

Renewable Natural Resources (RNR) Research Programme in Bhutan : An Overview

Narendra K. PRADHAN¹⁾, Kinlay TSHERING²⁾, Karma DORJI¹⁾ and Tashi SAMDUP¹⁾

1) Council for Renewable Natural Resources Research of Bhutan (CoRRB), Ministry of Agriculture, Thimphu, Bhutan.

2) Renewable Natural Resources Research Centre, Yusipang, CoRRB. Ministry of Agriculture, Thimphu, Bhutan

Summary : The objective of this paper is to give an overview of how the Renewable Natural Resources (RNR) research is being implemented in Bhutan. The RNR sector comprises mainly of agriculture, livestock and forestry sectors. Agriculture research in Bhutan initially started in early 1960s through the introduction of new crop and fruit varieties from Indian Agriculture Research Institutes. Thereafter, livestock and forestry research started in livestock farms and forestry research institutes, respectively. The first Agriculture Research Institute in Bhutan was established in 1982 which underwent various changes culminating into the present Council for RNR Research of Bhutan (CoRRB) in 2003. The Council is chaired by the Minister of Agriculture and the Director of CoRRB functions as the member Secretary of the Council. Four research centres with national and regional mandates located at strategic locations of the country were established to cater to the research and development needs of the farmers living in different agro-ecological zones. These centres are mandated to carry out research in the field of agriculture, horticulture, livestock, forestry and other cross cutting sectors of soils, plant protection, water management, meteorology, socio-economic studies. Apart from the Regional centres of research, there are sub centres where ever the area to be covered by the centre is large. The different departments also conduct research in consultation with CoRRB to avoid duplication of efforts. The main objectives of the RNR Research are to generate relevant technologies for the farming communities for ensuring food security and enhancement of rural income. These technologies are packaged as extension materials, news letters and journals for dissemination to farmers and all concerned stakeholders.

Key word : Bhutan, Council for RNR Research of Bhutan, renewable natural resource, RNR, research system

1. Introduction

1.1 Agriculture Research in Bhutan

Agriculture research in Bhutan started sometime in 1964 when development wing of the Royal Government of Bhutan under the generous support of Government of India. The first Horticulture Research Station in Yusipang and Agriculture Research Station in Bhur, Galephug were established then. During that period, new varieties of crops like rice, wheat, potato and apple vari-

eties developed by Indian Council of Research were introduced which are still being grown in Bhutan. Thereafter, during early 80s, Ministry of Agriculture (MoA) established Centre for Agriculture Research and Development at Wangdiphodrang. In parallel, forestry research programme was operated by Bhutan Forest Institute in Taba, Thimphu and live stock research was carried out by different central programme in different parts of the country. In 1991, through the support of International Service for National Agriculture Research (ISNAR) undertook a major review of research system in the country following which an integrated approach to research was initiated.

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Under this system, the research components of agriculture, livestock and forest were brought under one umbrella. Thus the Research, Extension and Irrigation Division (REID) which was later designated as the Department of Research and Development Services (DRDS) was created. Consequently, four research centres at four different regions of the country were established. The 8th Five Year Plan mid-term review pointed out the lack of development focus as the major problem with the RNR integrated approach as a result of which the reorganization took place in 2003 and Council for RNR Research of Bhutan (CoRRB) was created.

1.2 RNR Research and Extension Systems of Bhutan

Council for RNR Research of Bhutan (CoRRB) under the Ministry of Agriculture is the apex national organization in the field of RNR research in Bhutan. CoRRB is tasked with coordinating and supporting the research and extension activities necessary to satisfy the present urgent technological needs of the farming population. CoRRB has an Executive Board at the helm, with its member drawn from key stakeholders within the Ministry. The CoRRB secretariat supported by the Divisions of Research, Communication and Farming Systems in Thimphu provides the administrative setting for the functioning of the Executive Board. At the functional level, the three technical committees, viz. Research Management Committee, Extension Coordination Committee and Variety Release Committee oversee and ensure the coordination of planning, implementation and facilitation of RNR research and technology packaging activities. The mandates of CoRRB are accomplished through the 4 RNR Research Centres (RNRRCs), their sub-centers and out-reach centers, Agro-meteorology and School Agriculture programme. The following are the vision, mission, goals and mandates of CoRRB:

Vision: An effective RNR Research system that will contribute towards the enhancement of socio economic prosperity of the farming communities

on an environmentally sustainable basis.

Mission: Generate appropriate RNR technologies for increasing productivity and profitability contributing to the enhancement of food security and rural income.

Goal:

- Generate technologies which are relevant to the farming communities for ensuring food security and enhancement of income
- Effectively communicate the research findings to the client organizations
- Build partnership with relevant stakeholders for developing frontier research

Mandates: The main mandate of CoRRB is to harmonize and prioritize research agenda with national development priorities; formulate research and extension policy in consultation with line departments, clear all RNR research programme in the country; forge links and networking with national and international institution such as international agriculture research institutes, higher education institutes, farmers organizations, etc; package and provide RNR technologies to line departments; promote and implement School Agriculture Programme, maintain and strengthen RNR integration concept in research and technology dissemination; and provide agro-meteorological services. Besides the routine and regular research programme of the RNRRCs, CoRRB will dwell more into research topics/themes of nationally (and internationally) strategic importance. Some of the possible themes based on emerging trends could be, viz. climate change and its implications on wetland and hydro power generation, wetland protection, payment for environmental services, impact of rural urban migration on agriculture development, etc.

2. Physical & Financial Achievements in the 9th Five Year Plan (June 2002–July 2008)

CoRRB with its research centres made the following physical (infrastructure and programmes) and financial achievements in the 9th Five Year Plan (FYP).

2.1 Infrastructure

2.1.1 RNRRC, Yusipang

- 1) Constructed Extension and Farm Produce Outlet Complex
- 2) Constructed one unit vegetable market shed with adequate parking area
- 3) Constructed one administrative and one research buildings
- 4) Completed the maintenance work on irrigation channel (about 2 km)
- 5) Completed drinking water supply to RSC Darla
- 6) Completed compound fencing, gate construction and farm road at RSC Darla

2.1.2 RNRRC, Bajo

- 1) Completed road black topping around the office building and parking
- 2) Constructed one rice breeding house
- 3) Constructed boundary wall between the New Wangdue Town and the office
- 4) Constructed ram, water servicing and drainage with funds from SDC/Helvetas
- 5) Fenced centre farm with chain-link mesh-wire
- 6) Renovated Tsirang Sub-Centre office (office, staff quarters, store, gates, water supply line, irrigation canal and fencing)
- 7) Constructed eight 4-unit-2 storey class III staff quarter

2.1.3 RNRRC, Jakar

- 1) Constructed office complex, field service centre, 2 staff quarters, and office gate at RSC Bhur
- 2) Constructed approach road to dormitory and staff quarters, and 2-units staff quarter at RC Jakar

2.1.4 RNRRC, Wengkhar

- 1) Completed Research & Administration building and black-topped approach road to it.
- 2) Constructed meeting hall at Wengkhar, research outlet at Khillikar and RNR Centres at Minji and Tangmachu
- 3) Constructed farm road: Phosorong (2.5km), Jamcholing (2km) and Massangdaza (3.5km)
- 4) Constructed 2.6 km power tiller track at Wengkhar

- 5) Completed fencing and irrigation facility of live genebank at Lingmethang

2.2 Research Programme

2.2.1 Forestry Research Programme

- 1) Completed forest fire risk mapping in Paro and Haa
- 2) Completed the study on the sustainable management and conservation of *Cordyceps sinensis* which helped in fixing the sustainable collection time and methods
- 3) Completed the study on the gradational forest change along the climatically dry valley slopes (Dochula-Wangdue transect)
- 4) Completed the study on provenance evaluation of *Alnus nepalensis* for industrial plantation
- 5) Completed a study on succession and age determination of Tseri (shifting cultivation)

2.2.2 Field Crops Research Programme

- 1) In rice, over 1000 different lines were evaluated for traits of interest. The high altitude paddy production in Bumthang has been expanded to 62 acres with 94 farmers.
- 2) A systematic impact assessment of maize research was conducted which showed that the modern maize varieties are grown to about 50% of the total area.
- 3) A systematic impact assessment of rice research was conducted. The study showed that the modern rice varieties are grown to about 35% of the total area.
- 4) The Centre packaged and distributed over 30 improved RNR technologies

2.2.3 Livestock Research Programme

- 1) Produced comprehensive report on the domestic animal genetic resources of Bhutan
- 2) Developed a technique using milk protein analysis for quantifying influence of Mithun on the cattle population of Bhutan.
- 3) Accomplished studies and sensitization on farmer participatory Nublang conservation and formation of Nublang breeders' society at Haa, Sambeykha.
- 4) Identified alternative pasture mixture for dairy

production in temperate environments.

- 5) Identified suitable tree and fodder legume combination for temperate silvo-pastoral system.
- 6) Released seed production technology in *Stylosanthes guianensis* and *Desmodium intortum*
- 7) Introduced and released 8 new sub-tropical and 5 new temperate grass species.

2.2.4 Horticulture Research Programme

- 1) Developed DHDP for the 6 Eastern Dzongkhags¹⁾ and 10th FYP Strategy for National Horticulture Research
- 2) Established and evaluated various fruit cultivars: Citrus (23), Pear (17), Walnut (16), Persimmon (7), Peach (7), Plum (6), Mango (5), Kiwi (6), Avocado (2) and Loquat (2).
- 3) Released 12 horticultural crop varieties: Potato (1), Chilli (2), Cauliflower (2), Mustard green (2), Carrot (1), Pumpkin (1) and Citrus (3). Identified and disseminated improved nursery production technologies for Walnut, Mango, Pear, Persimmon and Avocado.
- 4) Established demonstration orchards in the East: Walnut (6), Sub-tropical mixed fruit (6), Citrus (60), Warm Temperate mixed fruit (97).
- 5) Produced and distributed more than 5000 high quality grafted plants and promoted vegetables cultivation with 8 farmer's groups in Eastern Bhutan.
- 6) Enhanced the technical skills of EAs through technical training (Orchard Management, Temperate Fruit Crop Management & Nursery Production and Vegetable & Citrus Production Technology) and 550 farmers through trainings, study tours and field days.
- 7) Produced 7 leaflets (Top-working, Papaya and Watermelon), 3 Posters (Nursery Production of Mango and Walnut and DHDP) and 1 mid altitude cropping calendar.

2.2.5 School Agriculture Programme

- 1) Expansion of integrated agriculture concept in 125 schools
- 2) Developed basic infrastructure (piggery, poultry and dairy shed, and fencing in 88 schools).

¹⁾ Dzongkhag means province

- 3) Enhanced the technical capacity of 92 focal agriculture teachers through training.
- 4) Developed a technical guide book on integrated agriculture farming.
- 5) Incorporated integrated agriculture farming as a curriculum in school.

2.2.6 Agro-meteorology

- 1) On a daily basis the Agromet Office collects, keys in to electronic format and analyses weather and climate data and disseminates these data to end users.
- 2) Besides these the office also carried out climate change studies on rice production systems in Bhutan.

2.2.7 Achievement by CoRRB Headquarter and Common Sectors

- 1) Different approaches of transferring technologies to the farmers (focal village, research outreach programme, technology parks and school agriculture programme) have been adopted.
- 2) Provided weather forecast and agro-meteorological information.
- 3) Conducted nation-wide RNR extension service review survey.
- 4) CoRRB is developing methodology and strategy for setting up farmer's groups/co-operatives and for instituting rural finance programme under MoA.
- 5) CoRRB liaised with different agencies to develop RNR related national policies and by-laws like water policy, watershed management framework, Biodiversity Act, etc.
- 6) Around 350 technologies generated by RCs and other national programmes were put on web.
- 7) Published over 1000 copies of integrated agriculture technical guidebook.
- 8) Three volumes of RNR journal were published and distributed.

2.3 Financial

2.3.1 Financial achievements in the 9th FYP (July 2002-June 2007) (Table 1)

2.3.2 Financial achievements in the extended 9th

Table 1. Financial achievements in the 9th Five Year Plan (July 2002–June 2007). (Nu.* in millions)

| Programme/Activity | Plan outlay | Expenditure | | | | | Total |
|---------------------------|-------------|-------------------|-------------------|-------------------|-------------------|------------------|---------|
| | | Jul 02– Jun 03 | Jul 03– Jun 04 | Jul 04– Jun 05 | Jul 05– Jun 06 | Jul06– June07 | |
| Recurrent | 242.024 | 51.377 | 53.178 | 55.585 | 70.352 | 75.556 | 306.048 |
| Plan Programmes (Capital) | | | | | | | |
| Headquarter | 17.706 | 3.544 | 4.512 | 12.207 | 11.186 | 1.641 | 33.090 |
| School Agriculture | 16.961 | 0.948 | 1.131 | 3.137 | 2.530 | 2.420 | 10.166 |
| RNRRC** Yusipang | 39.296 | 2.290 | 2.299 | 3.550 | 8.893 | 9.672 | 26.704 |
| RNRRC Bajo | 32.796 | 2.098 | 2.783 | 5.549 | 8.015 | 3.404 | 21.849 |
| RNRRC Jakar | 27.724 | 1.870 | 0.259 | 6.674 | 3.500 | 0.931 | 13.234 |
| RNRRC Wengkhar | 71.719 | 12.000 | 2.600 | 12.035 | 7.310 | 1.170 | 35.115 |
| Grand total | 448.226 | 74.127 | 66.762 | 98.737 | 111.786 | 94.794 | 446.206 |

*Nu.: Ngultrum is a currency unit in Bhutan. One Nu. is about 1.9 yen.

**RNRRC : Renewable Natural Resources Research Centre.

Table 2. Financial achievements in the extended 9th Five Year Plan (July 2007–June 2008). (Nu.* in millions)

| Programme | Recurrent | Capital | Total |
|--------------------|-----------|---------|---------|
| School Agriculture | 1.185 | 2.700 | 3.885 |
| RNRRC** Yusipang | 23.099 | 4.551 | 27.650 |
| RNR RC Bajo | 16.635 | 5.883 | 22.518 |
| RNRRC Jakar | 18.480 | 0.900 | 19.380 |
| RNRRC Wengkhar | 22.240 | 4.564 | 26.804 |
| Grand total | 81.639 | 18.598 | 100.237 |

*Nu.: Ngultrum is a currency unit in Bhutan. One Nu. is about 1.9 yen.

**RNRRC : Renewable Natural Resources Research Centre.

FYP (July 2007–June 2008) (Table 2)

3. Major issues and constraints

- Negligible or very few impact studies, socio-economic studies, baseline surveys and diagnostic studies due to lack of economist under CoRRB.
- The project support through donors is drying up and all other projects have very small monetary support, thus hampers programme implementation.
- Lack of critical mass of researchers in all research programmes is one of the main constraints for research.
- Some of the research centers do not have adequate laboratory facility which needs to be provided as soon as possible.
- Each research center is supposed to cater to the needs of at least 5–6 Dzongkhags which demands a lot of travelling in the field, however the vehicles

with the RCs are very old which demand heavy maintenance cost.

- Some of the newly opened sub-centers like Mithun farm in Tsirang are unable to deliver the services as desired due to shortage of people.

4. Institutional Arrangements

4.1 CoRRB Secretariat

CoRRB will be the secretariat to the Council Governing Board (CGB) of Agriculture Research of MoA. CGB will be the apex authority, answerable to the Royal Government through Ministry of Agriculture. This Secretariat with advice from CGB will coordinate research (and extension) programmes of different provider agencies, institutions, both public and private. The CGB will be the supreme policy and decision making and approval body. The Secretariat through CGB, will have executive authority to manage, administer,

direct and control the national research fund, coordinate research and extension through its respective divisions. The CoRRB secretariat comprises of the following divisions and sections. i) Information Management Section (IMS), ii) Research Division, iii) Research Communication Division (RCD), and iv) Farming Systems Division (FSD). In the field there are four RNRRCs strategically located to cover all regions of the country. Each of these RCs has one or more sub-centres (Annexure 1).

4.2 Information Management Section (IMS)

The functions of IMS are as follows: to monitor and evaluate the planned programme and to act as the focal point for releasing the council M&E related information; to generate document, storage, retrieval and dissemination of scientific knowledge, information and technology and to maintain functional databank on related resources and programmes, to develop and maintain database to monitor inputs and its delivery mechanism and to conduct cost-benefit analysis of the council's programme and conduct field verification from time to time; to prepare annual report for submission to PPD and represent CoRRB in the MoA Monitoring and Evaluation Forum.

4.3 Research Division

The functions of the Research Division are as follows: to formulate research policies and develop strategic master plan for RNR research; to set research agenda, mobilize and manage research funds, scrutinize research protocol and provide research guidelines; to coordinate, monitor and evaluate research programme at national level; to act as a referral centre for research information at national level; to provide strategic technical/scientific advice to line departments and other agencies; to establish and strengthen linkages (national and international) and to coordinate and organize RCC, NSB, VRC, STC.

4.4 Research Communication Division (RCD)

The functions of RCD are as follows: to pack-

age technologies and other publication (extension materials, RNR Journal, etc); to carry out extension and social research (Extension methods and methodology studies, Adoption Study); to develop strategy and methodology for effective dissemination of information, to maintain database for all available technology and facilitate its access and distribution; to coordinate Research Outreach Programme and Methodological training and to implement School Agriculture and Non Formal Education Programme.

4.5 Farming Systems Division (FSD)

CoRRB will continue to issue policy directives, technical and scientific advisory, coordinate and fund research programmes emphasizing its changing role in the context of newly emerging research perspectives and issues in response to emerging technical needs, changing socio-economic scenario and the political environment. CoRRB shall be the coordination body which makes the research and innovation systems operate as a system and not as individual components. The functions of FSD are as follows: to produce a broad guideline/strategy document with systems perspectives in RNR research; to streamline the HRD needs of the sector and create the long overdue parental figure; to conduct research that will have implications on national policy and conduct annual workshops as for other sectors to streamline work-plan and to conduct necessary and timely M&E of field activities.

4.6 Renewable Natural Resources Research Centres (RNRRCs)

CoRRB has four major region based RNRRCs, each responsible for leading a national research programme and for implementing research in a specific mandate region. Each of these RCs is further supported by one or more research sub-centers and outreach centers (Table 3).

Table 3. Renewable Natural Resources Research Centres (RNRRCs).

| National Mandate | Research Centre | Research Sub-Centre | Region (with Districts) |
|------------------|-------------------|---|---|
| Forestry | Yusipang, Thimphu | Drala, Chukha | Western: Thimphu, Paro, Haa, Chukha and Samtse |
| Field Crops | Bajo, Wangdue | Mithun, Tsirang | West-Central: Wangdi, Punakha, Gasa, Dagana and Tsirang |
| Livestock | Jakar, Bumthang | Bhur, Sarpang | East-Central: Bumthang, Trongsa, Zhemgang and Sarpang |
| Horticulture | Wengkhar, Mongar | 1.Lingmithang, Mongar 2. Khangma, Trashigang | Eastern: Mongar, Trashigang, Lhuntshi, Trashi Yangtshi, Pemagatsetel and Samdrup-jongkhar |

5. Staff strength of CoRRB

Table 4. Staff strength of Council for Renewable Natural Resources Research of Bhutan (CoRRB).

| Name of organization | Administrative /Support staff | Research officer | Research assistant | Total |
|----------------------|-------------------------------|------------------|--------------------|-------|
| CoRRB Headquater | 14 | 8 | 3 | 25 |
| RNRRC* Yusipang | 17 | 18 | 32 | 67 |
| RNRRC Bajo | 16 | 10 | 25 | 51 |
| RNRRC Jakar | 14 | 6 | 31 | 51 |
| RNRRC Wengkhar | 23 | 15 | 29 | 67 |
| Total | 84 | 57 | 120 | 261 |

*RNRRC: Renewable Natural Resources Research Centre.

6. Strategies adopted in the 10th FYP (July 2008 –June 2013)

The following strategies are being pursued to achieve the vision, mission and mandates of CoRRB. Strategies and actions are grouped into immediate (within 1 year), short term (1 to 5 years) and long term (above 5 years) as follows:

6.1 Immediate Strategies (within a year)

6.1.1 Council Governing Board (CGB)

It is proposed that the nomenclature of Council Executive Board (CEB) be changed to Council Governing Board (CGB), since the mandates of the board is concerning endorsement of policy issues and to provide strategic direction for RNR research.

6.1.2 Scientific Technical Committee (STC)

Scientific Technical Committee (STC) has been instituted to assist the CGB in providing technical guidance on policy and planning, scientific and financial matters concerning RNR research and development.

6.1.3 Variety Release Committee (VRC)

The main function of the VRC is to coordinate and conduct the release of new varieties of crops, fodder and trees. VRC have members from Department of Agriculture (DoA), Department of Livestock (DoL), Department of Forestry (DoF), Research Centres (RCs), National Plant Protection Centres (NPPC), Bhutan Agriculture and Food Regulatory Authority (BAFRA), Druk Seed Corporation (DSC) with Chief Research Officer (CRO) and Director of CoRRB as member secre-

tary and chairperson, respectively.

6.1.4 National Seed Board (NSB)

Under the chairpersonship of the Hon'ble Secretary, MoA NSB will have representative from three technical departments, DSC and BAFRA along with Director, CRO and Chief Research Communication Officer (CRCO) from CoRRB.

6.1.5 Research Coordination Committee (RCC)

The main function of the RCC is to coordinate the research programme of the various research centres. In particular, coordination is needed for those research programmes that are not sector specific, e.g. natural resource management, farming system, water management, etc.

6.1.6 Extension Coordination Committee (ECC)

The main function of the ECC is to provide the necessary policy, technical and coordination support in making the delivery of extension services effective and efficient.

6.1.7 Annual National Sectoral Research Extension Coordination Workshops (ANSRECW)

ANSRECW is held annually for each of the Horticulture, Field Crops, Forestry and Livestock sectors with the objective to : review/monitor and plan research and extension collaborative activities ; exchange information on emerging technologies and research needs; provide forum for agreeing on activities/budgets planned by central programmes and projects for the region; and provide forum for clarification on policy issues, if any.

6.1.8 Annual Research Programme Coordination Meetings (ARPCMs)

ARPCMs are organized annually by CoRRB more as an in-house forum and its objectives are to: monitor progress, coordinate and plan national research programme activities; peer review and guide junior researchers ; and provide a forum for scientific presentation for researchers.

6.1.9 Enhancing Research Efficiency using a Stan-

dard Research Protocol

All researchers should adhere to prescribed research protocol format while proposing new research activities and a systematic evaluation and endorsement of research protocols are followed. Research protocols from RCs shall be evaluated and endorsed for implementation by a technical committee in the RCs and submitted to CoRRB for archiving. All research proposals from other agencies should also follow the prescribed format while submitting to CoRRB who shall be the approving authority upon recommendations from Scientific Technical Committee (STC).

6.1.10 Enhancing Research Relevance through Research Agenda and Priority Setting

The strategy documents for the different research programmes outline the broader research issues and needs. Based on this framework, the annual research agenda and activities are drawn. While the ANSRECW provides an opportunity to interact and discuss field problems, it is felt that the forum is large and diverse thus disallowing any in depth technical deliberation. Therefore, to strengthen the process of research agenda and priority setting, the following are proposed: STC members to identify research thrust areas and prioritize; conduct program-wise annual technical workshops and identify appropriate and relevant tools for research priority setting.

6.1.11 Development of RC Websites

For research institutions such as the RCs, a website of its own helps to create awareness about its aims and activities as well as convey valuable information and technologies to its clients and stakeholders. Therefore, CoRRB will assist the RCs in developing their websites.

6.1.12 From Agro-met to Farming Systems Division

Up till now, RNR research is mainly limited to testing and adapting farming technologies to local conditions. It is time now to also have a paradigm shift in research approach. There are now need

Table 5. Requirement of publication of papers by different qualification level.

| Researchers qualification | National Journal | Newsletter |
|---------------------------|------------------|------------|
| PhD | 3 | 5 |
| M.Sc. | 2 | 5 |
| B.Sc. | 1 | 1 |
| Diploma | Co-author | Co-author |
| Certificate | - | Co-author |

for new innovations to address global and local issues such as food security and climate change. A systems approach based research may be a key to addressing these new challenges.

6.2 Short term strategies (1–5 years)

6.2.1 CoRRB as the “Clearing House” for RNR Research within MoA

There are agencies, outside CoRRB but within MoA, which undertake RNR research activities. Such research compliments and helps to utilize CoRRB’s limited human and financial resources more judiciously. The problem at present, however, is that there is no institutionalized mechanism of knowing who does what outside of CoRRB. Therefore, establishing a focal agency for facilitating, streamlining and monitoring of research has become essential. Given the mandate, CoRRB will act as the “clearing house” for all research undertaken by MoA.

6.2.2 Improving research quality through publications

Scientific publication of research results is indisputably an integral part of the research and development process. Therefore, it is proposed that the publication of articles in journals should be directly linked to the career advancement of a researcher (Table 5).

6.2.3 Networking and strengthening linkages

Building and maintaining institutional linkages and networking with all the relevant stakeholders of research is of paramount importance for CoRRB. It will aim to improve linkages in the following manner :

- Establish and strengthen innovative and practi-

cal linkages with technical departments and other agencies.

- Establishment of formal links with national research organizations (RNR and non-RNR)
- Cross visits to RCs, other research sites etc. among the programme coordinators.
- Institute technical forum comprising of researchers from respective programmes.
- Joint visits to RNRRCs by Heads of CoRRB and line Departments annually.

6.2.4 Archiving all RNR research and extension materials

Presently, there are many agencies/projects within MoA that are involved in conducting RNR research and generate technologies for extension and general use. Agencies outside MoA (Royal University of Bhutan, College of Natural Resources, Sherubtse college, National Environment Commission, Centre for Bhutan Studies, etc.) are also involved in conducting RNR related research. Since research and studies are conducted by different agencies within and outside MoA, CoRRB is not able to maintain proper record of all the research publications, results and the technologies generated and promoted in the field. Proper archives or records will help to retrieve information as and when required for any reference but more importantly, it will help in avoiding repetition or duplication of works.

6.2.5 Promotion of Information Technology (IT) for dissemination

Although individual agencies maintain records of research and extension materials but such information may not be routinely updated. Records are available with individual agencies

only and access to it by outsider is difficult, as it is not digitalized. Since the information on research work and available extension material are not readily available there seems to be duplication of efforts at various level. To address such problems CoRRB initiated online digital compendium in December 2005 and it should be updated from time to time.

6.2.6 Publication of RC Newsletters

Where the access to digital and virtual information is limited, the printed newsletters are still a major source of information to the majority of our field extension staff. Newsletters provide new research information to the extension colleagues, while it helps to channelize valuable feedback and field issues to the research system. Therefore, all RCs will publish newsletters half yearly and CoRRB will bring 8 issues of CoRRB newsletters annually.

6.3 Long term strategies (Above 5 years)

6.3.1 Financial sustainability

The main funding for research will come from the government. Other funding sources will include financing by stake holders and other private sources, traditional donors, foreign direct investment and through payment for services. The following key strategies shall be pursued :

- *Negotiation for core RNR research fund* : The

Council through Policy and Planning Division (PPD) of MoA will negotiate directly with the MoF for funds for research. The Council will approve and allocate funds for core funding of public sector research institutes, for competitive grant schemes and for special research studies.

- *Acquisition of funding* : Acquisition of funding for specific activities and programmes is to be undertaken using logical and specific matrix-type outlines including goal hierarchy, objectively verifiable indicators, means of verification, detailed time-frames and budgets.

- *Establishment of a trust fund* : For the RNR research system to grow into a competent and autonomous system, CoRRB will endeavor to have its own fund. This will make research system more sustainable, reduce dependence and may even lead to co-financing by clients.

- *Diversification of funding and donors* : Proposals for general projects and programmes relating to overall CoRRB activities will be pursued and further proposals, aiming at the diversity of funding and donors will be an on-going task.

6.3.2 RNR Research Act

A RNR Research Act will be drafted and enacted and CoRRB will then become a statutory entity. Guided by the Act, National Agriculture Research Strategy will be developed and its main policy orientation will be provided by MoA.

Table 6. Stakeholders of Council for Renewable Natural Resources Research of Bhutan (CoRRB).

| Internal (MoA) | External (outside MoA) |
|---|--|
| Dept. of Agriculture : NPPC, NSSC, Dz. Agriculture Sector, NPHC, AMC, BPDP | CNR, Sherubste College, Agro-Industry, NEC, BDFC, Media (BBS, BT, BO, Kuensel), BCCI, RAA, MoEA, NGO-Tarayana, Business community, Schools (SAP), NFE, GYT, DYT, Farmers & Farmer groups |
| Dept. of Livestock : RVLs, NLBC, NFFDP, All production farms, Dz. Livestock Sector, NCAH | |
| Dept. of Forestry : FRDD, Social forestry, DFOs, NCD, Dz. Forestry Sector, NRDC | |
| Others : DSC, BAFRA, NBC, AMC, FCB, PPD, DSLR, AFD, RDTC, ADPs (WWMP, AMEPP, ECRADP, HRDP, SDC) | External International : JICA, Helvetas, WWF, UNDP, SNV, WFP, ICIMOD, IRRI, CIMMYT, CIP, ICRAF, EU, CIRAD, ILRI, FAO, DANIDA, GTZ, IDRC, Austria |

For acronyms, refer to annexure 2.

7. Stakeholders of CoRRB

Ultimate stakeholder is the countrywide farming population. According to its mandate, the main stakeholders are the 3 major departments within the Ministry (Table 6).

8. General research areas in the 10th FYP

8.1 Field crops sector

Areas for research include staple cereals, oilseeds and grain legumes. Particular emphasis on the diversity of crops involves research on minor crops, wild relatives, the domestication of particular wild crops and the improvement of local cultivars for rain-fed conditions. Emphasis will be given to organic and non-chemical methods of pest and disease control.

8.2 Horticulture sector

Areas for research encompass the wide variety of fruit and nut crops, vegetables, root and tuber crops, mushrooms, floriculture, medicinal and aromatic plants, plantation crops as well as spices

and condiments. The thrust is to broaden the genetic base, improve production technologies, produce seeds and plants, assess potentials for integrated use of organic and inorganic use of fertilizers and develop irrigation systems. Further, assessments of distribution of pests and diseases and the respective level of crop losses are to be met with corresponding strategies for integrated pest management.

8.3 Livestock sector

Areas for research include animal health, breeding and feed and fodder. Research on animal health contributes by undertaking epidemiological research backed by extensive animal health care networks. Animal breeding aims at improving stock by conserving and upgrading indigenous genetic resources. Research on native fodder resources is to increase resources by developing pastures through the improvement and introduction of productive species of grasses, legumes and fodder trees. In addition, applicable animal recording schemes are developed in order to improve livestock management systems in general.

Table 7. The 10th Five Year Plan Budget for Council for Renewable Natural Resources Research of Bhutan (CoRRB) (July 2008–June 2013). (Nu.* in Million)

| Organization / programme | Recurrent | Capital | Total |
|-------------------------------------|-----------|---------|---------|
| A. CoRRB Headquarter | | | |
| CoRRB Secretariat | 61.820 | | 61.820 |
| Research Division | 9.040 | 4.500 | 13.540 |
| Res. Communication Division | 7.500 | 5.300 | 12.800 |
| School Agriculture | 11.900 | 20.000 | 31.900 |
| Farming Systems Division | 6.700 | | 6.700 |
| Plants & Equipment | | 3.500 | 3.500 |
| Professional Service | | 5.000 | 5.000 |
| Vehicles | | 5.000 | 5.000 |
| Sub-total (A) | 96.960 | 43.300 | 140.260 |
| B. Field Programme | | | |
| Forestry Research (RC Yusipang) | 99.500 | 31.950 | 131.450 |
| Field Crops Research (RC Bajo) | 94.800 | 36.100 | 130.900 |
| Livestock Research (RC Jakar) | 95.500 | 35.300 | 130.800 |
| Horticulture Research (RC Wengkhar) | 98.050 | 57.000 | 155.050 |
| Sub-total (B) | 387.850 | 160.350 | 548.200 |
| Grand total (A + B) | 484.810 | 203.650 | 688.460 |

*Nu.: Ngultrum is a currency unit in Bhutan. One Nu. is about 1.9 yen.

8.4 Forestry sector

Areas for research include nature conservation, conifer management, broadleaf forest management, reforestation, social forestry, non-timber forest products, wood products and forest protection. Emphasis will be on the regeneration characteristics of timber in broadleaf and conifer forests and on the impact of collection on particular non-timber forest product species and their natural propagation. There will be impact assessments of silvi-cultural practices, analyses of choice for species and plantation techniques in degraded areas and climatic zones, as well as impact assessments of grazing on natural regeneration.

8.5 Farming Systems Sector

Areas of research cut across the above four sectors and it will involve interdisciplinary perspectives and cooperation amongst professionals of different disciplines, including soil science, water management, GIS, post-harvest, policy research, plant protection and economics. Research on integrated crop and livestock production systems and a systems perspective on water-

shed management are also key areas.

8.6 Human Resource Development (HRD)

The Council will organize for capacity assessment and development within the national RNR research system. Studies will be carried out on the present competences available, compare it to the projected requirements in the future and prepare a resource development plan. Both general and specific HRD shall be pursued. Opportunities for researchers to pursue higher studies (B.Sc, M.Sc and PhD) in their specific fields may be expanded to undertake quality research, create competitive incentive and increase human resource efficiency.

9. The 10th Five Year Plan Budget for CoRRB (July 2008–June 2013) (Table 7)

10. References

- CoRRB. 2009. 10th Five Year Plan Strategic Document. Ministry of Agriculture, Thimphu, Bhutan.
CoRRB. 2008. 9th Five Year Plan Terminal Review. Ministry of Agriculture, Thimphu, Bhutan.

ブータン王国における再生可能自然資源研究プログラムの概要

Narendra K. PRADHAN¹⁾, Kinlay TSHERING²⁾, Karma DORJI¹⁾ and Tashi SAMDUP¹⁾

- 1) ブータン王国農業省再生可能自然資源研究評議会, ティンパー, ブータン
2) ブータン王国農業省再生可能自然資源研究評議会, ユシバン再生可能自然資源研究センター, ティンパー, ブータン

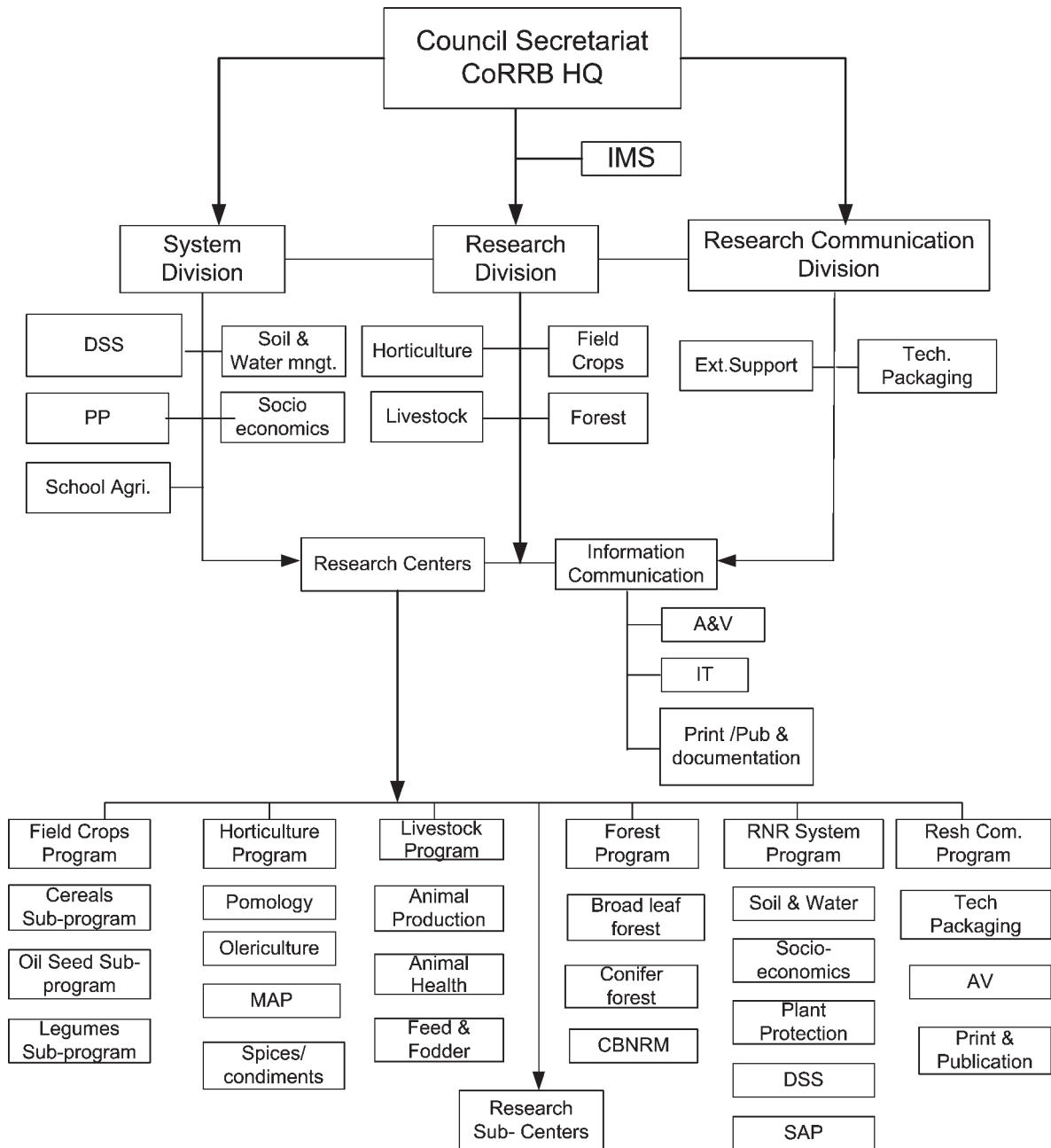
要 約

本論文はブータン王国における再生可能自然資源 (RNR) 研究について概観するものである。RNR 研究は主に農業, 畜産, 林業の3分野からなる。ブータンにおける農業研究は1960年代初頭にインドの農業研究機関から作物や果樹の新品種を導入することから始まった。1982年にブータンで最初の農業研究所が設立され, その後の変遷を経て2003年に現在の再生可能自然資源研究評議会 (CoRRB) が設立された。研究評議会の議長は農業大臣が務めている。その傘下で, 農業生態学的に異なる4地域に研究センターが設置され, 地域の農民たちの要望に応える研究を行っている。これらの研究センターでは農業, 園芸, 畜産, 林業の研究に加えて, 土壌, 植物防疫, 治水, 気象, 社会経済などの分野横断的な研究も行われている。研究センターの担当地域が広い場合には支所が設置されている。研究の重複を避けるために, 農業省以外の省庁はCoRRBと調整しながら研究を行っている。RNR研究の主目的は, 農村集落の食料を保証し, 収入を増加させるための技術を開発することである。これらの技術は普及用資材, ニュースレターおよび広報誌などを通じて農民

たちと関係者に提供され、普及されている。

キーワード：研究組織，再生可能自然資源，ブータン，RNR 研究評議会，RNR

Annexure 1. Organogram of Council for Renewable Natural Resources Research of Bhutan (CoRRB). For acronyms, refer to annexure 2.



Annexure 2. Acronyms.

| | |
|---------|--|
| ACC | Anti Corruption Commission |
| ADP | Area Development Project |
| AFD | Administration and Finance Division |
| AMC | Agriculture Machinery Centre |
| AMEPP | Agriculture Marketing and Enterprise Promotion Programme |
| ANSRECW | Annual National Sectoral Research Extension Coordination Workshops |
| ARPCM | Annual Research Programme Coordination Meetings |
| AV | Audio Visual |
| BAFRA | Bhutan Agriculture and Food Regulatory Authority |
| BBS | Bhutan Broadcasting Service |
| BCCI | Bhutan Chamber of Commerce and Industry |
| BDFC | Bhutan Development Finance Corporation |
| BO | Bhutan Observer |
| BPDP | Bhutan Potato Development Project |
| BT | Bhutan Times |
| CEB | Council Executive Board |
| CGB | Council Governing Board |
| CIMMYT | International Maize and Wheat Improvement Center |
| CIP | International Potato Centre |
| CIRAD | Agricultural Research for Developing Countries |
| CNR | College of Natural Resource |
| CoRRB | Council for Renewable Natural Resources Research of Bhutan |
| CRCO | Chief Research Communication Officer |
| CRO | Chief Research Officer |
| CSO | Central Statistical Organization |
| DANIDA | Danish International Development Agency |
| DFO | Dzongkhag Forestry Officer |
| DHDP | Dzongkhag Horticulture Development Plan |
| DoA | Department of Agriculture |
| DoF | Department of Forests |
| DoL | Department of Livestock |
| DRDS | Department of Research and Development Services |
| DSC | Druk Seed Corporation |
| DSLRL | Department of Survey and Land Records |
| DYT | Dzongkhag Yargay Tshogdu |
| ECC | Extension Coordination Committee |
| ECRADP | East Central Region Area Development Project |
| EU | European Union |
| FAO | Food and Agriculture Organization |
| FCB | Food Corporation of Bhutan |
| FPR | Farmer Participatory Research |
| FRDD | Forest Resource Development Project |
| FSR | Farming Systems Research |
| FSD | Farming Systems Division |
| FYP | Five Year Plan |
| GDP | Gross Domestic Product |
| GIS | Geographical Information System |
| GYT | Geog Yargay Tshogdu |
| GTZ | Deutsche Gessellschaft fur Technische Zusammenarbeit |
| HQ | Head Quarter |
| HRD | Human Resources Development |
| HRDP | Horticulture Research and Development Project |
| ICIMOD | International Centre for Integrated Mountain Development |
| ICRAF | International Centre for Research in Agroforestry |

Annexure 2. Acronyms (continued).

| | |
|-------|---|
| IDRC | International Development Research Centre |
| ILRI | International Livestock Research Institute |
| IMS | Information Management Section |
| IRRI | International Rice Research Institute |
| ISNAR | International Service for National Agriculture Research |
| IT | Information Technology |
| JICA | Japan International Cooperation Agency |
| MAP | Medicinal and Aromatic Plants |
| M&E | Monitoring and Evaluation |
| MoA | Ministry of Agriculture |
| MoEA | Ministry of Economic Affairs |
| MoF | Ministry of Finance |
| NBC | National Biodiversity Centre |
| NCAH | National Centre for Animal Health |
| NCD | Nature Conservation Division |
| NEC | National Environment Commission |
| NFE | Non Formal Education |
| NFFDP | National Feed and Fodder Development Programme |
| NGO | Non Government Organization |
| NLBC | National Livestock Breeding Centre |
| NPHC | National Post Harvest Centre |
| NPPC | National Plant Protection Centre |
| NRDC | Natural Resource Development Corporation |
| NRM | Natural Resource Management |
| NSB | National Seed Board |
| NSSC | National Soil Service Center |
| PAM | Production, Accessibility, Marketing |
| PD | Programme Director |
| PPD | Policy & Planning Division |
| PRA | Participatory Rural Appraisal |
| RAA | Royal Audit Authority |
| RC | Research Center |
| RCC | Research Coordination Committee |
| RCD | Research Communication Division |
| R & D | Research and Development |
| RDTC | Rural Development Training Centre |
| REID | Research, Extension and Irrigation Division |
| RGoB | Royal Government of Bhutan |
| RMC | Research Management Committee |
| RNR | Renewable Natural Resources |
| RNRRC | Renewable Natural Resource Research Centre |
| RNRRC | Renewable Natural Resource Research Sub Centre |
| RRCO | Regional Research Communication Officer |
| RSC | Research Sub Centre |
| RVL | Regional Veterinary Laboratory |
| SAP | School Agriculture Programme |
| SDC | Swiss Agency for Development and Cooperation |
| SNV | Netherlands Development Organization |
| STC | Scientific Technical Committee |
| UNDP | United Nation |
| VRC | Variety Release Committee |
| WFP | World Food Programme |
| WWF | World Wildlife Fund |
| WWMP | Wang Watershed Management Project |