuentsholing (Pasakha, Chukka district). The private company (Karma Feeds) has recently undergone a restructuring and expansion of its plant. An old plant, established in 1985 has been decommissioned and the facility is now used only for storage purposes. Raw material is virtually all imported, mainly sourced from India but also from Nepal, while some ingredients are sought from USA and Europe<sup>17</sup>. The plant is able to manufacture feed for all types

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46 Raw material includes 500 tons of maize purchased every month. Less than 10% of this is sourced in-country (from the Eastern districts) as domestic maize is expensive as compared to the Indian produce (15-20 Nu per kg against 11 Rupees per kg).

and stages of livestock industries (cattle, poultry and piggeries, with plans for the fish industry). Until 2004 production capacity was 100 tons/month, while the new plant is now capable to produce 1 000 tons/month. This expansion has been graduated by the market growth. Feed composition and quality standards are studied and agreed with MoAF's DOL and certified by BAFRA. The plant follows high standards levels, particularly for the poultry industry. However, given that raw material (all imported) makes up about 80% of the feed cost, which is high compared to the Indian product<sup>47</sup>, there is scope to study and agree with DOL feed compositions and specifications that are more 'friendly' to the Bhutanese farmers and in line with their current capacity and market position.

The current feed demand<sup>48</sup> is as follows:

- layers, 45%;
- broilers, 20%;
- pigs, 10%; and
- dairy cattle, 25%.

The poultry industry is more developed in the southern Dzongkhags (mainly in Tsirang and Sarpang) where both layer and broiler enterprises exist. In the north, 60-80% of the poultry undertakings are for layers. Dairy is developing more in Paro, Thimpu (rural) and in Trashigang. Demand shows that the poultry industry is the major livestock industry<sup>49</sup>, growing rapidly, and absorbs 65% of the feed output. However, the company declares it is unable to market the entire current production capacity (1 000 tons/month), and needs to stock up to 20% of the feed produced at times<sup>50</sup>. This is reported to be due in turn to the low capacity of the public hatcheries to furnish the poultry industry with DOC and pullets given the sector's fast pace of development. Part of the excess production is reportedly placed in the Indian market. The plant however has a ready potential to expand production (with two shifts) to 1500-2000 tons/month; this could in theory, be stretched further (3000 tons/month with three production shifts).

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<sup>47</sup> Bhutanese safety regulations are very strict; Indian specifications are more relaxed in particular on protein (TDN) content.

<sup>48</sup> Personal communication, Karma Feed managing director.

<sup>49</sup> In the Bhutanese context, the poultry industry being an 'off-farm' enterprise has a higher development potential as compared to dairy farms which require for feeding purposes more agricultural land.

<sup>50</sup> At present Karma Feed reports to be working under its breakeven. Its turnover, 20-30 million Nu per month, is at par with the cost of raw material. Breakeven can be met only with a zero-stock situation.

The industry has an issue with its distribution network and transportation costs. Feed is currently commercialized through the CAs (there are about 34 affiliated in the whole country). Transportation costs are additional and covered by the CAs, who then charge this cost on top of a 5% commission fee to the ex factory price list. Transportation cost of raw materials is also likely to increase due to recent truck load restrictions<sup>51</sup> introduced on Indian roads (max of 15 tons) that will augment the number of truck trips necessary to deliver the same amount. The feed industry intends facing this challenge and its future plans are to establish a network of depots; the first would be located in Geliphu (Sarpang).

## Assessment

The public sector is struggling to address producers' demand for inputs and services but it is showing its limitations in a rapidly changing environment. Growing needs of the farming sector require timely availability of adapted food, and particularly, of cash crop quality seeds and planting material. The department of livestock requires increased support to be able to assist the growing poultry industry. The need for mechanical means to cover as many operations as possible either through owned machinery or through rental services is evident while the need to keep up with draught animals particularly in the remote areas should not be underestimated. Availability of accessible and near-to-farm spare parts and repair services is already an issue wherever power tillers and the alike have been provided, which can be served to a very limited extent by AMS and its four regional branches. Service delivery systems of the public sector would require targeted strengthening in terms of capacity building of human resources, productive infrastructure and equipment.

Indeed, a small private sector exists which appears to be expanding. The input provision segment that is showing a somewhat virtuous cycle is that of the animal feed. Another area with an interesting potential is witnessed by the private sector-led vegetable seed production venture. There are also interesting signals from large and several medium-scale hatcheries that are increasingly becoming service providers for DOCs. However,

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51 Maximum truck load on Bhutanese roads is 5-7 tons.

notwithstanding their inherent promises all face the issue of weak distribution networks.

The 10th FYP in general and the Triple Gem Concept<sup>52</sup> in particular, all emphasize the functional need to increase the private sector's participation to the development process. The MoAF now needs to be consistent with its strategic decision of facilitating and supporting the capacity up-scaling of the emerging private sector. This would entail gradually phasing out from all those areas where there is evidence of a private sector interest while retaining only those where there isn't one yet or those which are considered strategic (see an indication in Box 3). This would also require a restructuring and a re-alignment of the public sector-run activities, and would mean putting in place required policy mechanisms but also identifying appropriate financing instruments, and involving participating institutions that would facilitate this process.

The MoAF's concrete support to the development of a private sector engagement in inputs provision needs further analyses but should consider a number of priority areas. A declared area of prime importance for the private sector is certainly that of its own HRD policy and action for which incentives (including fiscal), and financial support mechanisms, as well as logistical support (in public-run premises) can be engineered. Infrastructural capacity building may be facilitated through improved access to credit lines and for instance, by allowing the private sector to competitively purchase public assets to be phased out. Ad hoc financing instruments should be studied including the introduction of dedicated credit lines through participating financing partners and credit interest subsidies; the issuing of guarantee funds and rebate schemes on lending programmes; operational grants; and temporary tax relief. Sector-related risk assessment capacity on the part of the participating financing institutions may also be supported.

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52 The Triple Gem Concept is the strategy for a gradual transition of subsistence agriculture to small family-based commercially oriented farming enterprises, which emphasizes the importance of enhancing production, promoting accessibility, and improving marketing (PAM).

**Box 3. Input services: indications for a way forward of the public sector**

Phase out	Retain
<p>Vegetable seed production: the management buy-in option by Bhutan Alpine Seeds of the vegetable and cash crop seed segment of the NSC (including infrastructure and production means) should be analysed carefully. The option should in all cases be pursued through a transparent competitive bidding process and be open to other potentially interested private competitors.</p>	<p>Seed and planting material: genetic resources and parent planting material production to kept with the RCs; field crop seeds' production retained until and for whichever type there is no private sector interest.</p>
<p>Animal breeding stock: layer and broiler DOC and pullet production through large and medium-scale private hatcheries. Strengthening and up-scaling of AI services with community workers.</p>	<p>Animal breeding stock: large animals maintained; and DOC/pullets to be downscaled at the pace of a growing private sector capacity and organization.</p>
<p>Input marketing: seeds/planting materials, fertilizers and feed through private wholesalers/retailers including a mix of CAs; OSSs; farmer groups facilitating all spontaneous up scaling processes; including increased DEPOT network for feed distribution.</p>	<p>Input marketing: herbicide and pesticide purchasing and distribution to be maintained pro-tempore. Fertilizers purchasing should be gradually downscaled at the pace of a growing private sector up-taking.</p>
<p>Machinery services: new machinery should be available only through private importers. Repair services and spare parts sales should be encouraged through private workshops. Organization of 'machinery rings' ought to be facilitated.</p>	<p>Machinery services: technical assistance and training services championed by AMS; collaborative programmes with the CNR and with RDTC;</p>
<p>Certification: to avoid further overstretching of BAFRA, all inspection and compliance certification services tied to inputs' supply to be handed over/ outsourced to interested private entities.</p>	<p>Regulatory: supervision by BAFRA to be maintained at all times.</p>



# ANNEX 1

## MoAF institutional set-up and 10th FYP

The MoAF has been recently<sup>1</sup> reorganized to better align itself to the decentralisation policy undertaken by the RGoB. MoAF is organized with four technical departments (of Agriculture, Forest, Livestock, Marketing and Cooperatives; DoA, DoF, DoL, DAMC); the Council of RNR Research; a non-Departmental Agency (for regulatory<sup>2</sup>, information and communication, biodiversity and rural training functions); and one Corporation (the Food Corporation of Bhutan). At Dzongkhag level the structure mirrors the one existing in MoAF headquarters and the respective district level agriculture, forest and livestock sectors are technically aligned with the Departments at central level but are administratively answerable to the Dzongkhag governors. The district offices (20) are organized each with District Agriculture, Forest and Livestock Offices (DoA, DoF, DoL), which are also reflected at every (205) geog level with EAs, one per sector (AEA, FEA, and LEA). From the planning and financing point of view the Dzongkhags operate through annual work plans and budgets, which cater for geog budgets as well. Any central programme and plan needs to be reflected operationally and financially in the Dzongkhag (and very soon also at geog level as these are going to have more autonomy) AWPB if they need to be implemented at this level.

The Council for RNR Research of Bhutan is under the MoAF and is responsible for research strategy, policy and general coordination matters. Four main research centres in different locations of Bhutan are now called Research and Development Centres (RDCs) and are each primarily in charge of research work for one sector (and are functionally placed under their respective departments): Agriculture (Wengkhari and Bajothang), Livestock (Jakar), and Forest (Yusipang).

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<sup>1</sup> Latest developments have been discussed during an annual planning workshop held on 10-12 March 2010 at Damphu, Tsirang.

<sup>2</sup> Through the Bhutan Agriculture and Food Regulatory Agency (BAFRA).



The DOA at central level also groups under its organisation a number of specialized national centres: the Agricultural Machinery Centre and the Post Harvest Centre (NAMC and NPHC, in Paro); the Plant Protection Centre, the Soil Service Centre, and the Mushroom Centre (NPPC, NSSC, and NMC in Semthoka); and the National Seed Centre (NSC, in Thimpu; formerly there was the Druk Seed Corporation, which has been phased out). The NAMC has four regional agricultural machinery centres: in Khangma (for the East); in Bhur (for the South and Centre) and in Bajothang (for the West-central areas). The Department of Marketing and Cooperatives has one regional unit which deals with the six eastern Dzongkhags and is based in Khangma.

As regards to training and capacity building, the main institution in charge of RNR staff training is the College of Natural Resources (CNR) in Lobesa (Wangdue), which is under the Royal University of Bhutan. Otherwise farmers' trainings are carried out at the Rural Development Training Centre (RDTC, in Zhemang).

The RNR 10th FYP is organized around 29 programmes.

In order to foster closer linkage between the central plans (detailed in the second volume of the 10th FYP, including the required technical, institutional and financial support for their implementation); harmonize the local plans with national policies; align central programme resources and inputs with local plans, the RNR sector carried out Dzongkhags level technical discussions with the field level RNR sector staff. This attempt is contained in the 3rd volume of the RNR 10th Plan: one geog three products (OGTP, see annex 2).

The MTR of the 10th FYP of the MoAF was conducted on 12th November 2010. The 29 programmes of the 10th plan have been re-organized around 12 compact outcomes, with identified specific responsibilities.

Resource allocation for the completion of the 10th plan are intended prioritized along eight lines of investment under one – umbrella programme which is called Accelerated Bhutan Socio-economic Development (ABSD):

- Rice commercialization;
- Contract farming and exports;

- Cooperatives and farmer groups;
- Sustainable Forest Management;
- Financial Inclusion;
- Irrigation and water management;
- Organic farming; and
- Service delivery.

## 10th FYP mid-term review

Programme Code	Programmes	Indicative Capital Expenditure Costs ('000 Nu)
MoAF/01	Commodity/Cereal Development	60.000
MoAF/02	Post Harvest Management	99.500
MoAF/03	Integrated Pest Management	30.000
MoAF/04	Irrigation and Water Management	70.500
MoAF/05	Seed and Plant Development	20.000
MoAF/06	Horticulture/Cash Crop Development	118.850
MoAF/07	Organic/Natural Agriculture	24.500
MoAF/08	National Medicinal and Aromatic Plants	40.450
MoAF/09	Integrated Soil Fertility & Sustainable Land Management	266.000
MoAF/10	Rural Access	516.090
MoAF/11	Farm Mechanization	60.696
MoAF/12	Extension Coordination and Information Management	12.000
MoAF/13	Feed & Fodder Development	23.076
MoAF/14	Livestock Health and Laboratory Services	145.492
MoAF/15	Livestock Breeding and Input Supply	146.670
MoAF/16	Livestock Production	442.640
MoAF/17	Targeted Highland Livelihood Support	34.760
MoAF/18	Participatory Forestry Management	83.200
MoAF/19	Non-wood Forest Resources Development	65.000
MoAF/20	Forest Resources Development	89.850
MoAF/21	Watershed Management and Plantation	123.000
MoAF/22	Forest Protection	243.040
MoAF/23	Nature Conservation	190.000
MoAF/24	Forestry and Environmental Education	170.550
MoAF/25	RNR Research	219.850
MoAF/26	Rural Development Training	14.520
MoAF/27	Agriculture Marketing	114.870
MoAF/28	Bio-security and Quality Assurance	117.185
MoAF/29	National Biodiversity Conservation	89.220
<b>Grand Total</b>		<b>3,626.509</b>

Outcome	Responsibility
1. Increased household and national food self-sufficiency	DOA
2. Increased production and for domestic and export markets	
3. Improved rural livelihood through increased road access	
4. Enhanced livestock production	DOL
5. Biodiversity resources managed sustainably to ensure diversity and resilience	DOFPS
6. Sustainable utilization of biodiversity resources contributes to improved rural livelihoods	
7. Increase Agriculture trade within and outside Bhutan	DAMC
8. Improved varieties of cereal-cash and fodder crops developed to enhance food security and income	CoRRB
9. Sustainable management practices and technologies developed to enhance productivity	
10. Biodiversity resources conserved and sustainably utilized to enhance livelihoods, food security and environment well-being	National Bio-diversity Centre
11. Bio-security and food safety enhanced	BAFRA
12. RNR farm enterprises increased through vocational training	RDC



## ANNEX 2

### OGTP Summary

#	Products	Definition	No. of Dzongkhags
1	Apple		3
2	Areca nut		3
3	Asparagus		8
4	Cardamom		5
5	Chilli	Fresh, Dried	10
6	Ginger		4
7	Groundnut		1
8	Honey		1
9	Maize		5
10	Maize Products	Tengma and other processed	6
11	Mandarin Orange	Citrus, orange	13
12	Mango		1
13	Mung bean	Black dal	1
14	Mushroom	Shiitake, Oyster/straw	10
15	Mustard	Edible oil	2
16	Organic Vegetable		2
17	Passion Fruit		2
18	Peas		1
19	Potato	Ware potato	14
20	Potato Products	Chips & other processed	1
21	Rajma Beans		2
22	Rice	Aromatic, Red	14
23	Seed Potato		2
24	Sugarcane		1
25	Vegetables	Cole crops-cabbage, cauli, tomato, cucumber, wild asparagus, onion, Carrot, Peas, Beans	9
26	Walnut	Soft shell	2
27	Boiler		1
28	Butter and Cheese	milk, milk products, butter, cheese, fresh cheese, dairy products, dates	19
29	Chevon	Commonly referred to as "mutton"	3
30	Chugo		2
31	Eggs	Eggs, poultry products, pullet	15

No. of Geog	Total Baseline	Total Target	Unit
5	1,640.96	2,130.85	MT/Year
8	535.05	1,235.25	MT/Year
9	747.00	1,332.00	MT/Year
8	225.93	530.11	MT/Year
24	2,006.03	2,977.68	MT/Year
9	548.40	736.60	MT/Year
1	5.00	10.00	MT/Year
1	0.00	1.20	MT/Year
9	2,702.60	3,491.00	MT/Year
9	38.50	69.50	MT/Year
53	12,996.92	24,347.53	MT/Year
1	200.00	350.00	MT/Year
1	3.00	20.00	MT/Year
16	245.10	727.90	MT/Year
4	226.86	314.60	MT/Year
3	25.50	82.00	MT/Year
6	1.00	64.50	MT/Year
1	273.27	523.50	MT/Year
40	31,774.86	44,789.00	MT/Year
1	0.70	1.50	MT/Year
4	162.50	448.00	MT/Year
28	12,514.93	16,678.66	MT/Year
2	4,025.62	4,500.00	MT/Year
1	1.30	6.00	MT/Year
20	11,872.90	22,633.60	MT/Year
3	1,070.00	3,000.00	Trees
1	3.50	8.00	MT/Year
53	1,232.35	1,943.14	MT/Year
3	3.90	16.30	MT/Year
3	8.68	12.30	MT/Year
49	327,693.03	2,305,284.67	Doz/Year

#	Products	Definition	No. of Dzongkhags
32	Fermented Cheese	Zoetey	1
33	Fermented Cream	Phelu	1
34	Fish	Fresh fish, fish	3
35	Fresh Milk		11
36	Ice Cream		1
37	Piglets		4
38	Pork	Piggery, pork,	11
39	Broom Grass		3
40	Cane and Bamboo	Raw materials (e.g. Construction)	2
41	Cane and Bamboo Products	Handicrafts pr other products made from cane & bamboo	3
42	Cordyceps		2
43	Daphne Paper		1
44	Ecotourism		1
45	Fodder Seeds		1
46	Incense	Sangzey	3
47	Lac		1
48	Lemon Grass Oil		1
49	Medicinal and Aromatic Plants	Pangi meto, Ruta, Goney, Yangku, Chirata	4
50	Medicinal Fruits	Aru, Baru, Churu, Star anise	1
51	Nya Dotshem		1
52	Sapindus		1
53	Spices	Pipla, Star anise, Xanthoxylum	6
54	Timber and Firewood		4
55	Tree Seedlings		2
56	Wild Boar Meat		1
57	Wild Vegetables	Cymbidium spp., Patsha, Fern tops	3
58	Wood Products	Handicrafts pr other products made from wood	2

No. of Geog	Total Baseline	Total Target	Unit
2	9.00	22.00	MT/Year
1	0.00	0.80	MT/Year
9	36.80	71.51	MT/Year
24	1,869.75	3,899.50	MT/Year
1	54,000.00	90,000.00	Sticks
7	639.00	9,915.00	Piglets
17	110.36	289.70	MT/Year
5	3,000.00	24,000.00	Bundles
15	6,000.00	102,580.00	Nos.
4	2.12	5.28	Nu. million/ Year
3	131.82	30.00	kg/Year
1	0.00	0.50	MT/Year
1	100.00	100.00	Households
1	1.00	5.00	MT/Year
4	1.00	30.00	MT/Year
1	0.50	0.80	MT/Year
1	800.00	1,500.00	Litre/Year
7	485.02	11.64	MT/Year
1	3.00	5.00	MT/Year
1	1.50	4.00	MT/Year
1		40.00	MT/Year
8	202.65	1,008.20	MT/Year
6	40,200.00	45,800.00	Nos.
2	2,500.00	45,000.00	Nos.
3			MT/Year
4	820.10	313.85	MT/Year
3	14.15	15.20	Nu. million/ Year



## ANNEX 3

### Farmer field schools

Past Farmer Field School<sup>1</sup> (FFS) experiences in Bhutan refer to the Wang Watershed Management Project (WWMP) and the on-going Agricultural Services Support Project both supported by the European Union. Responsibility for overall coordination of the FFS process would be within the Departments of MoAF. In all cases, it is necessary to be certain that in the selected districts where the approach is implemented, the capacity of the institutional operators and farmers that ought to be involved in project implementation be available at foreseen operational milestones.

The FFS, is an approach in which adult education and experiential learning methods is applied to enable groups of farmers to diagnose constraints and opportunities to improving production, food security and livelihoods, to agree on actions to be taken and to access relevant knowledge on both technical and institutional issues. Farmers exposed to the FFS approach are expected to build-up their capacity and accordingly make informed development and investment decisions.

Field Schools assume that farmers already have a wealth of experience, and knowledge. Field Schools are oriented to providing basic agro-ecological knowledge and skills, but in a participatory manner so that farmer experience is integrated into the programme. The Field School is initiated by an extension staff member of the government, farmers' organization, or NGO. But in all cases the facilitator must have certain skills.

The Field Schools and season long training are based on the crop phenology; seedling issues are studied during the seedling stage, fertilizers issues are discussed during high nutrient demand stages but also any other topic the group of farmers decide they want to focus on. This method allows using the crop, the animal, water or

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<sup>1</sup> The FFS concept originated from the FAO Inter-country Programme for Integrated Pest Management (IPM) in Asia. Since 1995, the approach has been introduced successfully in several countries. The term "Farmer Fields Schools" came from the Indonesian expression *Sekolah Lapangan* meaning just *field school*.



whatever else is the specific topic of the FFS, as a teacher-means, and to ensure that farmers can immediately use and practice what is being learned. Meeting on a weekly basis means that farmers are participating in a course for a whole season, but from an administrative/financial point of view, the same time as in an intensive one week programme. Also the courses are delimited by the crop/topic-cycle. There is a definite beginning and end. Field schools may extend beyond one season if groups agree. Most Field Schools are organized for groups of about 20-25 persons with common interests that can support each other, both with their individual experience and strengths, and to create a “critical mass”. The Field Schools are always held in the community where farmers live so that they can easily attend weekly and maintain the Field School studies. The EA travels to the site on the day of the Field School. The steps to create a FFS are as follows:

- Build a capacity within MoAF at central, Dzongkhag and Geog level to manage the FFS system, implement programmed investments and interventions, monitor the progress achieved by farmers’ groups and facilitate continuous exchange of experiences between groups; and knowledge linkages with subject matter specialists sourced from R&D as well as from other specialized national centres of MoAF;
- Provide practical training to district and geog level staff to promote the emergence of local human resources to become master trainers and skilled community facilitators capable of dealing with a range of different technical topics according to priorities expressed by farmers groups;
- Demonstrate the feasibility of integrating a farmer-based approach to extension and capacity building by enabling an increasing number of farmers to organize themselves FFS and facilitate extension activities in liaison with the Extension Agents, and to develop profitable activities to enable them to sustain and expand their common projects, thereby raising the skills of all the members; and
- Enable farmers and livestock holders to participate in FFS during a scheduled period of time.



# ANNEX 4

## Released crop varieties

(MoAF, 2011)

### List of released crop varieties

#### Field crop

Sl no	Name of varieties	Year of release	Releasing Agency	Yield Potential (t/acres)	Maturity (days after sowing)	Recommended Agro-Ecology (MaSL)
<b>1</b>	<b>Finger millet</b>					
	Lingmithang Kongpu-1	2002	RC Wengkhari	0.7 - 0.8	120	300-1700
	Lingmithang Kongpu-2	2002	RC Wengkhari	0.64 - 0.85	140	300-1700
<b>2</b>	<b>Maize</b>					
	Yangtsipa	1992	RC Wengkhari	1.2 - 1.6	120-130	<1800
	Khangma Ashom 1	1999	RC Wengkhari	2.0	140-160	<1800
	Khangma Ashom 2	1999	RC Wengkhari	1.6 - 2.0	110-120	<1800
<b>3</b>	<b>Mungbean</b>					
	KPS-2	2002	RC Wengkhari	0.3	120-130	800-1200
	Bari Mung	2002	RC Wengkhari	0.3	120-130	800-1200
<b>4</b>	<b>Mustard Oil Seed</b>					
	M-27	1989	RC Bajo	0.4	85-90	<2000
	Bajo Peka 1	1994	RC Bajo	0.5	145-155	<2000
	Bajo Peka 2	1994	RC Bajo	0.4	120-130	<2000
<b>5</b>	<b>Potato</b>					
	Ysikap	1988	RC-Yusipang	20.0 - 25.0	100-120	<2500
	Kufri Joyti	1989	RC-Yusipang	20.0 - 23.0	100-120	<2500
	Desiree	1989	RC-Yusipang	15.0 - 18.0	90	1000 - 2000
	Khangma kaap	2002	RC Wengkhari	16.0 - 20.0	100-105	600-2500
<b>6</b>	<b>Rice</b>					
	IR 64	1988	RC Bajo	2.0 - 3.2	140-155	600-1500
	IR 20913	1989	RC Bajo	1.6 - 2.4	130-140	600-1500
	No11	1989	RC Bajo	1.6 - 2.4	160	Above 1500
	BR 153	1989	RC Bajo	1.2 - 1.6	140-150	Upto 600
	BW 293	1990	RC Bajo	1.2 - 1.8	140-150	Upto 600
	Khangma maap	1999	RC Wengkhari	20.0-25.0	120-130	Above 1500
	Bajo Maap 1	1999	RC Bajo	2.0 - 3.2	150-155	600-1500
	Bajo Maap 2	1999	RC Bajo	2.0 - 3.0	145-155	600-1500
	Bajo Kaap 1	1999	RC Bajo	2.0 - 3.4	145-155	600-1500
	Bajo Kaap 2	1999	RC Bajo	2.0 - 3.4	150-165	600-1500
	Yusi Ray Maap	2002	RC Yusipang	2.5 - 3.5	170-180	1500-1800
	Yusi Ray Kaap	2002	RC Yusipang	2.5 - 3.5	170-180	Above 1800
	Wengkhari Rey Kaap 2	2002	RC Wengkhari	1.7 - 1.9	160-165	1000-1800
	Wengkhari Rey Kaap 6	2006	RC Wengkhari	1.7 - 1.9	160-165	1000-1800

**Note:** \*Varieties notified for provisional release

\*\*Varieties notified for export and not for local sale

Source: Council for RNR Research of Bhutan (CoRRB)

## Horticulture / Vegetable crops

SI no	Name of varieties	Year of release	Releasing agency	Yield potential (t/acres)	Maturity (days after sowing)	Recommended agro-ecology (MaSL)
<b>1</b>	<b>Asparagus</b>					
	Merry Washington	2002	DSC	0.5 - 1	2-3 yrs	1000-2500
	UC- 157 (Hybrid)	2006	DSC	1.0 - 2.0	2-3yrs	1000-2600
<b>2</b>	<b>Beans</b>					
	Borloto	1990	RC Bajo	2.0 - 4.0	65-70	<1500
	Pusa Parvati	1999	RC Bajo	2.5 - 3.5	50-60	<1500
	Green Arrow	1999	RC Bajo	2.0	60	700-2000
	Top Crop	1990	RC Bajo	1.0-2.0	70-85	<1500
	Rasma	1994	RC Bajo	2.5	80-90	700-2000
	White no.1**	2004	DSC	1.5 - 2.5	70-80	700-1500
	Selection 9**	2004	DSC	1.5 - 3.0	70-80	<2200
<b>3</b>	<b>Bulb Onion</b>					
	Senshu Red	1994	NASEPP	7.0	120-170	<2600
	White Creole	2002	DSC	5.0 - 7.0	120-160	<2600
	Bajogop 1	2002	RC Bajo	7.0 - 8.0	120-140	<2200
	Bombay	2002	DSC	4.0 - 6.0	110-160	<2200
<b>4</b>	<b>Bunching Onion</b>					
	No 21	2002	DSC	1.0 - 3.0	80-90	<2600
<b>5</b>	<b>Bottle Gourd</b>					
	Mindapur	1999	RC-Bajo	6.0 - 7.0	85-95	<1500
<b>6</b>	<b>Brinjal</b>					
	Paro Local	1990	NASEPP	1.0 - 2.0	90-100	<2600
	Big Round	1990	NASEPP	2.0 - 4.0	75-90	600-1500
	Pusa purple Long	1990	RC-Bajo	2.0 - 3.0	90-110	600-1500
<b>7</b>	<b>Beetroot</b>					
	DDR*	2004	DSC	4.0 - 5.0	70-80	<2500
<b>8</b>	<b>Broccoli</b>					
	Desico	1994	RC Bajo	0.8 - 1.0	100-110	600-2600
<b>9</b>	<b>Cabbage</b>					
	Copenhagen	1990	RC Bajo	9.0 - 10.0	75-85	<2600
	Market					
	Golden Acre	1990	RC Bajo	5.0 - 6.0	70-80	<2600
	Green Coronate (Hybrid)	2006	DSC	12.0 - 13.0	80-90	Across all AEZ
	Gianty (Hybrid)	2006	DSC	11.0 - 12.0	70-80	Across all AEZ
	T1-163 (Hybrid)	2006	DSC	10.0 - 11.0	65-75	Across all AEZ
	Bonday Cross (Hybrid)	2006	DSC	10.0 - 11.0	90-110	Across all AEZ
	Lucky Ball (Hybrid)	2007	DSC	9.0 - 10.0	80-100	
<b>10</b>	<b>Capsicum</b>					
	California Wonder	1990	RC-Bajo	4.0 - 5.0	75-80	700-2000
<b>11</b>	<b>Carrot</b>					
	Early Nantes	1990	RC-Bajo	4.0 - 6.0	80-90	600-2600
	Nisa	2002	DSC	4.0 - 6.0	90-100	<2000
	Khuruda	2006	RC-Wengkhar	14.0	105	600-2500
	All Seasons Cross (Hybrid)	2006	DSC	8.0 - 10.0	110-120	<2200

<b>12</b>	<b>Cauliflower</b>					
	White top	1990	RC Bajo	10.0 - 15.0	100	1500-2600
	White Summer	1990	RC Bajo	10.0 - 12.0	90-100	1500-2000
	19905	2002	DSC	3.0 - 4.0	120	1500-2200
	Khangma Kopi 1	2004	RC-Wengkhar	7.0 - 8.0	90	600 to 2500
	Khangma Kopi 2	2004	RC-Wengkhar	10.0 - 12.0	120	600 to 2500
<b>13</b>	<b>Chilli</b>					
	Super Solo*	2004	RC-Wengkhar	19.0	90-10	700 to 2500
	Sha Ema	1990	RC-Bajo	15.0 - 20.0	90-100	600-2000
	Yangtse aeyma	2007	RC-Wengkhar	4.0 - 6.0	90-100	1000-2000
<b>14</b>	<b>Cucumber</b>					
	Shabigenchu	1990	NASEPP	1.2 - 2.0	70 - 100	<2400
	Bajogenchu 1	1999	RC-Bajo	2.0 - 4.0	70-85	<2000
<b>15</b>	<b>Celery</b>					
	Cornel	2002	DSC	5.0 - 6.0	120-160	<2600
<b>16</b>	<b>Chinese Cabbage</b>					
	Kyoto 1	1990	RC-Bajo	12.0 - 16.0	60-85	1500-2200
<b>17</b>	<b>Garlic (bulb)</b>					
	Local	1990	NASEPP	4.0 - 6.0	230-250	<2000
<b>18</b>	<b>Japanese Green</b>					
	Taisai	1990	NASEPP/DSC	3.0 - 4.0	40-50	<2600
	Mibuna	1990	NASEPP/DSC	3.0 - 4.0	40-50	<2600
<b>19</b>	<b>Ladies Finger/Okra</b>					
	Kranti	2004	DSC	3.0 - 5.0	70-80	600-1500
<b>20</b>	<b>Lettuce</b>					
	Great Lake	1990	NASEPP	3.0 - 4.0	70-80	<2600
<b>21</b>	<b>Mustard Green</b>					
	Wengkhar Petshe 1*	2004	RC Wengkhar	3.5 - 4.0	100-120	600-2600
	Wengkhar Petshe 2*	2004	RC Wengkhar	3.5 - 4.0	100-120	600-2600
	Him Beauty	1990	NASEPP/DSC	2.5 - 4.0	50-60	1200 - 2600
	Takana Red	1990	NASEPP/DSC	2.0 - 3.0	50-60	1200 - 2600
<b>22</b>	<b>Pumkin</b>					
	Rongthong Brumsha	1990	NASEPP	2.0 - 4.0	100-140	<1200
	Tetsu Kabuta	1990	NASEPP	2.0 - 3.0	90-100	<1500
	Summer Squash	1994	NASEPP	1.0 - 2.0	60-80	<2400
	Wengkhar Kakur	2002	RC Wengkhar	1.0 - 2.0	90-100	<1700
<b>23</b>	<b>Pea</b>					
	Arkel	2002	DSC	1.0 - 2.0	65-75	All AEZ
	Usui	2002	DSC	2.0 - 3.0	90-100	<1800
<b>24</b>	<b>Parsley</b>					
	Paramount	1990	NASEPP	2.5 - 3.5	130-160	<2200
<b>25</b>	<b>Radish</b>					
	Spring Tokanashi	1990	RC Bajo	8.0-10.0	50-80	<2600
	Minowase	1990	NASEPP	9.0 - 10.0	50-60	<2000
	Bajo Laphu 1	2002	RC Bajo	12.0 - 20.0	45	<1500
<b>26</b>	<b>Spinach</b>					
	All Green	1990	RC Bajo	4.0 - 10.0	50-60	<1500
	Leaf Beet	2002	DSC	4.0 - 10.0	50-70	<1800
<b>27</b>	<b>Tomato</b>					
	Roma	1990	RC Bajo	4.0 - 6.0	90-150	<1500
	Cherry Tomato	1999	RC Bajo	8.0 - 12.0	60-70	1300-1800
	Nozomi	1990	RC Bajo	4.5 - 6.0	90-100	1000-2200
	Bajo Lambenda 1	2002	RC Bajo	9.0 - 10.0	80-90	700-2200
<b>28</b>	<b>Turnip</b>					
	PTWG	1990	NASEPP	8.0 - 12.0	60-70	>1000
	Local Purple	1990	NASEPP	8 - 12 t/ac	70-90	>1000

## Fruit crops

sl no	Name of varieties	Year of release	Releasing agency	Yield potential (t/acres)	Maturity/ harvest time (Days or Month)	Recommended agro-ecology (MaSL)
<b>1</b>	<b>Apple (Scion)</b>					
	Red Delicious	1994	RC- Yusipang	7.0	Sept-October	2000 - 2800
	Royal Delicious	1994	RC- Yusipang	7.0	Sept-October	2001 - 2800
	Golden Delicious	1994	RC- Yusipang	3.7	Sept-October	2002 - 2800
	Jonathan	1994	RC- Yusipang	5.0	October	2003 - 2800
	Rich-a-red	1994	RC- Yusipang	3.5	August-Sept.	2004 - 2800
	Lobo	2002	RC- Jakar	3.2	Late Sept.	2005 - 2800
	Red Chief	2004	RC- Yusipang	2.0 - 3.0	Sept-October	2000 - 2500
	Red Free	2004	RC- Yusipang	3.8	Mid August	2000 - 2500
	Bajo Apple	2004	RC- Bajo	2.5	Mid July	1000 - 1500
	Fuji	2007	DSC	5.0 - 7.0	October	2000 - 2500
	Mutsu	2007	DSC	5.0 - 7.0	Early October	2000 - 2500
<b>2</b>	<b>Apple Root Stock</b>					
	MM-106	1994	RC-Yusipang	Rootstock		>2000
	MM9	2006	DSC	Rootstock		>2000
	MM-111	2006	DSC	Rootstock		>1200
<b>3</b>	<b>Apricot</b>					
	Bajo Khamchung 1	2002	RC-Bajo	2.5 - 4.8	Mid May	1200 - 2000
	Shakapara	2002	DSC	3.0 - 4.0	May	<1800
<b>4</b>	<b>Arecanut</b>					
	Bhur selection	2004	DSC	3.0 - 5.0	Dec-March	<1000
<b>5</b>	<b>Almonds</b>					
	Texas	2004	RC-Bajo	0.12 kg/tree	Late August	1300 - 2500
	Drake	2004	RC-Bajo	0.45 kg/tree	Late August	1301 - 2500
	Dhebhar Badhan	2004	RC-Bajo	2.5 kg/tree	Late August	1302 - 2500
	Kagzi	2004	RC-Bajo	1.6 kg/tree	Early August	1303 - 2500
<b>6</b>	<b>Banana</b>					
	Jaji	2002	DSC	5.0 - 7.0	Sept - April	<1500
	Gheukola	2002	DSC	5.0 - 7.0	Sept - April	<1500
	Chinichampa	2002	DSC	3.0 - 5.0	Sept - April	<1500
<b>7</b>	<b>Cardamom</b>					
	Bharlangey	2002	RC-Jakar	0.25 - 0.35	Sept-Oct	900 - 1600
	Golsey	2002	RC-Jakar	0.25 - 0.35	August-Sept	900 - 1200
<b>8</b>	<b>Table Grapes</b>					
	Muscate of Alexandria	2004	RC-Bajo	3.0	August	500 - 1800
	Perlette	2004	RC-Bajo	1.0	June	500 - 1800
<b>9</b>	<b>Litchi</b>					
	Bhur selection-1*	2004	DSC	9.0 - 10.0	June-july	<1200
	Shahi*	2006	DSC	10.0 - 12.0	Late June	<1200
	Early Bedana	2006	DSC	8.0 - 9.0	Early June	<1200
<b>10</b>	<b>Lime</b>					
	Bears (Swingle)	2004	RC-Bajo	1.0 - 2.0	Aug-January	500 - 1500
	Rangpur lime (as root-stock)	2004	RC-Bajo	Rootstock	Rootstock	700 - 1500
<b>11</b>	<b>Mandarin/Orange</b>					
	Dorokha Selection*	2004	DSC	4.0 - 5.0	Oct-December	700 - 1700
	Wengkhar Tshelu 1	2007	RC-Wengkhar	>3.0	Mid November	1300 - 1700
	Wengkhar Tshelu 2	2007	RC-Wengkhar	>3.0	Mid November	1300 - 1700

<b>12</b>	<b>Mandarin rootstock</b>					
	Wengkhar Tshelurhato	2006	RC-Wengkhar	Rootstock		800 - 1600
	Carrizo	2006	DSC	Rootstock		800 - 1800
	Troyer citranze	2006	DSC	Rootstock		800 - 1800
	Cleopatra	2006	DSC	Rootstock		800 - 1800
<b>13</b>	<b>Mango</b>					
	Langra	2002	DSC	5.0 - 7.0	July-August	<1500
	Chausa	2002	DSC	4.0 - 6.0	August	<1500
	Daseree	2002	DSC	3.0 - 4.0	July-August	<1500
<b>14</b>	<b>Musk Melon</b>					
	Honey Dew	1990	RC-Bajo	2.0 - 4.0	90-110	600 - 1500
<b>15</b>	<b>Peach</b>					
	BajoKham 1	2002	RC-Bajo	3.0 - 4.0	Mid may	1000 - 2000
	BajoKham 2	2004	RC-Bajo	2.9 - 3.7	July	1200 - 2500
	Bathpala Super*	2004	RC-Jakar	4.0 - 6.0	July - August	2000 - 2600
	Nonomiwase	2002	DSC	5.0 - 8.0	June-july	>1500
<b>16</b>	<b>Pear</b>					
	Hosui	2002	DSC	6.0 - 7.0	Mid August	1500 - 2200
	Kosui	2002	DSC	5.0 - 6.0	July Early August	1500 - 2000
	Bajo Lhee 1	2004	RC-bajo	2.0 - 3.0	August	1300 - 2500
	Zhey Lhee *	2004	RC-Jakar	4.8 - 5.5	Early October	<2000
<b>17</b>	<b>Plum</b>					
	Santa Rosa	2002	DSC	3.0 - 5.0	May-June	>1700
	Oishiwase	2002	DSC	5.0 - 6.0	May-June	>1700
	Jambay Lhakhang Chuli	2004	RC-Jakar	4.0 - 5.0	July-August	2000 - 2600
<b>18</b>	<b>Persimom</b>					
	Fuyu*	2004	DSC	3.0 - 4.0	Mid November	1000 - 1650
	Jiro*	2004	DSC	3.0 - 4.0	Early October	1000 - 1650
	Wengkhar anday 1	2007	RC- Wengkhar	2.0 - 3.0	Mid October	1500 - 2300
<b>19</b>	<b>Pomegranate</b>					
	Bedana*	2004	DSC	2.5 - 4.0	Late August	<1500
<b>20</b>	<b>Passion fruit</b>					
	Local	2004	DSC	1.0 - 2.0	May-June	<1500
<b>21</b>	<b>Strawberry</b>					
	Yusi sagong 1	2006	RC-Yusipang		0.7	8 months
						1500 - 2500
<b>22</b>	<b>Walnut</b>					
	KantheI	2004	RC-Yusipang	1.0 - 1.5	September	1400 - 2800
	Yusipang 2	2004	RC-Yusipang	0.5 - 1.0	September	1400 - 2800

**Note:** \*Varieties notified for Provisional Release

\*\*Varieties Notified for Export and not for local sale

Source: Council for RNR Research of Bhutan (CoRRB)

## Feed and fodder crops

Sl No	Variety	Year of release	Releasing agency	Yield potential (dry matter yield, t/ac)	Maturity for grazing	Recommended agro-ecology (MaSL)
1	Paspalum Atratum Var. CIAT 26986	2002	RC-Jakar	2.0 - 3	1 yr (Perennial)	<1500
2	Palisade Grass	2002	RC-Jakar	3.2 - 3.6	1 yr (Perennial)	<1500
3	Lucerne Var. Eureka	2002	RC-Jakar	1.6 - 2.5	1 yr (Perennial)	1000-2800
4	Swede Var. Ostega	2001	RC-Jakar	2.0 - 2.5	1 yr (annual)	2500-2700
5	Oat (FOB)	2001	RC-Jakar	2.0 - 3.0	1 yr (annual)	20 - 4000
6	Oat (Naked)	2004	RC-Jakar	2.0 - 3.0	1 yr (annual)	200-4000
7	Oat (Sampede)	2004	RC-Jakar	2.2 - 4.0	1 yr (annual)	200-4000
8	Fodder Beet (Alba)	2004	RC-Jakar	1.5 - 3.0	1 yr (annual)	2000-3500
9	Gautemala Grass	2004	RC-Jakar	1.2 - 2.4	1 yr (annual)	<1500
10	White Clover Var. Ladino	2001	RC-Jakar	3.2 - 4.4	1 yr (Perennial)	1700-3300
11	Italian Rye grass Var. Lipo	2001	RC-Jakar	1.2 - 2.2	1 yr (Perennial)	2000-3000
12	Cocks foot., Var Amba	2001	RC-Jakar	0.8 - 1.2	1 yr (Perennial)	2000-3500
13	Tall Fescue Var. Barcel	2001	RC-Jakar	1.5 - 3.0	1 yr (Perennial)	2000-3500
14	Willow	2001	RC-Jakar	0.8 - 2.2	3 yr (Fodder Tree)	1700 - 2800
15	Molasses grass	2001	RC-Jakar	1.6 - 2.4	1 yr (Perennial)	<2000
16	Ruzi	2002	RC-Jakar	2.8 - 3.2	1 yr (Perennial)	500-2000
17	Sugarcane	2002	RC-Jakar	16.0 - 20.0	1 yr (Annual)	<1200
18	Fig	2001	RC-Jakar	3.0 - 3.5	2-3yrs (Fodder Tree)	300-2000
19	Fodder peanut	2001	RC-Jakar	1.1 - 2.0	1 yr (Perennial)	<1500
20	Stylo Var. CIAT 184	2001	RC-Jakar	4.0 - 12.0	1 yr (Perennial)	<1200
21	Kikuyu grass	2001	RC-Jakar	4.0 - 6.0	1 yr (Perennial)	1000 - 2300
22	Napier	2001	RC-Jakar	4.0 - 6.0	1 yr (Perennial)	<2000
23	Greenleaf desmodium	2001	RC-Jakar	2.0 - 2.5	1 yr (Perennial)	<1500
24	Guinea grass	2007	RC-Jakar	2.4 - 3.2	1 yr (Perennial)	>1000

Source: Council for RNR Research of Bhutan (CoRRB)

# ANNEX 5

## Note by National Seed Centre

### The annual demand/sale forecasts

(Demand based on average sale of at least 3 years)

**Table 1. Seeds/Seedlings**

Sl. No	Item	Unit	Quantity
1	Food Crops	Mt	140.00
2	Vegetable Seeds	Mt	4.00
3	Seed Potato	Mt	300.00
3	Fruit plants	Nos.	180000.00
4	Asparagus	Nos.	150000.00

**Table 2. Fertilizers**

The annual sales volume is approximately 3300.00 Mt. The major commodity is presented below.

Sl. No	Item	Unit	Quantity
1	Suphala	Mt	100.00
2	SSP	Mt	500.00
3	Urea	Mt	1.400.00

**Table 3. Weedicide**

Sl. No	Item	Unit	Quantity
1	Butachlor	Mt	320.00



**Current production capacity of seed/seedling on NSC  
Farms across the country  
(About 115 ha)**

**Table 1. Seedlings**

Sl. No	Farm	Unit	Major production activities	Production quantity (average)
1	Bondey/ Jeuphu/ Chundudingkha Farms at Paro	Nos.	Temperate fruit plants & Asparagus	120,000.00
2	Bhur Farm	Nos.	Sub-tropical Fruit plants	160,000.00
3	Bajo Farm	Nos.	Asparagus	50,000.00

**Table 2. Vegetable, Cereals & Seed Potato**

Sl. No	Farm	Unit	Major production activities	Production quantity (average)
1	Bondey Farm	Kg	Vegetable seeds	200.00
2	Bajo Farm	Kg	Vegetable seeds & Mid- altitude rice	15,500.00
3	Phobji Farm	Kg	Seed Potato	20,000.00
3	Chenary Farm	Kg	Vegetable seeds & Maize	800.00
4	Bhur farm	Kg	Low altitude rice	18,000.00

## Current production capacity of Seed Growers Groups

**Table 1. Vegetable, Cereals & Seed Potato**

Sl. No	Location	Unit	Major production activities	Production quantity (average)
1	Paro Farmer Group	Kg	High altitude rice & Vegetable seeds	16,000.00
2	Chapcha Farmer Group	Kg	Seed Potato	20,000.00
3	Dagana Farmer Group	Kg	Oil Seeds	2,000.00
	Sephu & Phobji Grower Groups	Kg	Seed Potato	280,000.00
5	Chamkar & Ura Grower Groups	Kg	Seed Potato	250,000.00
6	Trashigang Grower Groups	Kg	Maize, Vegetable & Food Crop	50,000.00
7	Sarpang Grower Groups	Kg	Low altitude rice	20,000.00

## Selling Price as of 20 August 2010

Sl. No.	Crop	Selling Price in Nu/ Unit		Remarks
		Unit	Ex.Go-Down	
<b>Cereal Seeds</b>				
1	Maize-Var. Yangtsepa	Kg	25.00	10 Kg Pack
2	Paddy-Var. BR-153	Kg	27.50	20 Kg Pack
3	Paddy-Var. IR-64	Kg	27.50	20 Kg Pack
4	Paddy Chumro	Kg	40.00	20 Kg Pack
5	Wheat-Sonalika	Kg	33.00	20 Kg Pack
6	Millet-Local	Kg	20.00	5 Kg Pack
7	Mustard-M27	Kg	40.00	5 Kg Pack
8	Bean-Var. pusaparvi	Kg	125.00	5 kg pack
<b>Vegetable Seeds</b>				
1	Broccoli-Var. Dessico50g	50 g	20.00	50 g Packet
2	Broccoli Hybrid-Centauro	10 g	140.00	10 g Packet
3	Beet Root-Var. DDR	10 g	20.00	10 g Packet
4	Brinjal-Var. Pusa Purple Long	10 g	20.00	10 g Packet
5	Bunching Onion-Var. No.21	10 g	20.00	10 g Packet

Sl. No.	Crop	Selling Price in Nu/ Unit		Remarks
		Unit	Ex.Go-Down	
6	Bottle Gourd-Var. (Hybrid)	10 g	40.00	10 g Packet
7	Chilli-Var. Sha ema	10 g	20.00	10 g Packet
8	Chilli-Var. Super solo	10 g	30.00	10 g Packet
9	Capsicum-Var. C. Wonder	5 g	30.00	5 g Packet
10	Cabbage-Var. Golden Acre	10 g	25.00	10 g Packet
11	Cabbage-Hybrid Varieties	10 g	110.00	10 g Packet
12	Cauliflower-Hyb. Var. Snow Mystique	10 g	125.00	10 g Packet
13	Cauliflower-Var. Khangma Early	10 g	20.00	10 g Packet
14	Cauliflower-Var. Khangma Late	10 g	20.00	10 g Packet
15	Carrot-Var. New Kuroda	10 g	20.00	10 g Packet
16	Carrot-Var. All Season Cross	10 g	50.00	10 g Packet
17	Carrot-Var. Early Nantes	10 g	20.00	10 g Packet
18	Chinese Cabbage-Var. Kyoto	10 g	20.00	10 g Packet
19	Cucumber-Var. Santon-1	10 g	20.00	10 g Packet
20	Coriander-Var. Local	10 g	20.00	10 g Packet
21	French Bean-Var. Selection- 9	50 g	15.00	50 g Packet
22	French Bean-Var. Pole bean white	50 g	20.00	50 g Packet
23	French Bean-Var. Borloto	50 g	15.00	50 g Packet
24	Japanese Green-Var. Taisai	10 g	20.00	10 g Packet
25	Japanese Green-Var. Mibuna	10 g	20.00	10 g Packet
26	Lettuce-Var. Great Lake	5 g	25.00	5 g Packet
27	Lady Finger-Var. Kranti	10 g	20.00	10 g Packet
28	Mustard Green Him Beauty	10 g	20.00	10 g Packet
29	Onion-Var. Bombay Red	10 g	25.00	10 g Packet
30	Onion-Var. Hybrid Pune Red	10 g	30.00	10 g Packet
31	Pea-Var. Usui	50 g	15.00	50 g Packet
32	Pumpkin-Var. Tetsu kabuta (Hybrid)	10 g	30.00	10 g Packet
33	Radish-Var. Bajo Laphu 10g	10 g	10.00	10 g Packet
34	Radish-Var. Bajo Laphu 50g	50 g	20.00	50 g Packet
35	Radish-Var. Minowase 10g	10 g	10.00	10 g Packet
36	Radish Minowase 50g	50 g	20.00	50 g Packet
37	Radish-Var. Hybrid(Ivory White)	10 g	30.00	10 g Packet
38	Radish Spring Tokinashi	10 g	25.00	10 g Packet
39	Spinach-Var. All Green	10 g	20.00	10 g Packet
40	Spinach-Var. Leaf beat	10 g	20.00	10 g Packet
41	Squash-Var. Zucchini (Hybrid)	10 g	75.00	10 g Packet
42	Tomato Roma	10 g	20.00	10 g Packet
43	Tomato-Var. Ratan	5 g	20.00	5 g Packet
44	Turnip-Var. Purple Top White Globe	10 g	20.00	10 g Packet

Sl. No.	Crop		Selling Price in Nu/ Unit	Remarks
1	Orange seedling- Non Grafted	Nos.	32.00	
2	Orange seedling- Grafted	Nos.	40.00	
3	Mango-Var. Langra/Dasheree/ Amrapali/Chausa	Nos.	60.00	
4	Jack Fruit-Var. Bhur S-1	Nos.	25.00	
5	Pomegranate-Var. Bedana	Nos.	50.00	
6	Guava-Var. L-49	Nos.	50.00	
7	Litchi-Var. E-Bedana/Shahi	Nos.	50.00	
8	Banana suckers-Variou s	Nos.	25.00	
9	Passion Fruits-Local	Nos.	10.00	
10	Areca Nut	Nos.	25.00	
11	Asparagus-Var. UC157(F2)	Nos.	4.50	
12	Almond-Var. Kagzi	Nos.	50.00	
13	Apple- All varieties	Nos.	50.00	
14	Apricot-Var. Shakharpapa	Nos.	50.00	
15	Cherry-Var. Seneka	Nos.	50.00	
16	Chestnut-Var. Jep hu-1	Nos.	50.00	
17	Peach-Var. N-Wase/S-Hakuto	Nos.	50.00	
18	Pear-Var. Hosui/Kosui/Chujoro	Nos.	50.00	
19	Plum-Var. Santarosa/Stanley	Nos.	50.00	
20	Persimmon-Var. Fuyu	Nos.	125.00	
21	Walnut-Var. Kazji	Nos.	110.00	
22	Walnut Seedling	Nos.	50.00	
23	Lemon	Nos.	50.00	
24	Strawberry- Chandler	Nos.	8.00	
25	Papaya	Nos.	25.00	

### Ornamental Plants

Sl. No.	Crop	Unit	Selling Price per Unit	Remarks
1	Group 1 (High value plants e.g. Orchids, Azalea hybrids)	Nos.	200.00	Price for plant in full bloom is Nu. 400/plant
2	Group 2 (Low value plants e.g. Azalea single)	Nos.	150.00	
3	Whole sale price of ornamental Orchid Azalea (only single)	Nos.	150.00 75.00	Minimum bulk – 100 Nos. for whole sell price to be effective

### Fertilizers and Supplements

Sl. No.	Types of Fertilizers	Unit	Selling Price per Unit	Remarks
1	Urea	50 kg	379.00	50 kg pack
2	Urea	10 kg	98.00	DSC's 10 kg pack
3	Suphala (NPK 15:15:15)	50 kg	734.65	50 kg pack
4	Suphala (NPK 15:15:15)	20 kg	330.34	20 kg pack
5	SSP (16% P <sub>2</sub> O)	50 kg	428.00	50 kg pack
6	DAP (18% N 46% P <sub>2</sub> O)	50 kg	821.50	50 kg pack
7	Bone Meal	50 kg	694.00	50 kg pack
8	Rock Phosphate	50 kg	164.00	50 kg pack
9	MOP (60% K <sub>2</sub> O)	50 kg	432.00	50 kg pack
<b>Herbicides and Others</b>				
10	Butachlor	10 kg	231.00	10 kg pack
11	Borax	5 kg	888.00	DSC's 5 kg pack



# ANNEX 6

## Fertilizers, herbicides and pesticides

### Fertilizers and herbicides

Sl. No.	Types of Fertilizers	Unit (bag)	Selling Price per bag	Remarks
1	Urea	50 kg	379.00	50 kg pack
2	Urea	10 kg	98.00	DSC's 10 kg pack
3	Suphala (NPK 15:15:15)	50 kg	734.65	50 kg pack
4	Suphala (NPK 15:15:15)	20 kg	330.34	20 kg pack
5	SSP 16% P <sub>2</sub> O	50 kg	428.00	50 kg pack
6	DAP (18% N 46% P <sub>2</sub> O)	50 kg	821.50	50 kg pack
7	Bone Meal	50 kg	694.00	50 kg pack
8	Rock Phosphate	50 kg	164.00	50 kg pack
9	MOP (60% K <sub>2</sub> O)	50 kg	432.00	50 kg pack
10	Butachlor	10 kg	231.00	50 kg pack
11	Borax	5 kg	888.00	DSC's 10 kg pack size

Source: National Seed Centre, DoA, Paro

### Price of pesticides

February, 2010

Sl. No.	Products	Unit	Rate (Per unit)
<b>1</b>	<b>INSECTICIDES</b>		
1	Chlorpyrifos 20 EC	100 ml	28.00
2	Cypermethrin 10 EC	100 ml	27.00
3	Dimethoate 30 EC	100 ml	40.00
4	Fevelerate 0.4 D	1kg	37 .00
5	Malathion 5D	1kg	68 .00
6	Malathion 50 EC	100 ml	51. 00
<b>2</b>	<b>FUNGICIDES</b>		
1	Carboxin 75 WP	25kg	37,485 .00
2	Captan 50 WP	500 gm	177.00
3	Carbendazim 50 WP	500 gm	177.00
4	Copper Oxychloride 50 WP	500 gm	171.00
5	Hexaconazole 5 EC	100 ml	38.00
6	Mancozeb 75 WP	500 gm	162.00
7	Metatalaxyl 8% Mancozeb 64% (Ridomil)	100 gm	111.00
8	Propiconazole 25 EC	500 ml	641.00
9	Sulfur 80 WP	500 gm	89.00
10	Tricylazole 75 WP	100 gm	168 .00
<b>3</b>	<b>HERBICIDES</b>		
1	Glyphosate 41SL	1lt.	410.00
2	Metribuzin 70 WP	100 gm	141.00
<b>4</b>	<b>RODENTICIDES</b>		
1	Zinc phosphate 80 W/W	10 gm	8.00
<b>5</b>	<b>ACARICIDES</b>		
1	Dicofol 18.5 EC	100 ml	79.00
<b>6</b>	<b>NON TOXIC</b>		
1	Sticker/Spreader (sandovit)	1lt.	189.00
2	Tree Spray oil (TSO )		101.00
<b>7</b>	<b>BIO-PESTICIDES</b>		
1	Trichoderma viride	500 gm	116 .00

Source: National Plant Protection Center, DoA



**Please address comments and inquiries to:**

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