

**Food and Agriculture Organization of  
The United Nations**

**Report on  
Wheat Stem Rust Ug99 Contingency Plan  
For Bhutan**

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# **Report on Wheat Stem Rust Ug99 Contingency Plan For Bhutan**

## **Executive Summary**

1. Wheat is grown under varied agro-ecological conditions both under dryland and wetland conditions in Bhutan. In wetland it is grown on a limited area as a second crop after the harvest of paddy. Though the current area under wheat is about 16,981 acres there is a great potential to expand the area especially under wetland condition after paddy to meet the increasing domestic demand for wheat and its products.

2. All the three rusts viz., stem rust, brown rust and yellow rust have been reported to occur in Bhutan. In late 90s serious outbreak of yellow rust was responsible for heavy wheat production losses.

3. Sexual phase of wheat stem rust has been reported to occur on *Berberis vulgaris*, the alternate host, and it grows in the hilly terrains at different altitudes in Bhutan. To elucidate further on the sexual phase of stem rust on Berbery there is an urgent need to survey the wheat growing area in Bhutan.

3. So far there are no attempts made to study the distribution of races of wheat rusts in the country. Under such a situation and in the event of reconfirmation of aecial stage of wheat stem rust on Berbery a systematic study to map the race distribution would be of great significance in rust disease management. This will also help to rule out the possibility of any escape of Ug99 getting established on the alternate host which grows wildly at different altitudes.

4. The three day workshop held on 24-26 November 09 has facilitated in:

- Short listing seven institutions viz. National Plant Protection Center (NPPC), Bhutan Agriculture and Food Regulatory Authority (BAFRA), National Biodiversity Center (NBC), RNR-Research Center (4 Regional Research Centers), Seed Services (DSC), Agriculture Division, DoA and National Soil Service Center (NSSC) as members of the National Wheat Team and identifying the role and responsibilities of each member of the Team. The formation of National Wheat Team will come into effect after a formal approval and notification by DoA
- Identifying a number of possible approaches to sensitize and create awareness among policy makers, Dzongkhag extension staff, farmers and other stakeholders on wheat stem rust Ug99, viz. use of electronic and print media, display of posters and hoardings at strategic locations like air port arrival hall, distribution of pamphlets in local languages and organizing workshop meetings
- Identifying the gap in the functional system of pest surveillance and recommending the following measures to strengthen it:
  - Establishment of an exclusive surveillance unit at NPPC to revive surveillance and monitoring of pest and diseases at national level
  - Simplification of the present pest surveillance and monitoring format to a digital mode to facilitate displaying it on the MoA website for wider use by the extension staff and others and exploring the possibility of introducing
    - e-surveillance system using appropriate electronic devices with sensors for geo-referencing and recording of temperature, humidity, etc. to facilitate mapping progress of pest/disease development,
  - SMS and toll free number services for exchange of information on disease development, etc. in Dzongkhags/Gewogs,

- Updating of the present pest/disease database commissioned very recently at NPPC with wheat rust survey data and sharing of the information with all stakeholders
- Linking with Druk DIF web site at NSSC for uploading information on wheat rust diseases monitoring and their management
- Preparing a ‘Contingency Plan’ to deal with wheat stem rust Ug99 in Bhutan
- Identifying international institutions like CIMMYT for collaboration to facilitate getting wheat differentials set for establishing ‘Trap Nurseries’ for timely reporting of wheat rust development in Dzongkhags (Districts) and Gewogs (Blocks)

The timing of the next Consultancy mission should coincide with rust disease development in the field. This will facilitate organizing training programmes for capacity building of research and extension staff on the:

- Diagnosis of different rust diseases,
- Survey and surveillance methodology.

During the next mission the Consultant may also discuss with the National Wheat Team and counterparts in planning the season long ToT-FFS and other arrangements for implementing the Contingency Plan during 2010-11.

## **Report on Wheat Stem Rust Ug99 Contingency Plan For Bhutan**

### **1. Background**

As a follow up to “SAARC Declaration by Agriculture Ministers of SAARC member countries and subsequent “Delhi Declaration during the International Conference in New Delhi to combat Wheat Stem Rust Ug99” the Ministry of Agriculture, RGOB, has approached FAO to assist them in developing a contingency plan to deal with wheat stem rust Ug99 in Bhutan. Keeping this in view FAO has deputed Dr. Rangunathan, formerly Plant Protection Adviser to the Government of India, as an International Consultant on a mission to Bhutan and the Terms of Reference are as under:

- To sensitize and create awareness among stakeholders on Ug 99 through a Workshop meeting
- To evaluate the present situation of the involved institutions and their capacities to form a National Team who will work together as a team
- To prepare, together with the national counterparts a National Action Plan (which includes awareness creation, inter-institutional information sharing and linkages, surveillance & monitoring and race analysis, varietal testing, seed multiplication, and farmers education on wheat rusts, and regional and international linkages)
- To help national team to link up with regional and international organizations working on same theme and
- To suggest way forward for the national team, in implementation of the strategies at national level

### **2. Importance of wheat crop in Bhutan**

Wheat is grown under different agro ecological conditions mostly in dryland situations. In wetland it is grown as a second crop after the harvest of paddy. Wheat ranks third to rice and maize among cereal crops grown in the country. Over 18% of the total households grow this crop and it contributes 2% to total cereal production. The current area under wheat is 16,981 acres with an annual production of 8879 MT. Potential wheat growing Dzongkhags are Samtse, Chukha, Wangdi Punakha, Paro, Bumthang, Haa and Mongar. Since 2004 there is an increasing trend in area and production of wheat in East, West, East Central and West Central regions of Bhutan. To meet the increasing domestic demand over 9804 MT of wheat grain and 1600 MT of wheat flour are imported annually, which signifies the importance of wheat in food security of Bhutan.

Dzongkhag-wise area and production of wheat under different agro ecological zones are given in table-1.

**Table-1.** Area and production of wheat in Bhutan

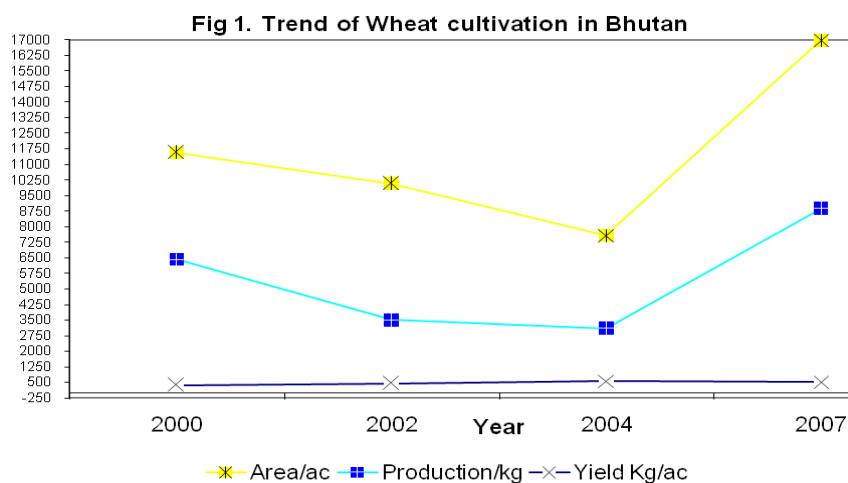
Dzongkhag	Harvested Area (Ac)	Total production (kgs)	Yield (kg/Acre)	Agro ecological zone*
Samtse	2523	1408000	558	HST/WST
Punakha	1900	1140000	600	Alpine/CT/DST

Chhukha	1677	962000	574	HST
Wangdue	1,552	819000	528	CT/ DST
Paro	1339	922000	689	CT /WT
Bumthang	1233	551000	447	Alpine/CT
Ha	1112	613000	551	Alpine/CT/WT
Mongar	1087	400000	368	DST
Trashigang	1004	431000	429	Alpine/CT/DST/WT/HST
Zemgang	693	319000	460	HST
Trongsa	681	380000	558	Alpine/CT/DST/WT
Dagana	594	269000	453	HST
Sarpang	483	184000	381	HST
Yangtse	332	131000	395	DST
S/jonglhar	320	165000	516	DST
Tsirang	315	90000	286	HST
Pemagasthel	119	88000	739	HST
Gasa	17	7000	412	Alpine/CT/WT
Thimphu				Alpine/CT/WT
Lhuentse				DST
<b>Total</b>	<b>16981</b>	<b>8879000</b>	<b>523</b>	

\*CT: Cool Temperate; WT: Warm Temperate; DST: Dry sub Tropical; HST: Humid sub Tropical; WST: Wet sub Tropical;

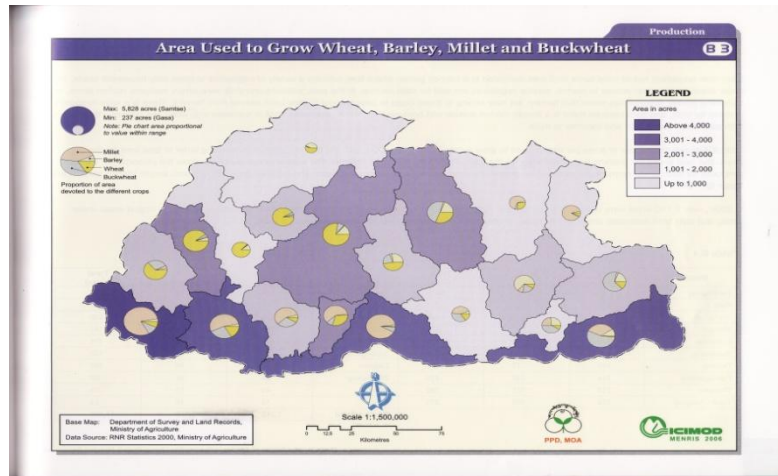
Source:RNR-RC, Yusipang, DoA,2007

The trend in wheat cultivation and Dzongkhag-wise distribution of area under wheat and other cereals are given in Fig.1 and Plate1.



Source:RNR-RC, Yusipang,DoA,2007

**Plate 1. Dzongkhag-wise area used to grow wheat and other cereals in Bhutan**



**Source:** Mapping the status of Bhutan's Renewable (Agricultural) Natural Resources, MoA, 2006

### 3. Wheat rust diseases in Bhutan

In Bhutan wheat crop is affected by all the three rusts viz., stem rust (*Puccinia graminis* Pers.: Pers. f. sp. *tritici* Eriks. E. Henn.), brown rust (*Puccinia triticina* (= *P. recondita* Roberge ex Desmaz. f. sp. *tritici*.) and yellow rust (*Puccinia striiformis* Westend). At present there is no major incidence of either stem rust, or yellow rust or brown rust in the country. However, the country had experienced serious outbreaks of yellow rust during late 90s which resulted in severe wheat production losses.

Though the stem rust fungus generally survives as mycelium or uredinia on volunteer wheat during the non-wheat growing season its sexual phase has been reported to occur on *Berberi vulgaris*, the alternate host which grows wildly in the hilly terrains at different elevation (Reference for sexual phase is to be provided by Dr.Thinlay, NPPC).

So far no attempts have been made to study the distribution of races of either wheat stem rust or other rusts in Bhutan.

### 4. Workshop on Wheat Stem Rust Ug99

A three day workshop was organized on 24-26 November 09 in Thimphu to sensitize and create awareness among stakeholders on wheat stem rust Ug 99 and to identify members of National Wheat Team and prepare, together with the national counterparts, a Contingency Plan to facilitate dealing with wheat stem rust Ug99 as detailed in the Terms of Reference.

The opening session of the workshop was held on 24 November 09 in the Conference Hall of MoA. This was followed by detailed discussion on certain focus areas viz. *Sensitization and creation of awareness at*



*different levels; Wheat rust disease surveillance; Formation of National Wheat Team and its role, etc.,* and the second and third day sessions of the workshop were held at National Soil Service Center, Semtoka.

The details of the agenda and list of participants are at **Annex-I and II** respectively.

In the opening session, Mr. Karma Drukpa, the Officiating Secretary, Agriculture informed that the cereal crops are vital component to enhance self-sufficiency and food security of the Bhutanese people. The RNR sector has been identified as one of the important elements to attain Millennium Development Goal (MDG) of poverty alleviation, food self-sufficiency and economic growth. Though wheat occupies third position next to rice and maize among food crops there is a great potential to expand the area under wheat cultivation, considering its importance to national food security. In line with the SAARC Declaration and subsequent Delhi Declaration in November 2008, there is a need to strongly support wheat stem rust Ug99 prevention and control as a matter of national policy and international cooperation.

Thereafter, the FAO Consultant made a power point presentation to sensitize the participants and stakeholders representing various institutions/organizations about the large scale devastation of wheat crop in other countries due to wheat stem rust Ug99 and the need for preparedness to deal with the disease in Bhutan in the event of its introduction (**Annex-III**).

The opening session of the workshop was given a wider coverage in the TV news bulletins of Bhutan Broad Casting Service (BBS) both in Bhutanese at 20.00 & 21.00 Hrs and English at 22.00 Hrs on 24 November. Subsequently the MoA has also displayed the event on its web site [www.moa.gov.bt](http://www.moa.gov.bt) with a caption “Ug99 could be a threat to the global wheat production” for wider publicity (**Annex-IV & Plate 2**).

**Plate 2. Ug99 could be a threat to the global wheat production**



After the opening session the following focus areas were discussed in detail and the outcome is briefly summarized below:

**4. 1. Sensitization and creation of awareness at different levels**

A number of approaches were discussed to sensitize and create awareness among policy makers and stakeholders. Most of the participants are of the view that that ‘workshop meeting’ is the most appropriate forum to sensitize, especially, the policy makers. Further, this forum can be effectively

used to highlight about the imminent danger of wheat stem rust Ug99 and its impact on national food security. Besides, other issues like lessons learnt from earlier experiences of disease outbreaks like rice blast and maize grey leaf spot diseases as well as the likely disease outbreaks in near future due to climate change could also be highlighted during such workshop meeting.

Further, the Ministry of Agriculture, whenever it organizes seminars and meetings on Wheat Crop Improvement Programs, should highlight the imminent danger of wheat stem rust Ug99 and its impact on wheat production, especially, when the Hon'ble Agriculture Minister participates in such seminars/meetings. This will also enable Hon'ble Agriculture Minister to further sensitize other Ministers during the Cabinet meetings.

A separate workshop for awareness creation among larger stakeholders was also emphasized during the deliberations. At extension and farmer level awareness creation could be achieved more effectively through media, viz. BBS TV talk show and Radio programs. Besides, display of posters and hoardings at strategic locations like airport arrival hall and distribution of pamphlets especially in local language among all stakeholders would help greatly in creating awareness among the public and farmers.

To sensitize and create awareness on wheat rust Ug99 among students and faculty members of CNR Mr.Karma Penjor, Lecturer, CNR, has volunteered to organize meetings and seminars in the CNR campus.

#### **4.2. Wheat Rust Disease Surveillance**

At present the pest/disease surveillance system in Bhutan is not effectively functioning. This fact has been brought out in the earlier Pesticide Management Review mission report of the Consultant. The revival of pest/disease surveillance could be possible only when a dedicated surveillance unit is established at National Plant Protection Center. Further, the present format for pest/ disease reporting being bulky it is seldom used by the extension staff. Therefore, it needs to be simplified, preferably to a digital format and a digital copy of it may be put in the MoA website for wider use both by the extension staff and others.

To facilitate wheat rust disease mapping the possibility of introducing e-surveillance system by using appropriate electronic devices with facility for geo-referencing and recording of temperature, relative humidity, etc. needs to be explored. In addition, the possibilities to introduce SMS and toll free number need to be explored for exchange of information on disease development, etc. in Dzongkhags/Gewogs. FAO has already demonstrated e-pest surveillance through a pilot study in Andhra Pradesh, India and the possibility to share this experience needs to be examined. Besides, updating the present database on pest and disease recently commissioned at NPPC with wheat rust survey data and sharing of the information with all stakeholders should also be explored.

Presently Druk DIF web site at National Soil Service Center (NSSC) is in operation and the possibility to link up with this web site for uploading the survey data on wheat rust diseases in consultation with NSSC needs to be examined.

For establishing Trap Nurseries in different Dzongkhags CIMMYT differential sets are required and it was emphasized that FAO should facilitate getting access to the differential sets available with CIMMYT. This will help in reporting rust development in Dzongkhags and Gewogs well in advance of main crop season which spreads over from September-June depending upon different agro-ecological situations.

### **4.3. Formation of National Wheat Team**

After detailed discussion with participants representing different institutions the following seven institutions have been identified and they have agreed to work together as members of the National Wheat Team:

1. National Plant Protection Center (NPPC)
2. National Biodiversity Center (NBC)
3. RNR-Research Center (four Regional Research Centres)
4. Seed Services (Druk Seed Corporation, MoA)
5. Agriculture Division, Department of Agriculture
6. National Soil Service Center (NSSC)
7. Bhutan Agriculture and Food Regulatory Authority (BAFRA)

Brief information about each member institution of the National Wheat Team is given at **Annex-V**.

#### **4.3.1. Role of National Wheat Team**

The role and responsibilities of each member of the National Wheat Team have been identified during the discussion and are given briefly as under:

##### **4.3.1.1. Role of National Plant Protection Center (NPPC)**

- a. Organizing surveys and surveillance & monitoring of wheat rust diseases in collaboration with other members of National Wheat Team and sharing the information among stakeholders
- b. Management of wheat rust diseases in collaboration with other members of National Wheat Team and stake holders
- c. Pathotyping of wheat rust races in collaboration with other members of National Wheat Team
- d. Wheat rust Risk Assessment
- e. CNR to participate in wheat rust survey and surveillance & monitoring
- f. Participation in wheat variety improvement program of RNR-Research Centers

##### **4.3.1.2. Role of Bhutan Agriculture and Food Regulatory Authority (BAFRA)**

- a. Enforcement of plant quarantine regulatory measures against wheat stem rust Ug99 and races of other wheat rusts
- b. Participation in wheat rust surveillance and monitoring organized by NPPC.

##### **4.3.1.3. Role of National Biodiversity Center (NBC)**

- a. Collection and conservation of wheat germplasm
- b. Screening germplasm for wheat rust resistance
- c. Surveillance on alternate and collateral hosts of wheat rusts
- d. Facilitating Material Transfer Agreement

##### **4.3.1.4. Role of RNR-Research Center (4 Regional Research Centres)**

- a. Breeding/evaluation of rust tolerant/resistant wheat varieties
- b. Introduction of rust tolerant/resistant wheat varieties and their evaluation
- c. Collection and collation of information on role of wheat in food self sufficiency/food security

- d. Establishing linkages with International and Regional Research network on wheat improvement
- e. Participation in wheat disease survey and surveillance & monitoring organized by NPPC and regional/international collaboration
- f. Pathotyping of wheat rust races in collaboration with NPPC

**4.3.1.5. Role of Seed Services (Druk Seed Corporation)**

- a. Ensuring multiplication and availability of seeds of released rust tolerant/resistant wheat varieties

**4.3.1.6. Role of Agriculture Division (DoA)**

- a. Policy support to wheat rust survey and surveillance & monitoring, evaluation of rust tolerant/resistant wheat varieties and promotion of improved varieties
- b. Information management and sharing on wheat rust situation in the country and emergency action in the event of reported occurrence of wheat rust Ug 99 and promotion of use of rust resistant/tolerant varieties.
- c. Promotion of extension activities on wheat rust disease management and improved wheat cultivation and production practices
- d. Support to rust tolerant/resistant wheat varieties evaluation and promotion of improved varieties
- e. Multiplication of seeds of released rust tolerant/resistant wheat varieties for distribution among farmers

**4.3.1.7. Role of National Soil Service Center (NSSC)**

- a. Wheat crop soil nutrient assessment
- b. Wheat crop nutrient deficiencies management
- c. Participation in wheat rust disease management workshops organized by MoA and extension education campaigns on wheat improvement

**4.3.2. National Wheat Team Focal Persons**

A list of focal persons representing each institution of the National Wheat Team is given as under:

Institute	Name	Tele#	E-mail	Mobile #
NPPC	Dr Thinlay	351016	<a href="mailto:nppc@druknet.bt">nppc@druknet.bt</a> <a href="mailto:Baap10@yahoo.com">Baap10@yahoo.com</a>	17602441
BAFRA	To be identified?	Sent a letter to BAFRA to nominate	<i>I will send after being nominated</i>	
NBC	Ms.Asta Maya Tamang	351218	<a href="mailto:tamangasta@hotmail.com">tamangasta@hotmail.com</a>	17646616

RNR-Research Center (4 RC)	RC Jakar Mr. Wangda RC Wengkhar Mr. Tirtha Katwal RC Bajo_ Mr. Mahesh Ghimiray RC Yusipang- Mumta Chhetri	06240548  02481361 02321602	<u><a href="mailto:Wangda@druknet.bt">Wangda@druknet.bt</a></u>  <u><a href="mailto:tirthakatwal@gmail.com">tirthakatwal@gmail.com</a></u> <u><a href="mailto:mghimiray@gmail.com">mghimiray@gmail.com</a></u> <u><a href="mailto:muntachhetri@gmail.com">muntachhetri@gmail.com</a></u>	17645472  17669746 17634971 17618701
Seed Services (DSC)	Suraj Chhetri	08271465	<u><a href="mailto:surajchh@gmail.com">surajchh@gmail.com</a></u>	17937100
Extension (DoA)	Principal agriculture Officer- BN Bhattarai	322228		
NSSC	Ms. Yeshey Dema	351037	<u><a href="mailto:nssc@druknet.bt">nssc@druknet.bt</a></u> <u><a href="mailto:yesheydema@gmail.com">yesheydema@gmail.com</a></u>	

#### 4.3.3. Terms of Reference for National Wheat Team

During the discussion it was suggested that keeping in view the role and responsibilities identified for each member of the National Wheat Team, suitable Terms of References would be issued through an office order/notification by the MoA to facilitate immediate constitution and functioning of National Wheat Team

#### 4.4. Linkages with National, Regional and International Institutions

The linkages among the participating institutions of the National Wheat Team as well as Regional and International Organizations were discussed in the workshop on 25 November 09. The salient outcome of the discussions is as under:

##### 4.4.1. Linkages and Information sharing with National Institutes

In order to forge close linkages and sharing of information among the seven members of the National Wheat Team and other stakeholders a **two day Annual Meet** in August was suggested and it was agreed upon by the participating institutions during the workshop. The annual meet will facilitate reviewing the out come of the work done on wheat rust diseases during the crop season 2009-10 and to develop an Action Plan for the ensuing wheat crop season 2010-11 based on the experiences of earlier crop seasons. It was also suggested that the Program Leader may convene an emergency meeting of the National Wheat Team in the event of any emergent situation arising out of any occurrence of wheat stem rust Ug99.

As regards information sharing on wheat stem rust it was agreed to circulate BTOR among National Wheat Team members. However, a detailed report on wheat stem rust disease situation will be circulated among all stakeholders for dissemination of the information. However, as regards the Wheat Program Progress Report, it was felt appropriate to share it preferably once in three years. Further, it was also suggested that information on wheat stem rust Ug 99 may be put on RNR-RC, Bajo website to facilitate sharing the information among all countries dealing with wheat rust disease situation.

##### 4.4.2. Regional and International linkages

To deal with the emerging problem of wheat stem rust Ug99 linkages with Regional and International organizations are of paramount importance for Bhutan. Since FAO is currently coordinating with all international and regional organizations under its Wheat rust disease Global Programme, the participants felt that FAO should be requested to consider:

4.4.2.1. Forging linkages with Borlaug Global Rust Initiative (BGRI), CIMMYT, ICARDA, National Institute of Wheat Research, ICAR and other institutions for accessing to:

- Wheat stem rust Ug 99 and other rust tolerant/resistant varieties for adaptation trials
- Winter/spring wheat germplasm viz., cold tolerant short duration germplasm as well as for
- Interaction and information exchange on wheat stem rust Ug99

#### **4.5. FAO support**

Following are some of the areas identified during the workshop to seek the support of FAO for:

##### 4.5.1. Training of Research and Extension staff on:

- Survey and surveillance/reporting of wheat rust diseases and their alternate/collateral hosts
- Adaptation trials of disease tolerant/resistant varieties as well as
- Virulence monitoring of wheat rusts at national level

##### 4.5.2. Strengthening of infrastructure along with special equipments for wheat rust race analysis

##### 4.5.3. Popularizing adapted rust tolerant/resistant varieties through field demonstrations and their seed multiplication to facilitate replacement of susceptible ones

##### 4.5.4. Capacity building of Research and Extension staff and Farmers through

- Season Long Training of Trainers (ToT) and Farmers Field School (FFS) on wheat stem rust Ug99 and its management

##### 4.5.5. Bringing out suitable posters and pamphlets on wheat stem rust Ug99 to sensitize and create awareness among all stakeholders

##### 4.5.6. Capacitating RNR-Regional Research Centers including National Plant Protection Center in basic diagnostic equipment/infrastructure

#### **5. Contingency Plan**

Though there are no major incidences of rust diseases in the country, development of a strategy/contingency plan is very much needed to enable them in preparedness to deal with any possible outbreak of wheat stem rust Ug99 in Bhutan.

Following are some of the critical areas identified under contingency plan:

##### 5.1. Dedicated National Disease Surveillance and Monitoring system to be in place

##### 5.2. Improvement of the wheat varieties

##### 5.3. Improvement of National system for quick seed multiplication and distribution among farmers

##### 5.4. Eradication of “Green bridges” of alternate and volunteer plants carrying rust populations (wild grasses, barley or wheat grown out of season or self sown in abandoned fields)

##### 5.5. Targeted fungicidal application in hot spots of rust infections

Details of components of Contingency Plan and the institutions identified for initiating collaborative action are at **Annex-VI**.

## **6. Way Forward**

Considering the imminent danger to food security of the country due to wheat stem rust Ug99 the Royal Government of Bhutan should accord higher priority for:

6.1. Developing a Strategic National Program for Wheat. Such an approach will certainly facilitate increasing the area and production and contribute to food security of the country. Since the Indian sub continent has been already categorized by FAO as wheat stem rust Ug99 high risk country this assumes greater significance to Bhutan's food security concern

6.2. Strengthening of pest /disease surveillance system including establishing a dedicated surveillance unit at NPPC with adequate human resource allocation and capacity development of staff to under take regular surveys to monitor wheat stem rust Ug99 and other rust diseases and to organize appropriate control measures

6.3. Organizing Workshops and meetings to sensitize and create awareness among policy makers, Dzongkhag extension staff, farmers and other stakeholders about the imminent danger of wheat stem rust Ug99 and its possible impact on food security and to facilitate dealing with the problem more effectively

6.4. FAO support under Wheat Rust Disease Global Programme for the following priority areas have also been identified during the workshop:

6.4.1 Awareness creation and sensitization of policy makers, extension workers and farmers

6.4.2. Capacity building among Research and Extension staff and farmers in the diagnosis, survey and surveillance and management of wheat stem rust Ug99 and other rusts and their alternate/collateral hosts

6.4.3. Forging linkages with identified international institutes/Organizations and to gain access to wheat rust tolerant/resistant varieties /materials for adaptive trials and their seed multiplication to facilitate replacement of susceptible ones

## **7. Suggestions and Recommendation**

### **7.1. Higher priority for National Program for Wheat**

The National Program for Wheat should receive higher priority among other cereals considering the great potential for expanding wheat area and production to meet the growing demand for domestic consumption and its positive impact to food security of the country. This assumes greater significance to deal with emerging risk to wheat production, if any, on account of wheat stem rust Ug99 as the Indian sub continent has been already categorized by FAO as wheat stem rust Ug99 high risk country

### **7.2. Top priority for establishment of a dedicated surveillance unit**

Disease surveillance plays an important role for early diagnosis of the pest/disease development for initiating appropriate control measures. The present national surveillance system in the country is not fully equipped to meet the emerging challenges on account of wheat rust Ug99 and other pests/diseases. Therefore, the Government should give top priority for the establishment of a dedicated surveillance unit at NPPC with adequate human resources and other logistic supports to monitor the disease development more precisely for undertaking timely control measures

### **7.3. Awareness creation and sensitization on wheat stem rust Ug99 among policy makers**

Since *Berberis vulgaris*, an alternate host for the wheat stem rust fungus to complete its sexual phase of life cycle grows wildly in the hills at high altitudes in Bhutan and any possible escape of wheat stem rust Ug99 may likely to get established on the alternate host and cause devastation to wheat crop through the perpetuation and breeding of virulent races.

Therefore, awareness creation and sensitization on wheat stem rust Ug99 among policy makers, and other stakeholders are essential and this will help, to a great extent, to gear up country's preparedness to deal with such disease situation.

### **7.4. FAO Support**

FAO, on its part should consider extending support to Bhutan under its **Wheat Rust Disease Global Programme** for the following priority areas identified during the workshop:

7.4.1. Organizing workshop meetings, jointly with Ministry of Agriculture, for awareness creation and sensitization of policy makers and stakeholders

7.4.2. Capacity building among research and extension staff and farmers in the diagnosis, survey and surveillance and management of wheat stem rust Ug99 and other rusts and their alternate/collateral hosts.

7.4.3. Forging linkages with CIMMYT, BGRI, and other international organizations/institutes to get access to rust tolerant/ resistant wheat varieties for adaptive trials and sharing of information on wheat rust diseases.

7.4.4. Allocation and release of budget for implementing the contingency plan as outlined at **Annex-VII**.

The priority areas indicated at 7.4.1 and 7.4.2. may be timed during the active wheat crop season coinciding with rust disease development. Therefore, the next Consultancy mission may be planned some time in March-April 2010 depending upon wheat stem rust disease appearance in the field.

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## 9. References

1. "Fungi and Plant Parasitic Bacteria, Viruses and Nematodes in Bhutan. By: I. D. Firman, W. T. H. Peregrine, Thinlay and Pema Tamang, 1988".
2. Mapping the Status of Bhutan's Renewable (Agricultural) Natural Resources. International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal, 2006.
3. Mumta Chhetri: Trend in Wheat cultivation in Bhutan: RNR-RC, Yusipang, DoA, 2007
4. FAO Wheat Rust Disease Global Programme: Crisis Management Centre for the food chain: Plant Protection, pp 27, 2008.
5. SAARC Declaration to combat Wheat Stem Rust Ug99: The Extraordinary Meeting of SAARC Agriculture Ministers held in New Delhi on 5<sup>th</sup> November 2008.
6. Wafa El Khoury and Keith Cressman: Contingency plans for wheat rusts: Preparedness and early response. In FAO International Conference on Wheat Stem Rust Ug99 -A Threat to Food Security, 6-8 November 2008 New Delhi, India
7. Profiles of Ministry of Agriculture, CoRRB, BAFRA, National Biodiversity Centre, National Soil Survey Centre and Druk Seed Corporation, 2008.
3. Ragunathan .V: FAO Consultancy Report on Pesticide Management Review in Bhutan 2009

## **10. Annexure**

Annex-I: Agenda for Workshop on Wheat Stem Rust Ug 99 on 24-26 November 2009

Annex-II: List of Participants of 3-day Workshop on Wheat Stem Rust Ug99

Annex-III: Presentation by Consultant on wheat stem rust Ug99

Annex-IV: Opening Session of the Workshop on Wheat Stem Rust Ug99

Annex-V: Brief information about each member institution of the National Wheat Team

Annex-VI: Wheat Stem Rust Ug 99 Contingency Plan: Preparedness and Preventive Actions

Annex-VII: Estimated Budget for Wheat Stem Rust Ug99 Contingency Plan

