The International Treaty
ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Benefit-sharing Fund of the International Treaty on Plant Genetic Resources for Food and Agriculture

Project Cycle 2012-2014

WINDOW 2

IMMEDIATE IMPACT PROJECTS
PR-113-India

Final Technical Report
(General instructions)

This Final Technical report must be sent to the Secretary of the International Treaty on Plant Genetic Resources for Food and Agriculture electronically at the following address ***Treaty-Fund@fao.org***

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1. EXECUTIVE SUMMARY

The project on 'Using rice genetic diversity to support farmers' adaptation to climate change for sustainable production and improved livelihoods in India' was concluded with a reasonable degree of success. The project is based on the premise that while agricultural biodiversity remains central to the livelihood strategies of many rural farmers and communities, its continuing maintenance depends on more effectively mainstreaming the benefits from its appropriate conservation, management and use, with appropriate reflection in policy..

Recognizing the importance of agrobiodiversity to climate change adaptation, the project also addresses the development of appropriate strategies and actions that will ensure that agrobiodiversity supports the resilience, adaptability and transformation needed, thus underscoring its effective conservation and sustainable use.

The project has also sought to establish a farmer-based experimentation network in the IGP region and the Himalayan agro ecosystem for on-farm participatory testing in order to explore if a wider range of agriculture diversity in rice enhances the adaptive capacity of farmers in areas experiencing climate variability.

The main objective has been to ensure that rural communities are able to maintain and adapt traditional rice genetic diversity as well as adopt new varieties/landraces, where appropriate, from *ex situ* collections, for their food security and the environmental resilience of their production systems in the face of climate change.
In addition, there has been an effort to strengthen the local seed system to provide farmers with increased access to varietal choice for better climate change adaptation.

The existing situation before project start was assessed through a literature study and three baseline surveys on: Farmer Perceptions of Climate Change; Farmer Perceptions of Agro biodiversity and Existing Seed Systems and Indigenous Knowledge.

The primary crop studied was rice but given the importance of finger millet to mountain agriculture and food security and the fact that it is a highly climate resilient and nutritious grain, millets were included in the research.

The project was conducted in an inclusive and participatory manner and included 26,858 direct beneficiaries of which 25046 were farmers. The indirect beneficiaries numbered about 202000 rural people in 202 project villages. Some 2450 farmers were trained in Farmers Rights, as were 38 NGOs and 170 women's groups.

There have been significant achievements during the project implementation and some challenges.

The successes first: Four community seed banks have been established at four locations with a master seed bank in Uttarakhand which will keep back up collections and keep adding

germplasm beyond the life of the project. The total collection in the seed banks numbers 1050 accessions of which 487 are rice. Twenty five climate adapted varieties have become available to farmers.

The master seed bank in Uttarakhand in particular is valuable assets that will take forward the collection and conservation of genetic diversity, add to the national collection, help to maintain and increase on farm conservation and make available locally adapted germplasm to the community from time to time.

The seed samples conserved in the bank also make available to scientists and plant breeders well characterised varieties for trait evaluation and breeding of new plant varieties for future needs.

The PVS program was greatly appreciated by farmers who said: “The opportunity to see several varieties from different places in cultivation was very empowering. We got the chance to choose according to our needs.”

The Seed Diversity Fairs have proved to be great platforms for exchanging seeds and information and have created channels for farmer interactions. Farmers were able to track varieties they had lost from other farmers of the region who they met at the Seed Fairs.

The project has created a platform for farmer interactions created across diverse ecosystems, in the mountains and locations in the Indo-Gangetic Plains (IGP). This farmer to farmer learning and sharing of experiences will be a valuable tool in sharing strategies and experiences in using agrobiodiversity for stabilizing food security and adaptive response to climate change.

One big success of the project has been to revive interest in crop genetic diversity and underscore its importance as a resource that provides options to the farmers to ride out this or the other kind of inclement weather or uncertainties in the climate. Older farmers know the value of crop diversity but the project focus on diversity not only validates their position, it educates the younger farmers.

There were challenges too, mostly the systemic one of the neglect of on farm conservation in national policy. Conservation of genetic diversity is focused on ex situ conservation in the gene banks. The genetic erosion seen since the Green Revolution days is escalating since Government has been aggressively promoting the adoption of hybrids and HYVs of rice but has not been paying sufficient attention to conservation and use of traditional varieties. So the message that goes from government programs to farmers is that traditional varieties are not important as compared to HYVs and hybrids.

There is a growing the alienation from genetic diversity among young farmers. In Himachal Pradesh, even older farmers (35-55 years) do not know the names of the rice varieties they cultivate and think nothing of traditional varieties.

In Bihar and Uttar Pradesh engaging women proved a challenge. Due to the prevailing cultural situation where women do not come out freely in the presence of men, it was not easy to organise joint meetings with farmers or rural communities This challenge was overcome in two ways: one to conduct separate workshops, trainings and discussions for women farmers and two, by taking the views and responses of women in their homes rather in open or public spaces. The situation is very different in the mountain states of Himachal Pradesh and Uttarakhand, women engage freely in public. Especially in the Himalayan region, women have been in the forefront of farming activities and have been in a position to take decisions.

2. METHODOLOGY OF THE FINAL REPORTING

2.1. Monitoring approach and data collection methods

Baseline surveys were conducted in each project site to evaluate the ground reality and to monitor progress made by project interventions.

The overall responsibility for monitoring project activities was with the Gene Campaign (GC) team at the head office (HO) in Delhi, headed by Dr Suman Sahai. The HO team was supported by GC staff from its field station in Uttarakhand. The project staff hired for the current project worked in close coordination with the GC team.
Monitoring teams at each site consisted of one GC staffer, members of the project staff, a senior farmer or other member of the local community, often a member of the nearby university, research institute or KVK and sometimes a local organisation.

Monitoring was done carefully for each activity. Technical planning and issues faced in the field were usually handled by the team in consultation with scientific experts and the HO team. Dr Sahai being a scientist and an expert in genetic diversity was always at hand for guidance on scientific and technical issues as was Dr Prem Mathur of Bioversity International. Procedural issues or community issues were sorted out with the support and cooperation of community elders. If there were problems with planning , the HO team got involved to resolve the issue.

Monitoring was done regularly, field reports were made by project staff and submitted to the project leadership and HO team every month. The HO team made regular field visits to discuss plans, evaluate implementation and work with project staff to find answers to challenges.

Staff from all project sites met once a quarter with the project leadership to plan budgeting, interventions, community interactions implementation.

Methodology Used:

Baseline surveys were conducted in each project site to later evaluate progress made by the project activities.

Methods used to collect data for surveys and perception studies included the repertoire of social science methodologies for field work. These were household interviews, interviews with key persons, household surveys based on representative sampling, focus group discussions (FGD), community observations.

Collection of agrobiodiversity and community knowledge in UP, Bihar and Himachal Pradesh was done using the saturation approach in which every household that was cultivating traditional varieties was questioned. In the case of Uttarakhand where agrobiodiversity was still in use and more prevalent, FGDs were conducted to identify villages and families where traditional varieties were still being cultivated. Collection of agrobiodiversity and community knowledge was done using a structured survey form in which passport data was recorded as was the information about the variety provided by the farm family.

Field trials of rice varieties for characterisation as also for Participatory Varietal Selection at each of the four sites were laid using the Random Block Design. For evaluating performance of finger millet germplasm and varieties in Uttarakhand, the System of Millet Intensification (SMI) trials were laid out using the augmented design.

Participatory Varietal Selection Trials (PVS) were conducted in which 20-30 varieties of paddy were trialled at different villages in a region. The PVS process was standardized in the form of on-farm trial designs and we developed appropriate formats for trial evaluation. In Uttarakhand, PVS trials of millets was also undertaken since finger millets are a traditional crop and more widely cultivated as a staple than paddy.

Scientific Crowdsourcing was tried in this study to get farmer inputs about the performance of plant varieties, making farmers the decision makers, who select the varieties they want to cultivate. Farmers were given small amounts of seeds of many varieties are grown in small plots and to analyze their performance under a given set of climatic conditions. In each season, farmers rejected some varieties, took a few forward into the next season, to which were added a new set of varieties to grow and evaluate. This process can continue till the ‘crowd’ of farmers select the varieties that they find are best suited to their area and their cultivation. ClimMob is a software programme developed by the CGIAR system for crowdsourcing climate-smart agriculture. Crowdsourcing climate-smart agriculture implies that farmers contribute observations in order to produce information about technological options under different field conditions. These observations are then combined and patterns extracted, providing new insights about the suitability of the evaluated options.

Field trial and characterization of finger millet varieties was conducted, using the standard descriptors. Evaluation was done for the response of finger millet varieties to the principles of SRI (System of Rice Intensification) which is known to increase rice yields. Trials were done with traditional and improved varieties of finger millet in a System of Millet Intensification (SMI). This was done with the expectation of promoting those varieties that demonstrate yield increase under SMI. The importance of the strongly climate resilient finger millet to the food security of rural communities in mountain areas cannot be underestimated; hence Gene Campaign elected to include this crop in the research. 20 different varieties of finger millet

from National Bureau of Plant Genetic Resources (NBPGR) were taken for the trials in 3 different locations in Uttarakhand (Orakhan, Majhera & Hawalbagh) out of which 8 millet varieties were also evaluated through SMI. The qualitative and quantitative characterization was then done.

To assign geographic coordinates to the rice collection, the geo referencing software ESRI ArcInfo 10.0 was used. Mapping of climate variables was done using the current climate data from the Worldclim database (http://www.worldclim.org/). Each climatic variable for all the geo-referenced accessions was extracted using DIVA-GIS. The extracted climate data was then grouped into 6 classes for better visual representation.

In order to identify the 'outlier' accessions which are adapted to unique climate conditions, the current annual mean temperature (^{0}C) and annual precipitation (mm) were plotted in DIVA-GIS. The accessions lying outside the envelope are the unique accessions within the collection. The climate data for precipitation, mean temperature, maximum temperature and minimum temperature for India were obtained from the Worldclim climate database for current climate and the CSIRO -Mk3.5 General Circulation Model (GCM) SRES A1B of the CSIRO Atmospheric Research Group of Australia was used for the future data for the decades of 2020s and 2040s. The downscaled climate data was then mapped in ArcInfo 10.0 to obtain the information depicted in Figure 8.

The climate matching was done through the Maxent (http://www.cs.princeton.edu/~schapire/maxent/) program or maximum entropy modeling which was developed to model species' geographic distributions based on some environmental variables. Maxent, or Maximum Entropy Species Distribution Modelling, was written by Steven Phillips, Miro Dudik and Rob Schapire, with support from AT&T Labs-Research, Princeton University, and the Center for Biodiversity and Conservation, American Museum of Natural History. The model predicts the probability of the presence of a species based on any given environmental condition. In this case, future climate data was used as the environmental variable on whose basis the probability of the accessions being present in future conditions was determined.

Data representation of the project activities was done in form of various statistical and pictorial representations like bar graphs, pie charts, venn diagrams, flowcharts, pyramid, hierarchy, matrix form, etc.

Instruments Used:

- The climatic data are recorded by deploying advanced sensor-based data logging hardware's (iButton). iButtons were used for recording temperature and RH of the individual villages on real-time basis
- GPS was used to mark all the sampling units
- Video and audio recorders were used for digital documentation.
- Data recording was done real-time on Android based application using Tablets.

Places visited during the reporting

- Haryana: 30 villages in Karnal district
- Uttarakhand: 64 villages in Nainital, Almora and Pithoragarh districts
- Bihar: 51 villages in Vaishali, Muzzafarpur and Samastipur districts
- Himachal Pradesh: 43 villages in Kangra and Chamba districts
- Uttar Pradesh: 44 villages in Siddhartnagar, Badaun and Unnao districts
- Nepal- Libird, in Dhading and Kachorwa districts
- Delhi- GC Head Office, GC Field Station in Uttarakhand, GC Field Station in Jharkhand and Bioversity International Delhi Office

2.2. Stakeholders' involvement in the monitoring process.

Gene Campaign carried the overall responsibility for conducting the project activities in all project sites. It worked closely with Bioversity International at the planning and implementation levels as well as for preparing the Final Technical Report. Dr Prem Mathur's regular inputs were greatly appreciated.

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To make the project inclusive and to seek their collaboration and inputs, project activities were first discussed with the different stakeholders.

To enable local buy-in and acceptance of project activities so that the stakeholders, specially the community is involved and interested in taking the project forward, the project activities were conducted in collaboration with research scientists, field researchers, educational institutions, local NGOs and community based organisations, panchayats (local self government bodies), mahila samuhs (women's groups), woman self help groups (SHGs), farmer clubs and individual farmers. These agencies were also involved in monitoring one or the other activity and their inputs were sought for preparing the final report.

Roles & Responsibilities of Stakeholders

Uttarakhand (UK)

- Field staff- Conducting Project activities in collaboration with GC HO and local stakeholders, participation in collecting genetic diversity, sorting colletions and establishing a large seed bank

- Gene Campaign's Mahila kisan Samitis (Women farmers Associations), participation in project activities, engaged in monitoring activities, collecting genetic diversity and disseminating information about the value of genetic diversity to climate resilience, sustainable agriculture and food security. Involvement in setting up seed bank

- ICAR institution, Vivekananda Parvatiya Krishi Anusandhan Sansthan (Vivekanand Mountain Agriculture Research Center), Almora: Training programs, technical support

- NBPGR, Bhowali: providing seeds of traditional and improved varieties of finger millet varieties for trials

- Central Institute of Temperate Horticulture (CITH), Mukteshwar- Scientists provided training

- Govind Ballabh Pant University of Agriculture and Technology, Pantnagar:- Training programs and technical support

- Central Himalayan Rural Action Group (CHIRAG), Nainital – participation in collecting genetic diversity, awareness generation about genetic diversity and the need to conserve it

- Aarohi, Nainital – awareness generation about project activities

- Vimarsh, Nainital- disseminating information about the value of genetic diversity and farmers rights

- Himalayan Seva Samiti (HSS), Kumaon – awareness generation

Bihar

- Field staff- conducting 9roject activities in collaboration with GC HO and local stakeholders, collecting seeds of traditional crops and setting up seed bank

- IARI regional research station, Samastipur: Scientific and technical support, training programs, lending infrastructure

- Rajendra Agricultural University (RAU), Samastipur: Providing seeds for trials, training & monitoring, programs, trouble shooting

- Borlaug Institute for South Asia (BISA), Samastipur: Providing seeds for trials

-Bioversity International: conducting the crowd sourcing trials and field trials of HYV to evaluate performance and farmer preference, training programs and technical support

- Local NGOs: monitoring field trials, conducting surveys, participation in collecting genetic diversity

Men and women farmers: support in collecting seeds of traditional crops

Himachal Pradesh

- Field staff- conducting 9roject activities in collaboration with GC HO and local stakeholders

-Agriculture University, Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalay (CSKV), Palampur: Providing seeds of traditional and improved rice varieties for trials, training programs for farmers and field staff,

-KVK (Agriculture Science Center), Palampur- providing information on local conditions related to agriculture

-Farmer clubs – Participating in implementing and monitoring activities , generating awareness about the importance of genetic diversity to food security, participation in collecting genetic diversity

-Community organizations: support for collecting crop genetic diversity and community knowledge, participation in collecting traditional crops and setting up seed bank

-Women's groups: providing information on local varieties, villages cultivating traditional varieties, generating awareness about the importance of genetic diversity to food security, participation in collecting genetic diversity , engaged in monitoring

Uttar Pradesh

- Field staff- Conducting Project activities in collaboration with GC HO and local stakeholders

-Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad: technical support, training programs, seeds of improved rice varieties for trials

-Shohratgarh Environmental Society, Shohratgarh: collaborating to implement project activities, generating awareness about relevance of genetic diversity to sustainable agriculture, participation in collecting traditional crop varieties and setting up seed bank

-Krishi Vigyan Kendra (Agriculture Science Center), Faizabad: - Training programs, trouble shooting for problems in cultivation

-HPPI- Collaborating in conducting trials, awareness generation about genetic diversity

- Women's groups –participation in collecting genetic diversity

Degree of involvement of stakeholders

Stakeholders were involved in differing degrees in the monitoring process & preparing Final Technical Report. GC project staff, GC HO team , GC staff from Uttarakhand were constantly and consistently involved in all processes. They worked in collaboration with Bioversity International and other stakeholders at the each project site.

<u>Uttarakhand</u>

Gene Campaign's Field staff; Gene Campaign's Mahila kisan Samitis (Women farmers Associations); Farmers Clubs ; SHGs, scientists at the Central Institute of Temperate Horticulture (CITH), Mukteshwar; Govind Ballabh Pant University of Agriculture and Technology, Pantnagar:; ICAR institution, Vivekananda Parvatiya Krishi Anusandhan Sansthan (Vivekanand Mountain Agriculture Research Center), Almora; NBPGR, Bhowali; CHIRAG), Nainital ; Aarohi, Nainital ; Vimarsh, Nainital and Himalayan Seva Samiti Kumaon have provided help in monitoring field activities and provided inputs, information and data for the final report, in differing degrees.

Bihar

Gene Campaign field staff, scientists at IARI regional research station, Rajendra Agricultural University (RAU), Bioversity International; local NGOs as well as women and men farmers have been involved in preparing the final report (data, information) and have helped to monitor one or the other activity along with GC staff.

Himachal Pradesh

GC field staff; farmer clubs; community organizations; local SHGs and women's groups: scientists from the Agriculture Science Center and the Agriculture University played a role in monitoring field activities and provided inputs for the final report, in differing degrees.

Uttar Pradesh

GC field staff; Shohratgarh Environmental Society; scientists from the Agriculture Science Center and the Narendra Deva University of Agriculture & Technology as well as local farmers groups provided inputs for the final technical report and helped to monitor activities in the field

2.3. Challenges and major issues identified in conducting the monitoring

* In Haryana, which we had adopted in the first study year, farmers have lost complete interest in crop genetic diversity and traditional varieties. This part of the Indo Gangetic Plains (IGP) is given over to high chemical input, intensive agriculture that focuses only on crops for the market. This area cultivates rice for export, almost entirely as monocultures of HYV and hybrids. The region has also emerged as a significant producer of Basmati rice. Because farmers have adopted commercial agriculture to the fullest extent, there is zero interest in genetic diversity or broadening the genetic base of their agriculture. It was for this reason that we asked ITPGR to change our research model to include two different mountain ecosystems (Uttarakhand and Himachal Pradesh) and 2 locations in the IGP, UP and Bihar. This model has proved interesting since it provides opportunities for comparing perceptions and management of genetic diversity in the different communities in differing agriculture systems.

* In Bihar and Uttar Pradesh engaging women proved a challenge. Due to the prevailing cultural situation where women do not come out freely in the presence of men, it was not easy to organise joint meetings with farmers or rural communities This challenge was overcome in two ways: one to conduct separate workshops, trainings and discussions for women farmers and two, by taking the views and responses of women in their homes rather in open or public spaces. The situation is very different in the mountain states of Himachal Pradesh and Uttarakhand, women engage freely in public. Especially in the Himalayan region, women have been in the forefront of farming activities and have been in a position to take decisions.
* Since agriculture has become non-remunerative and even government surveys show that nearly 50% of young farmers want to abandon farming, we see a growing disenchantment with farming and a reluctance to invest too much effort into it. Younger farmers were most interested to engage in all activities related to productivity increase.
* The genetic erosion seen since the Green Revolution days is escalating since Government has been aggressively promoting the adoption of hybrids and HYVs of rice but has not been paying sufficient attention to conservation and use of traditional varieties. So the message that goes from government programs to farmers is that traditional varieties are not important as compared to HYVs and hybrids.
* In Himachal Pradesh, the alienation from genetic diversity among young farmers , is of a very high order. Even older farmers (35-55 years) do not know the names of the rice varieties they cultivate and think nothing of traditional varieties. In many villages in Kangra, where the agriculture university is located, farmers refer to rice varieties, not by their names but as “the one from the market” or “the one from the university”.
* It is obvious that the need for training programs on the importance of traditional varieties for coping with climate turbulence and adapting to climate change will have to be intensified and the cultivation of traditional varieties incentivized in some way. It is only when farmers realize that traditional varieties are important to their survival in agriculture that these varieties will get their due recognition.

3. EFFECTIVENESS

3.1. Attainment of objectives and planned results

BASELINE STUDIES

Before the project activities were initiated, baseline surveys with the local community were done in all the four sites of the project: Uttarakhand, Bihar, Uttar Pradesh & Himachal Pradesh. The following baseline studies were done:

1. Farmers’ Perception of Climate Change & Adaptive Responses

2. Seed systems and Indigenous knowledge
3. Farmer perception of agrobiodiversity/ traditional varieties

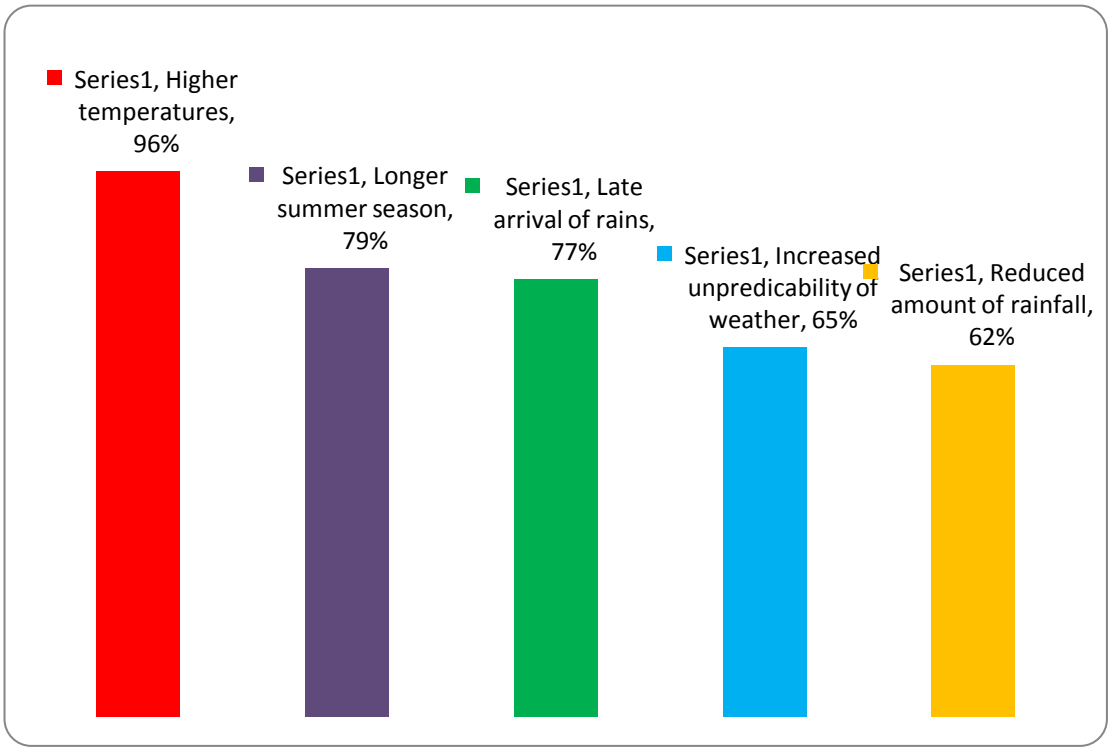
RESULTS:

1. FARMERS' PERCEPTION ON CLIMATE CHANGE & ADAPTIVE RESPONSES

UTTARAKHAND

Observed Changes in Weather Patterns:

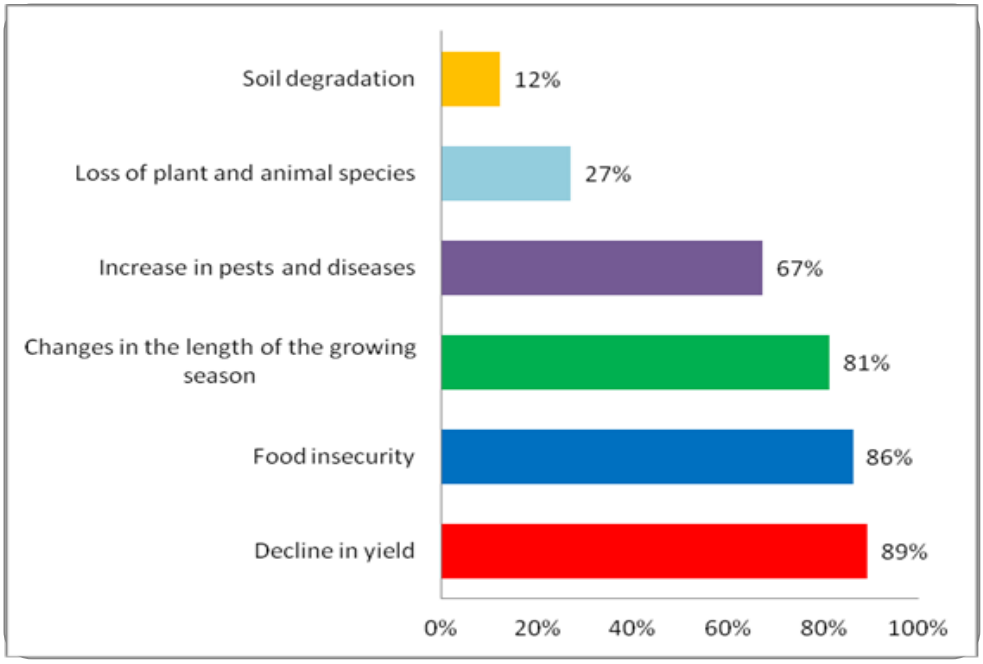
We find that almost every surveyed farmer has noticed that weather patterns are changing. Respondents observed changes in weather patterns, such as higher temperatures, increased unpredictability of weather, a longer summer season, reduced amount of rainfall, and later arrival of rains. These data indicate that the global phenomenon of climate change is having pronounced effects at the local level.



Effects of Perceived Changes in Weather Patterns:

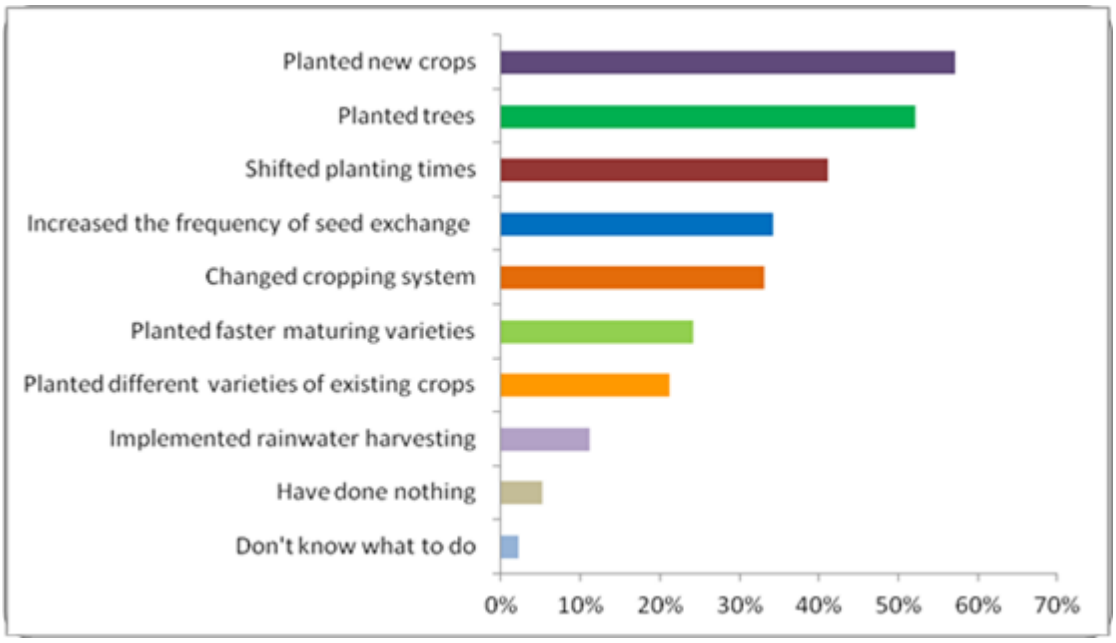
The most frequently noted effects of changes in weather patterns included changes to the length of the growing season, increases in pests and diseases, food insecurity, and decline in yield. Other effects that were less commonly mentioned were the loss of plant and animal species and soil degradation. These data expose the close relationship between the reliability

of weather patterns and food cultivation, and more strikingly, they reveal the detriment to crop cultivation already posed by the effects of climate change.



Response to Changes in Weather Patterns:

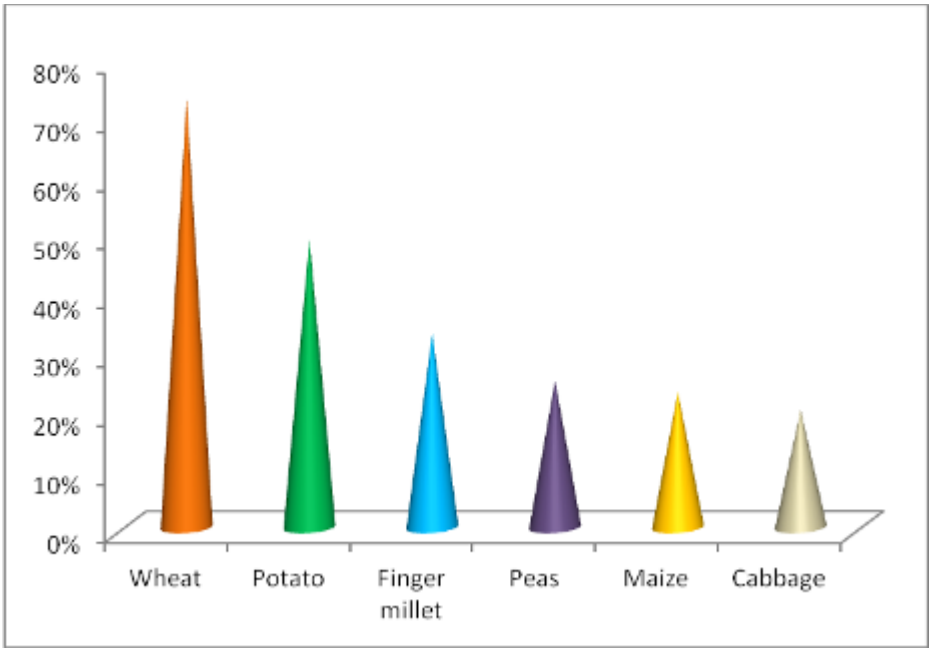
Respondents, however, noted that they had taken adaptive responses to these effects of changing weather patterns. Responses varied widely and the most common responses were that farmers had planted new crops altogether, planted trees, shifted planting times, increased the frequency of seed exchange with other farmers, changed their cropping system, planted faster maturing varieties of existing crops, planted different varieties of existing crops, and implemented rainwater harvesting.



The Present and Projected States of Crop Cultivation:

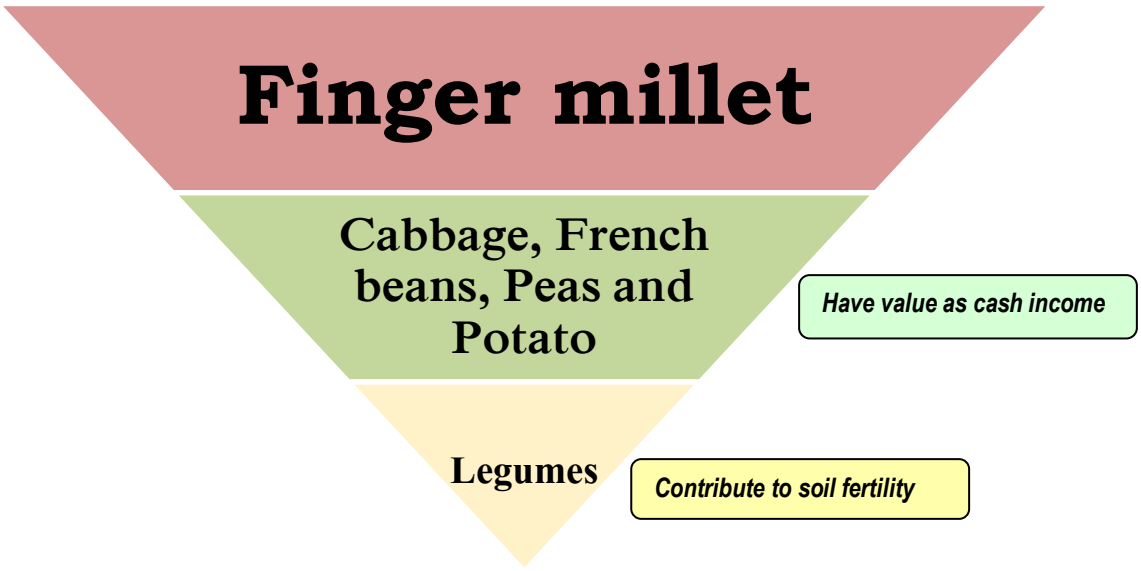
a) Crops that have declined over the past five years

When asked which crops had declined over the past five, respondents most often responded with wheat (73% of respondents), potato (49%), finger millet (33%), peas (25%), maize (23%), and cabbage (20%). Together, these crops comprise the most commonly grown vegetables and cereals for household consumption, which suggests that household food security could be growing less dependent on household food production.



b) Crops that would be important for the future

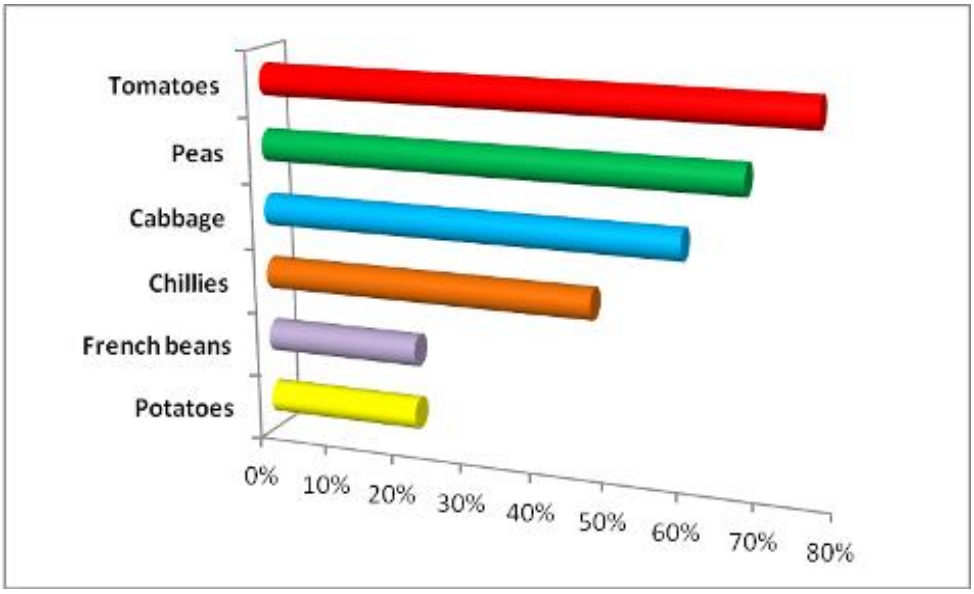
When asked which crops would be important for the future, respondents most frequently mentioned finger millet. French beans, cabbage, maize, peas, potatoes, and other legumes were also frequently mentioned. However, cabbage, French beans, peas, and potato were more likely to be named because of their value as a source of cash income than as food. Furthermore, respondents said that legumes were important for their contribution in sustaining soil fertility.



Perception of crops vulnerable and resilient to changing weather:

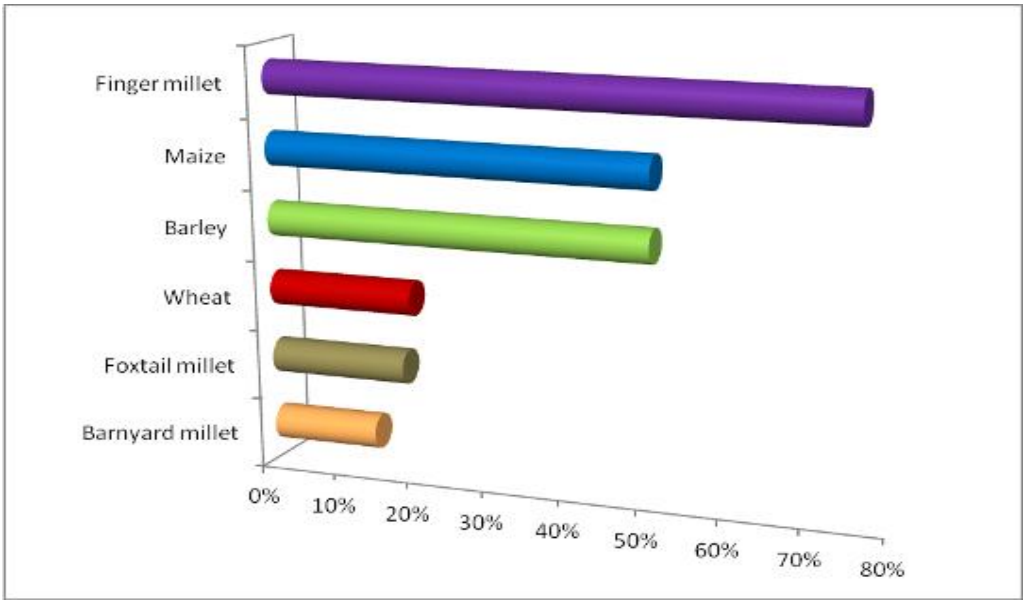
a) Crops vulnerable to changing weather patterns

The crops most commonly described as poorly suited to changing weather patterns are tomatoes (76% of all respondents), peas (67%), cabbage (59%), chilies (47%), French beans (22%), and potatoes (22%). A common theme is that these are all recently introduced vegetable crops, of which peas, cabbage, and potatoes are the most frequently grown.



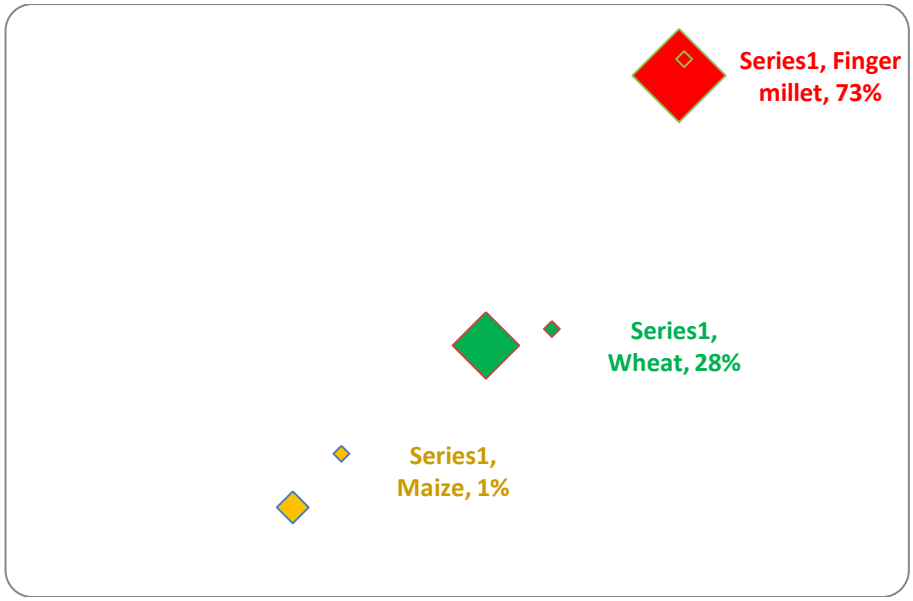
b) Crops resilient to changing weather pattern

The crops most commonly mentioned as resilient to changing weather patterns are finger millet (75% of all respondents), maize (50%), barley (50%), wheat (19%), foxtail millet (18%), and barnyard millet (14%). A characteristic shared by these crops is that they are all grains, which respondents also believe to be the most likely to decline in the future due to the availability of other, potentially more profitable, crop options.

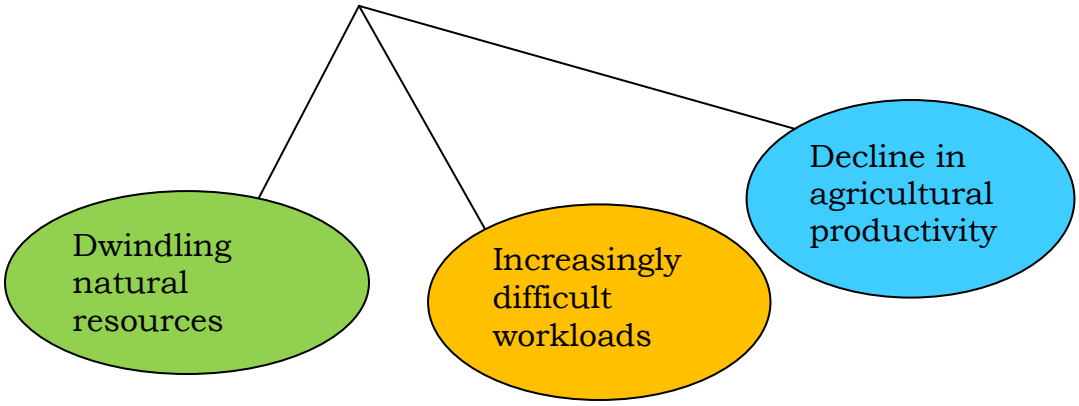


c) *Most nutritious crops*

73% of all respondents said that finger millet was the most nutritious crop; 28% noted wheat; and 1% believed maize to be most nutritious.



Impacts of Changing Weather Patterns on Workloads and Natural Resources:

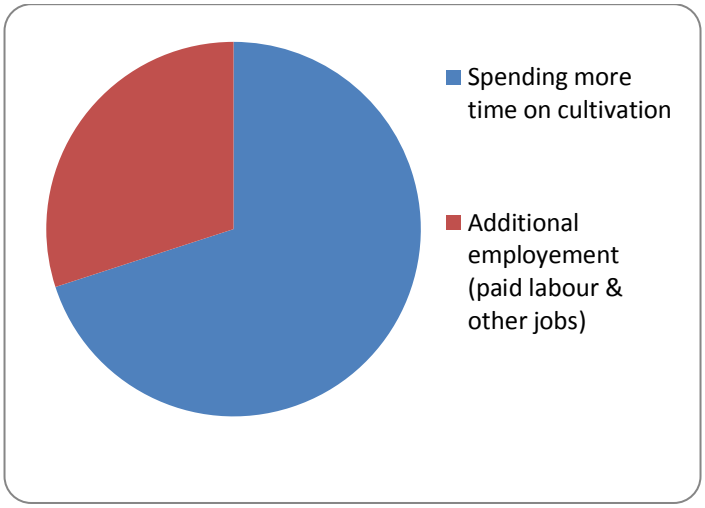


a) Impacts on natural resources

Great majority of respondents have described decreases in availability of fuel wood (83% of respondents), grass for fodder (87%), pasture land (89%).

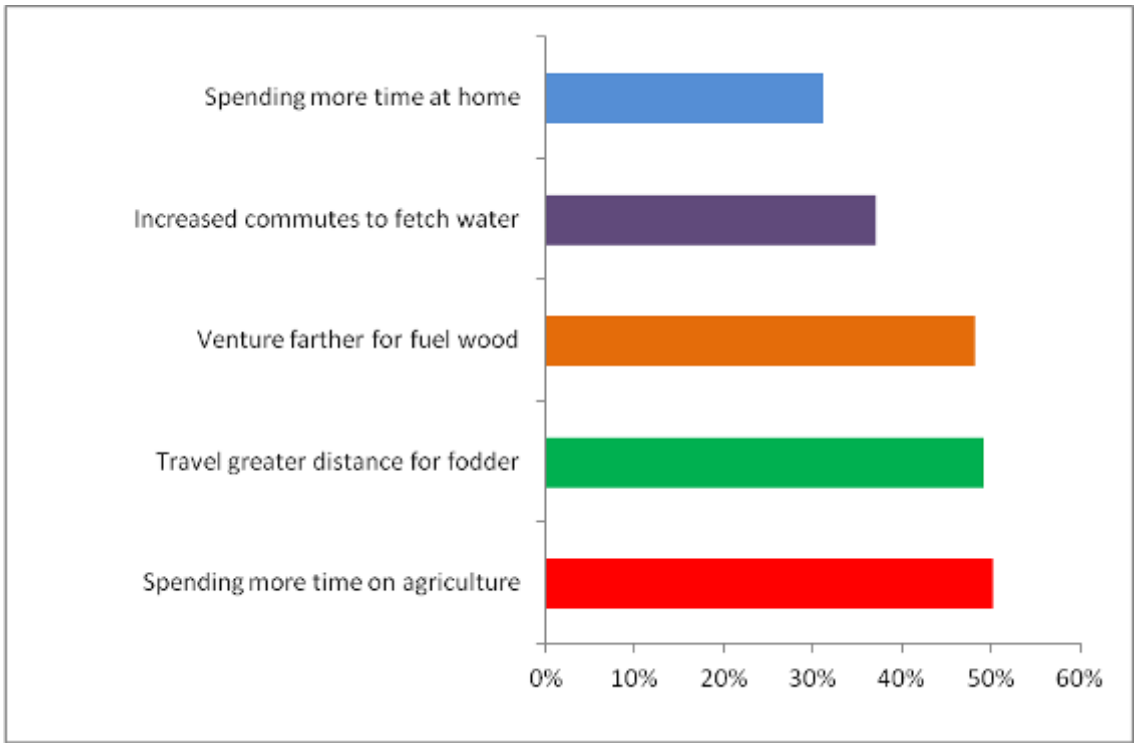
b) Impact on workloads of men

Respondents state that the roles of men and women have changed as a result of changing weather patterns. Men are spending more time on agricultural cultivation and taking up additional employment, in the forms of paid labor (16%) or other jobs (14%).



c) Impact on workloads of women

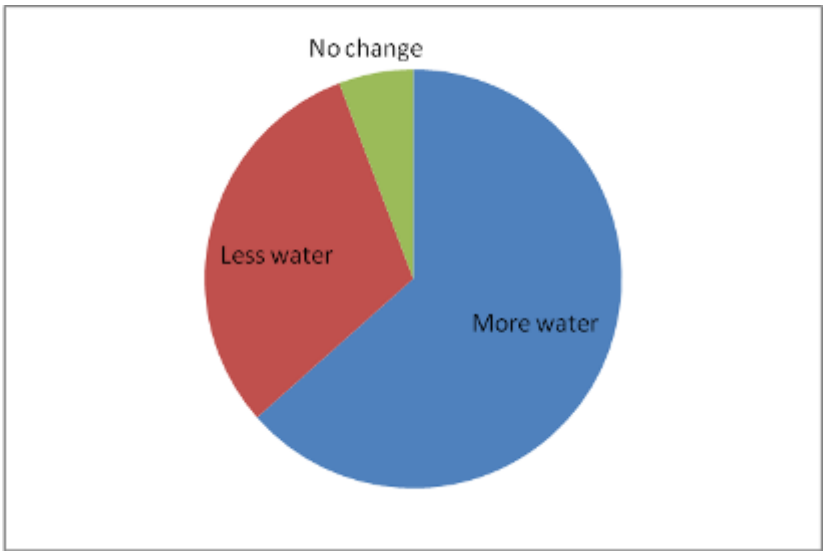
Respondents believe that women are also spending more time on agricultural cultivation and more time at home, and they have had to travel farther for collecting natural resources. They mentioned increased commutes for finding and fetching water, ventured farther for chopping and transporting wood and traveled a greater distance to harvest grass for their cattle.



HIMACHAL PRADESH

Change in water availability:

Majority of the respondents feel that in past few years there is a high availability of natural water resources due to which the farmers were not able to differentiate varieties according to their ability to face drought.



Change in water resources

Changes in weather pattern:

Majority of the respondents felt that there is a loss of distinction between seasons and no definite climate is prevalent in each season as it used to be in the previous times. The farmers also felt that the occurrence of rains has increased over the time even though the monsoon period has shortened in length. Overall increase in the average annual temperature was noticed by the farmers' with increased intensity of heat in the summers and decreased intensity of cold in the winters.

Less difference between seasons

More rain

Increase in temperature

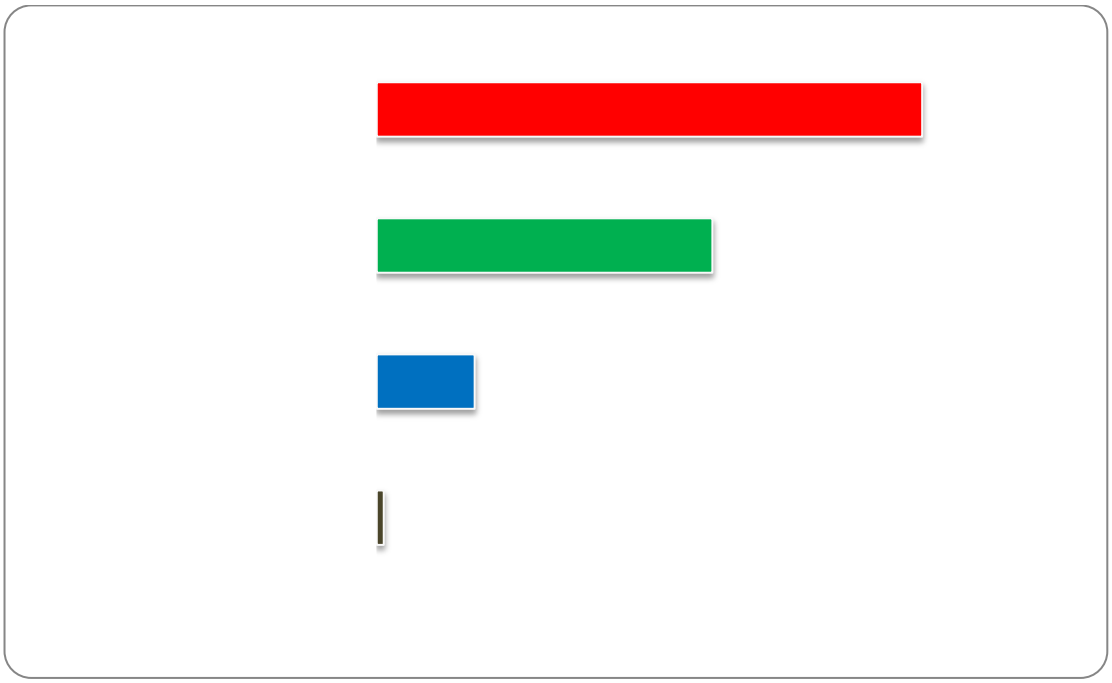
Shorter monsoon period

Increased intensity of summers

Less intense winters

Hail that destroys crops

Impact on Agriculture

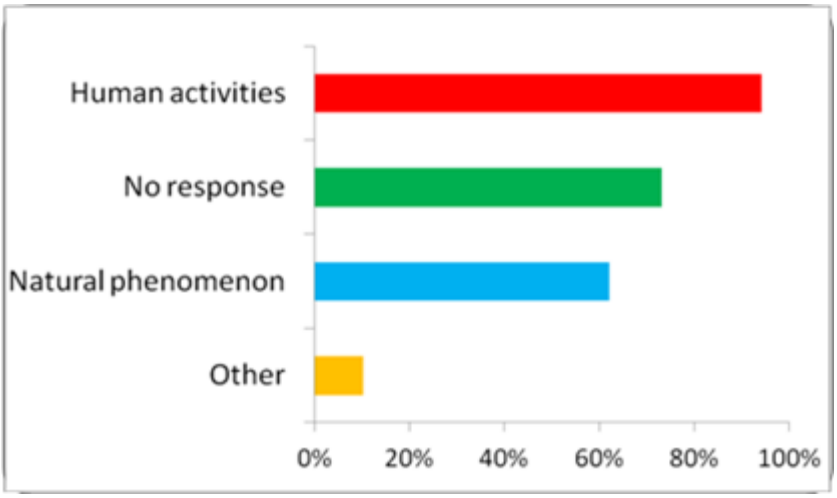


- Farmers of the area have lost useful information about rice varieties.
- Due to increased availability of water from snow melt, the farmers were not able to differentiate varieties according to their ability to face drought.

Shift in Preferences of Crops Sown in the Past and Present

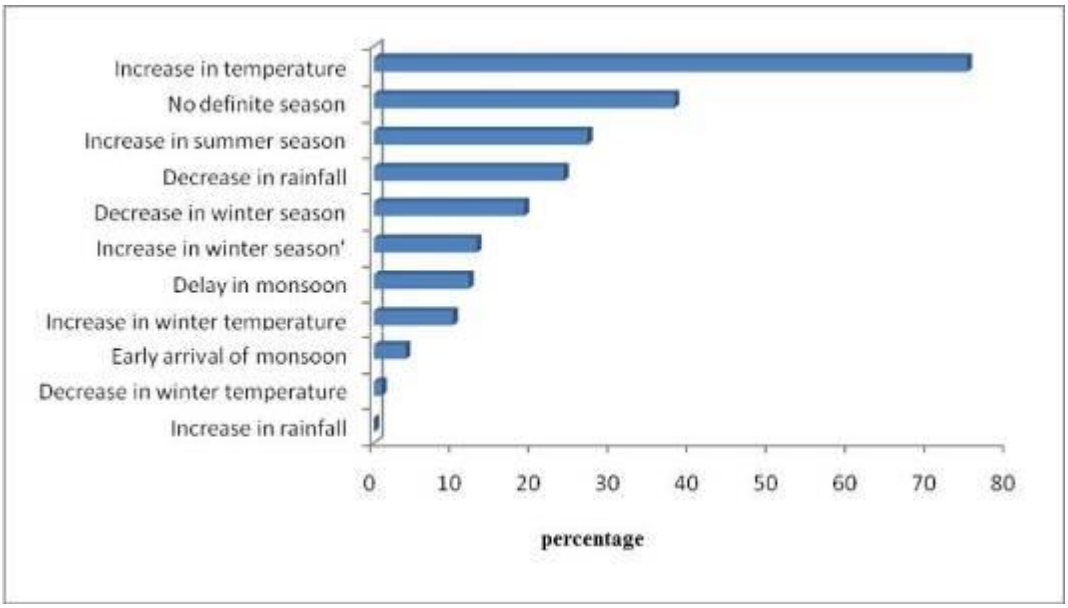
Crops grown in the past	Crops grown now
Wheat Finger Millet Paddy Maize Pulses Vegetables	Vegetables Wheat Paddy Maize Pulses Finger Millet

Reasons given for changing climate

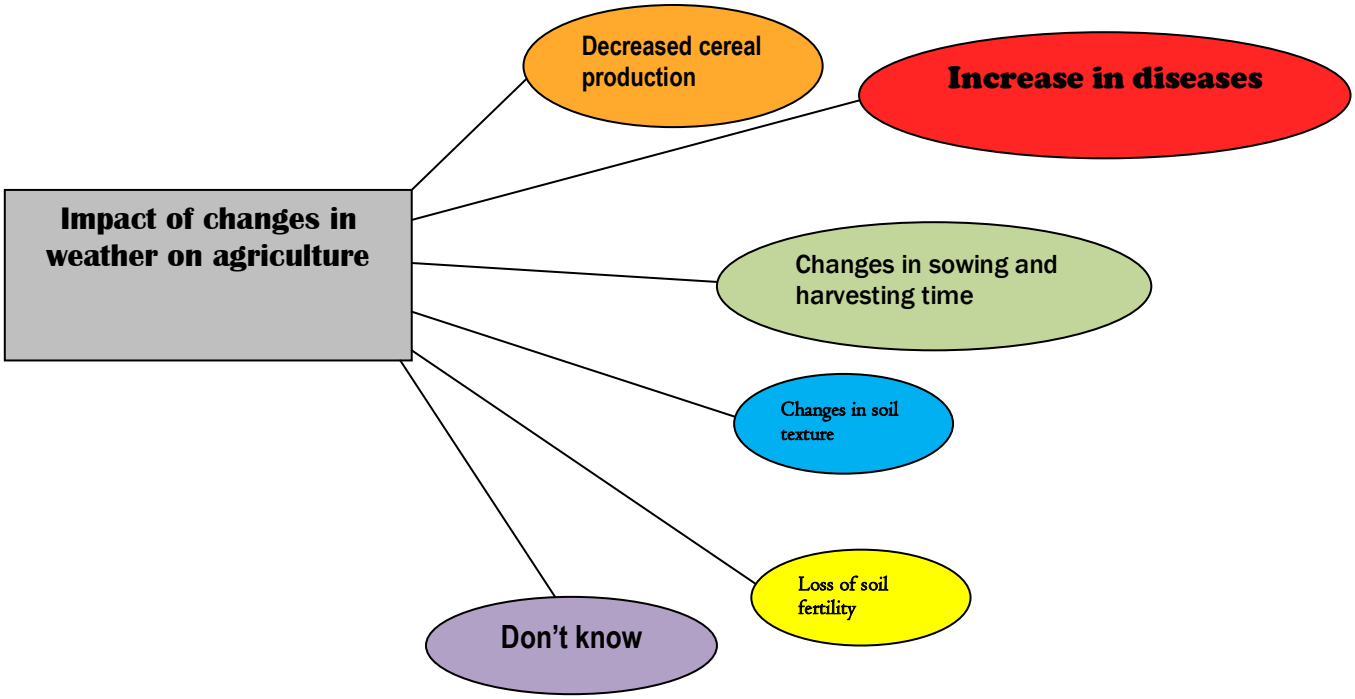


UTTAR PRADESH

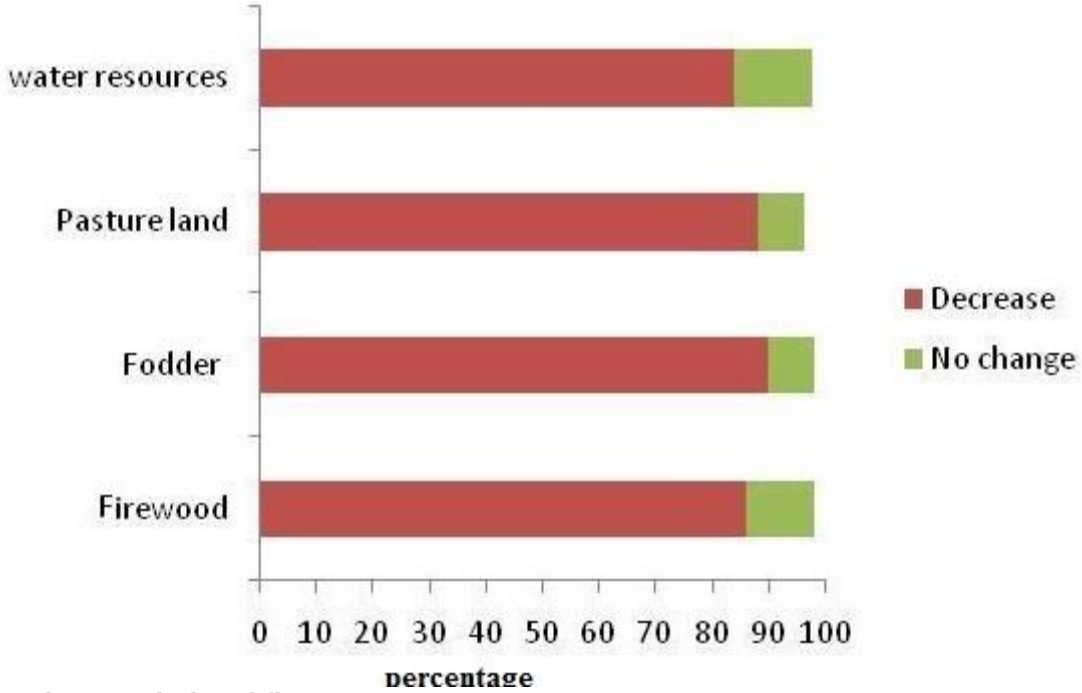
Observed changes in weather patterns:



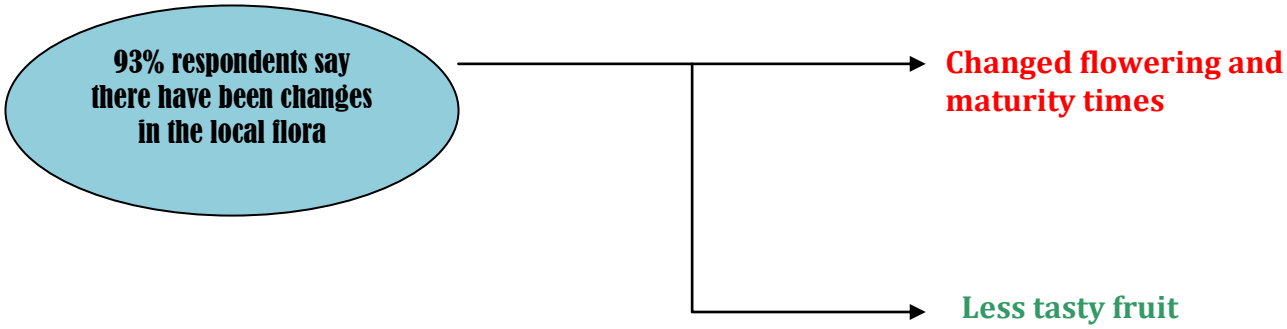
Impacts of changes in weather on agriculture:



Impact on availability of natural resources:

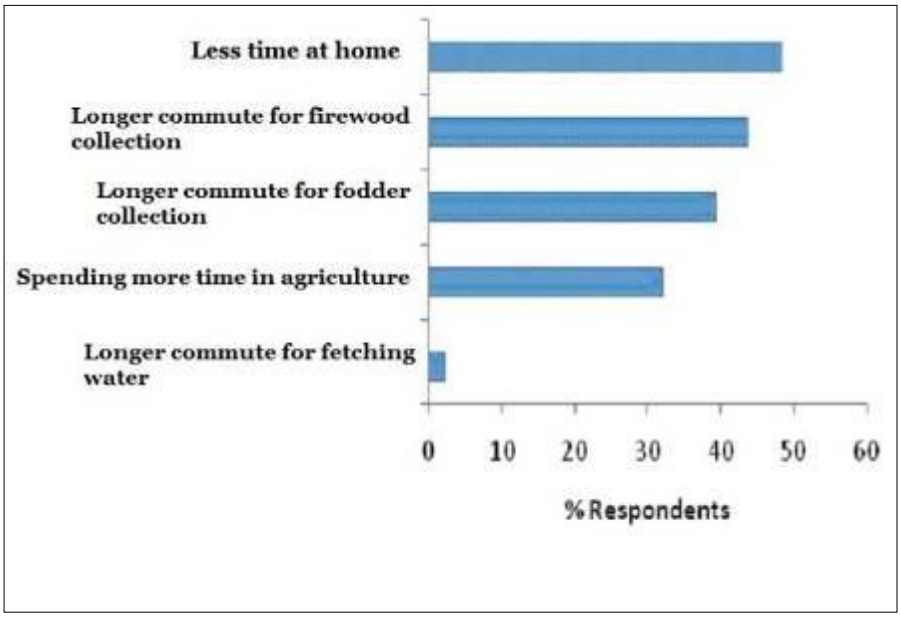


a) Changes in local flora:

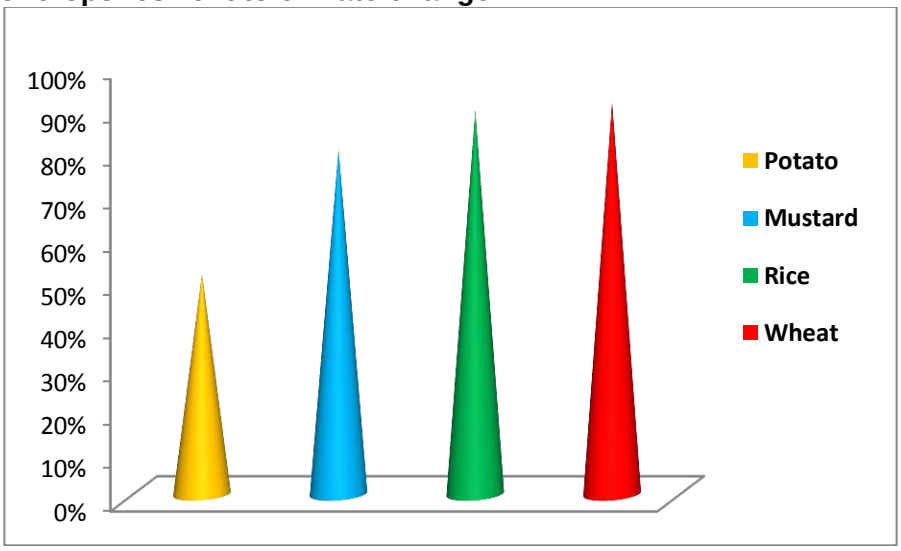


b) Changes in local fauna: Farmer friendly birds that eat insects and reduce the chances of pest infestations in crops have now become invisible in the area. At least 15 bird species show severe decline.

Impacts on women's work:



Perception of crops resilient to climate change:



BIHAR

Climate change vulnerability of Bihar

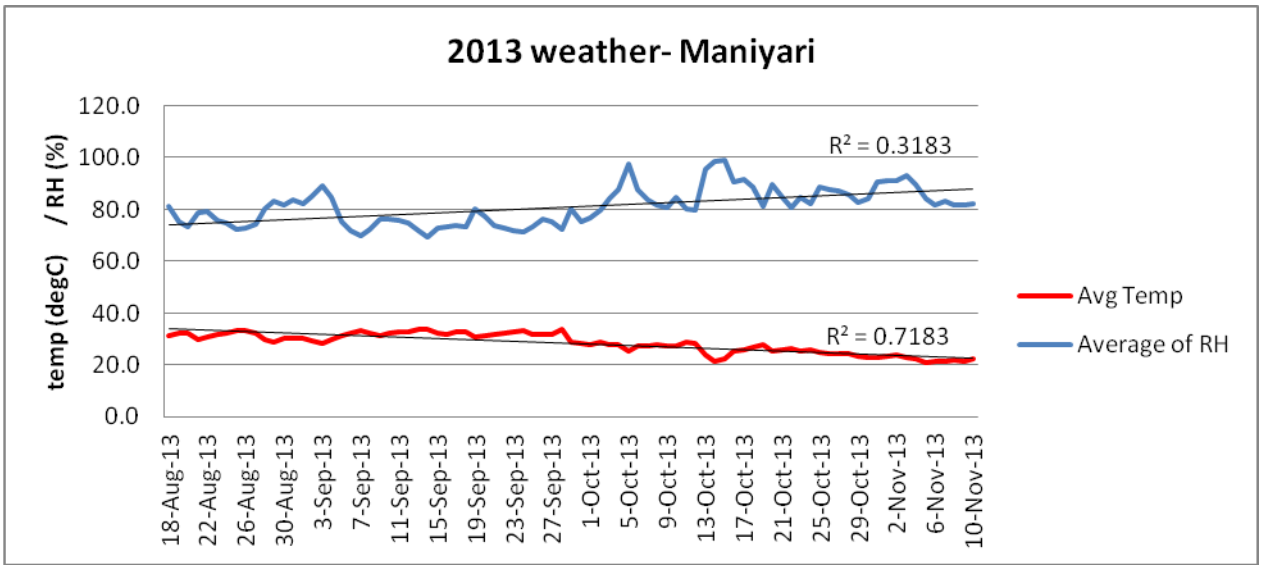
Available evidence shows that there is high probability of increase in the frequency and intensity of climate related natural hazards due to climate change and hence increase in potential threat due to climate change related natural disasters in India, and Bihar is no exception to this. It is highly vulnerable to hydro-meteorological natural disasters, with North Bihar in general being highly flood-prone, and South Bihar being highly drought prone. In the (relative) absence of state level climate models and/or vulnerability studies, as well low community awareness, Bihar is potentially more sensitive and vulnerable to the climate change and its impacts.

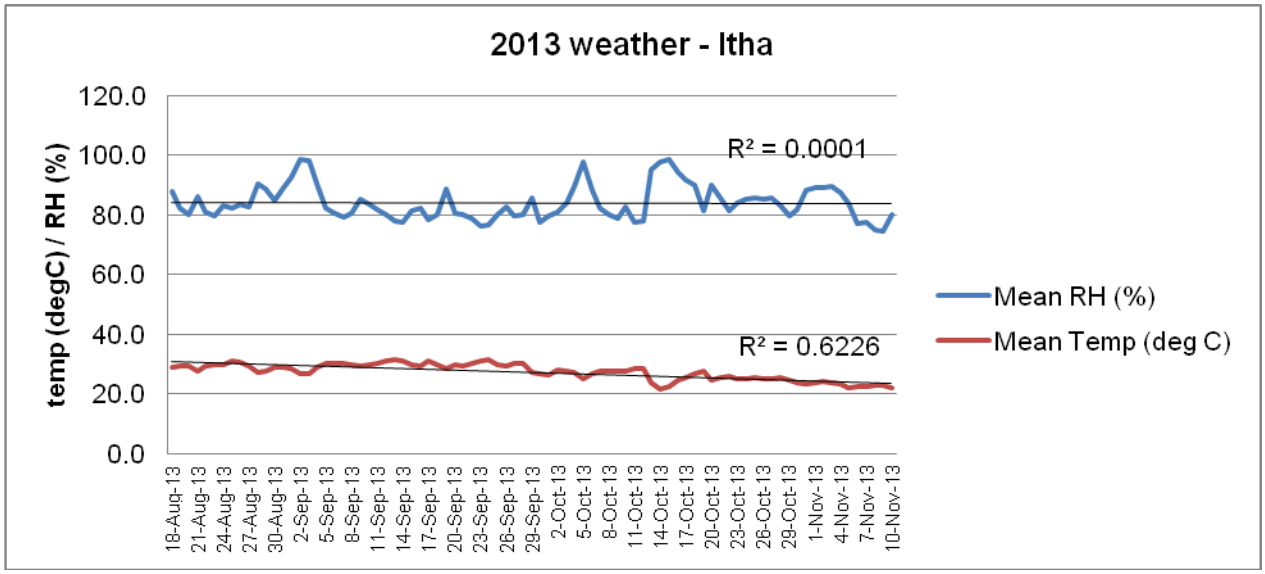
Location and Physiography

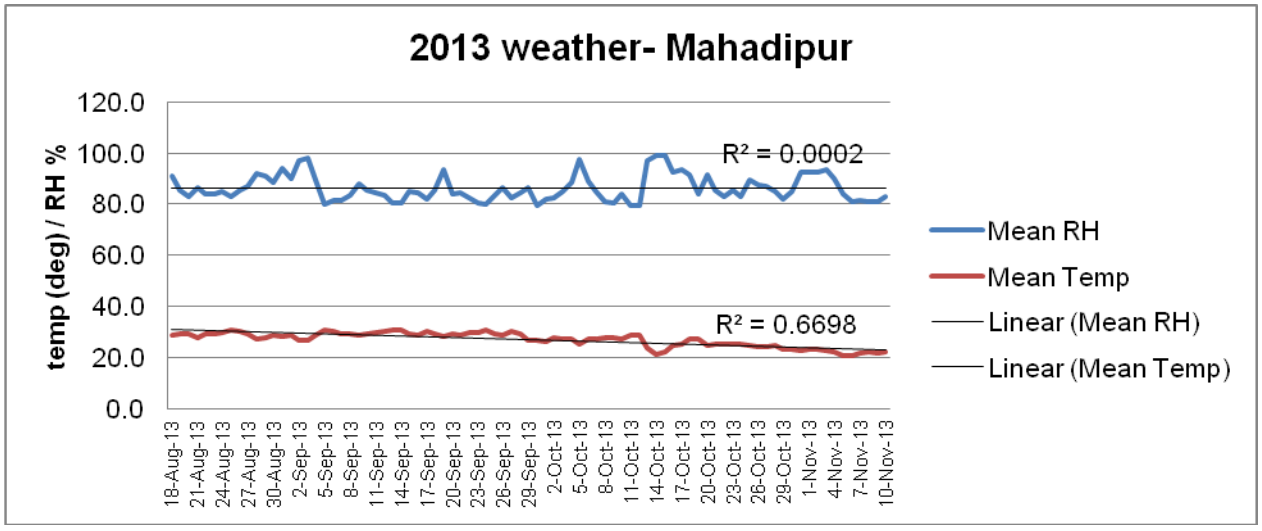
It is an entirely land locked state and is surrounded by West Bengal in the east, Uttar Pradesh in the West and the State of Jharkhand in the South. In the North, Bihar shares its boundary with Nepal. Humid West Bengal in the east and the sub humid Uttar Pradesh in the West provides it with a transitional position in respect of climate, economy, and culture.

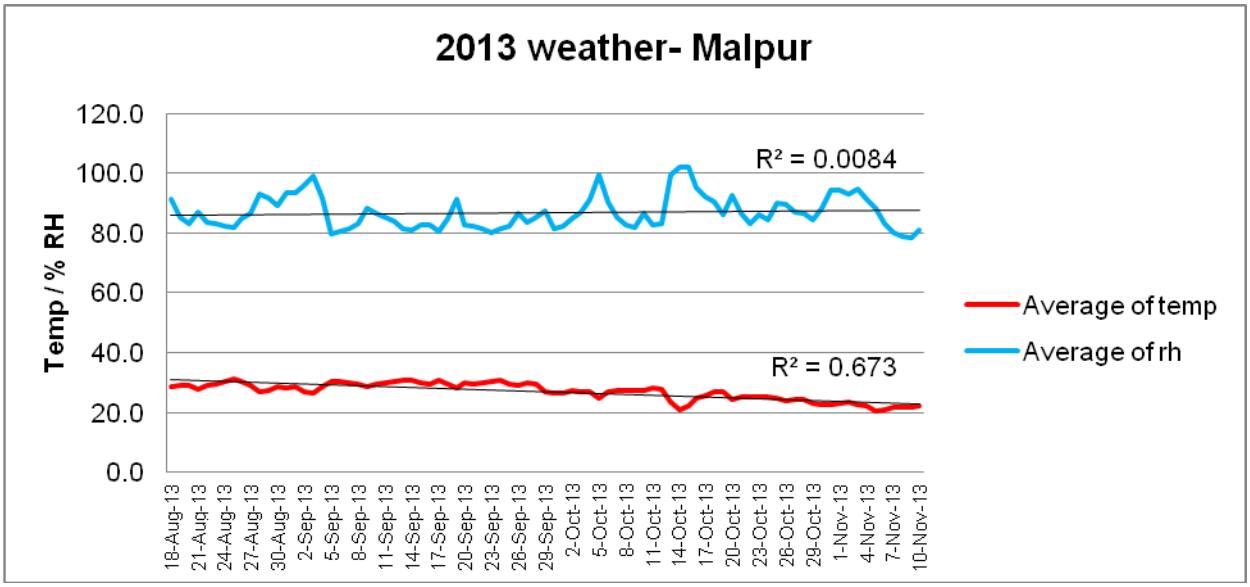
The Bihar plain is divided into two unequal halves by the River Ganga, which flows through the middle from West to East. Close to 88 percent of the population lives in villages. Bihar state is 12th largest in terms of geographical size (94,163 sq. km) and 3rd largest by population, 10.38 crores as per Census 2011, in the country. It is also known for its abundant natural resources, perennial rivers, fertile lands, and a long glorious history. Bihar lies in the tropical to sub tropical region. Bihar has a monsoon climate with an average annual rainfall of 1200 mm. The sub-Himalayan foothills of Someshwar and Dun ranges in Champaran constitute another belt of moist deciduous forests. The hot and dry summer gives the deciduous forests. Rich farmland and lush orchards extend throughout the state. Also, cane grows wild in the marshes of West Champaran.

Current Climate pattern in the project sites




2013 weather - Itha
temp (degC) / RH (%)
120.0
100.0
80.0
60.0
40.0
20.0
0.0
R² = 0.0001
R² = 0.6226
18-Aug-13
21-Aug-13
24-Aug-13
27-Aug-13
30-Aug-13
2-Sep-13
5-Sep-13
8-Sep-13
11-Sep-13
14-Sep-13
17-Sep-13
20-Sep-13
23-Sep-13
26-Sep-13
29-Sep-13
2-Oct-13
5-Oct-13
8-Oct-13
11-Oct-13
14-Oct-13
17-Oct-13
20-Oct-13
23-Oct-13
26-Oct-13
29-Oct-13
1-Nov-13
4-Nov-13
7-Nov-13
10-Nov-13
Mean RH (%)
Mean Temp (deg C)


2013 weather- Mahadipur
temp (deg) / RH %
120.0
100.0
80.0
60.0
40.0
20.0
0.0
R² = 0.0002
R² = 0.6698
18-Aug-13
21-Aug-13
24-Aug-13
27-Aug-13
30-Aug-13
2-Sep-13
5-Sep-13
8-Sep-13
11-Sep-13
14-Sep-13
17-Sep-13
20-Sep-13
23-Sep-13
26-Sep-13
29-Sep-13
2-Oct-13
5-Oct-13
8-Oct-13
11-Oct-13
14-Oct-13
17-Oct-13
20-Oct-13
23-Oct-13
26-Oct-13
29-Oct-13
1-Nov-13
4-Nov-13
7-Nov-13
10-Nov-13
Mean RH
Mean Temp
Linear (Mean RH)
Linear (Mean Temp)



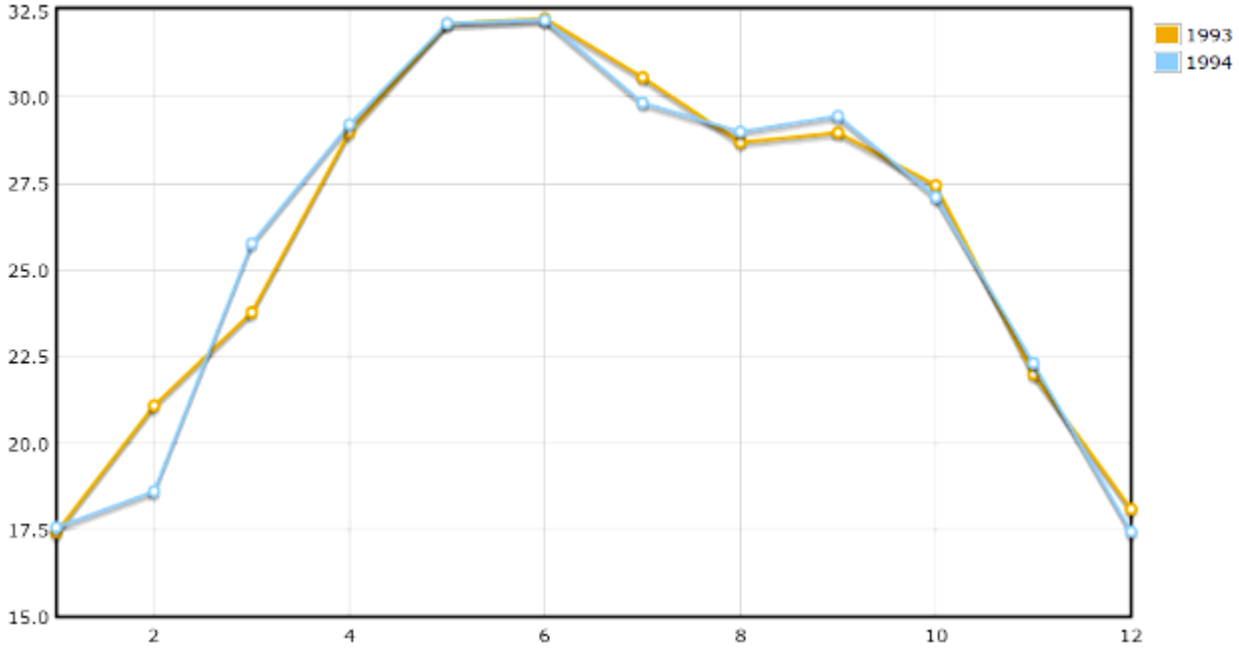
The above 4 charts shows the iButton RH and Temperature data for 4 locations (table 1) in the project site.

Farmer's Name	Village	District	F.Code	I. Button No.	Date	Time	LAT	LONG	ALT
Ram Sogarath Ray	Etha	Muzaffarpur	37	6100000025DA6D41	05.07.2013	1:12PM	25 58 34.9	085 35 14.3	34m
Raj Kishor Prasad	Mahadipur	Muzaffarpur	38	7300000025DAE641	05.07.2013	12:58PM	25 58 33.1	085 35 03.3	36m
Mahesh Kumar	Malpur	Muzaffarpur	C965	8A00000025E22241	05.07.2013	4:30PM	25 58 23.1	085 35 03.9	40m
Sunil Kumar	Maniyari	Muzaffarpur	39	5E00000025DA2041	05.07.2013	03:48PM	25 58 06.6	085 35 34.6	39m

Table 1: The iButton GPS and farmers details

We do not see much variations in the temperature pattern for the 4 months for which the data was recorded, among the locations (R^2 of the trendline ranging from 0.7 - 0.6). However we notice a Relative humidity (RH) differences and pattern of RH in the 4 locations. The Maniyari location had experienced a steady rise in the mean daily RH through August to November, on the other hand in Itha, Mahadipur and Malpur, the RH was pretty stable (86-87 %). However the daily fluctuation in RH was quite high in Maniyari (Standard deviation = 7.09) than the other 3 locations (standard deviation < 6).

Comparison of Climates of current data, with historical data

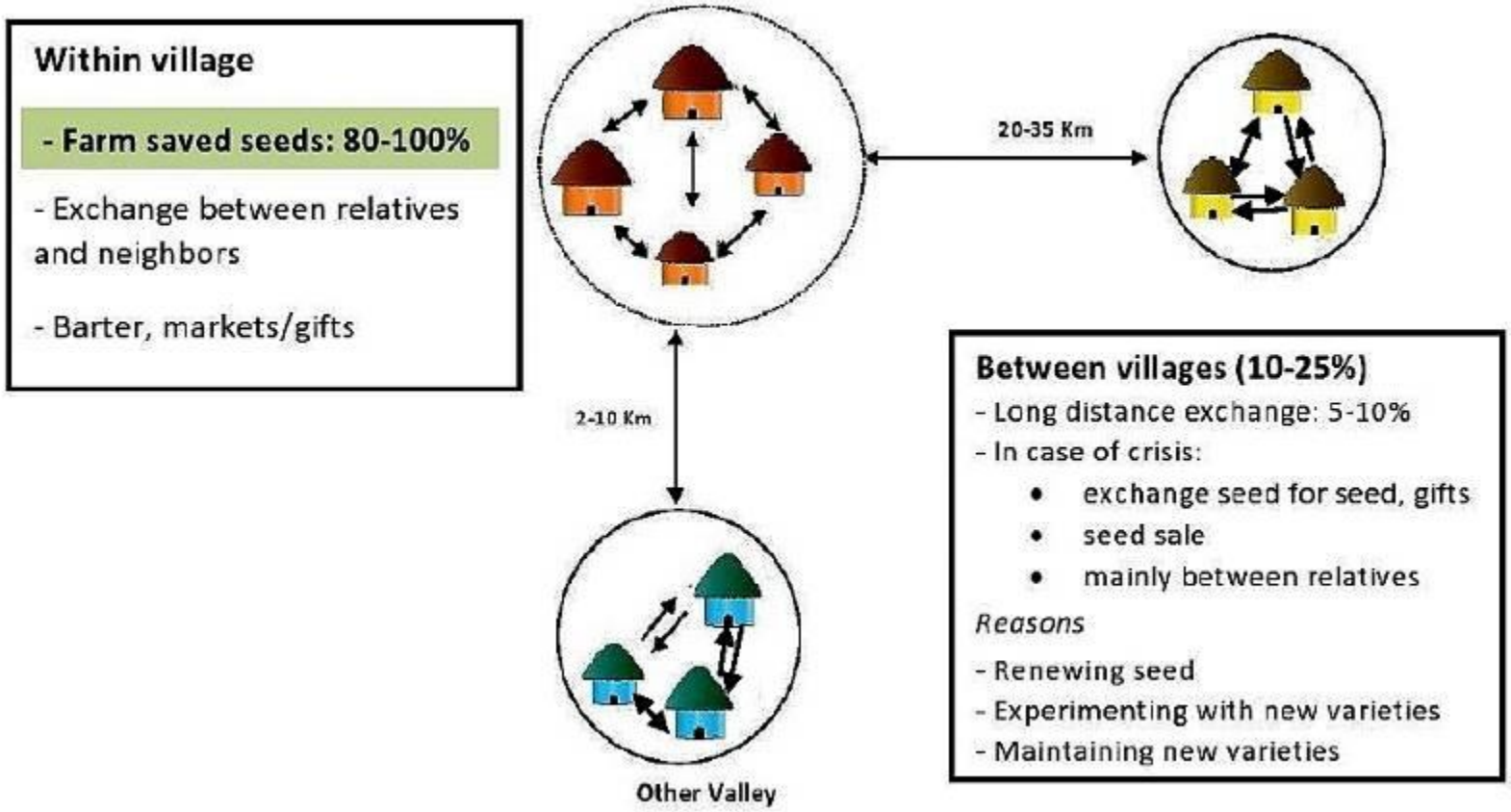


Seeing the above figure with the historical average monthly temperature of 20 years ago of Muzaffarpur district, we can see a sharp change. While the 20 years back the temperatures averaged below 30^0C while now they are predominantly above 30^0C in the months of August to September. This period is the rice flowering and panicle initiation and very critical to productivity.

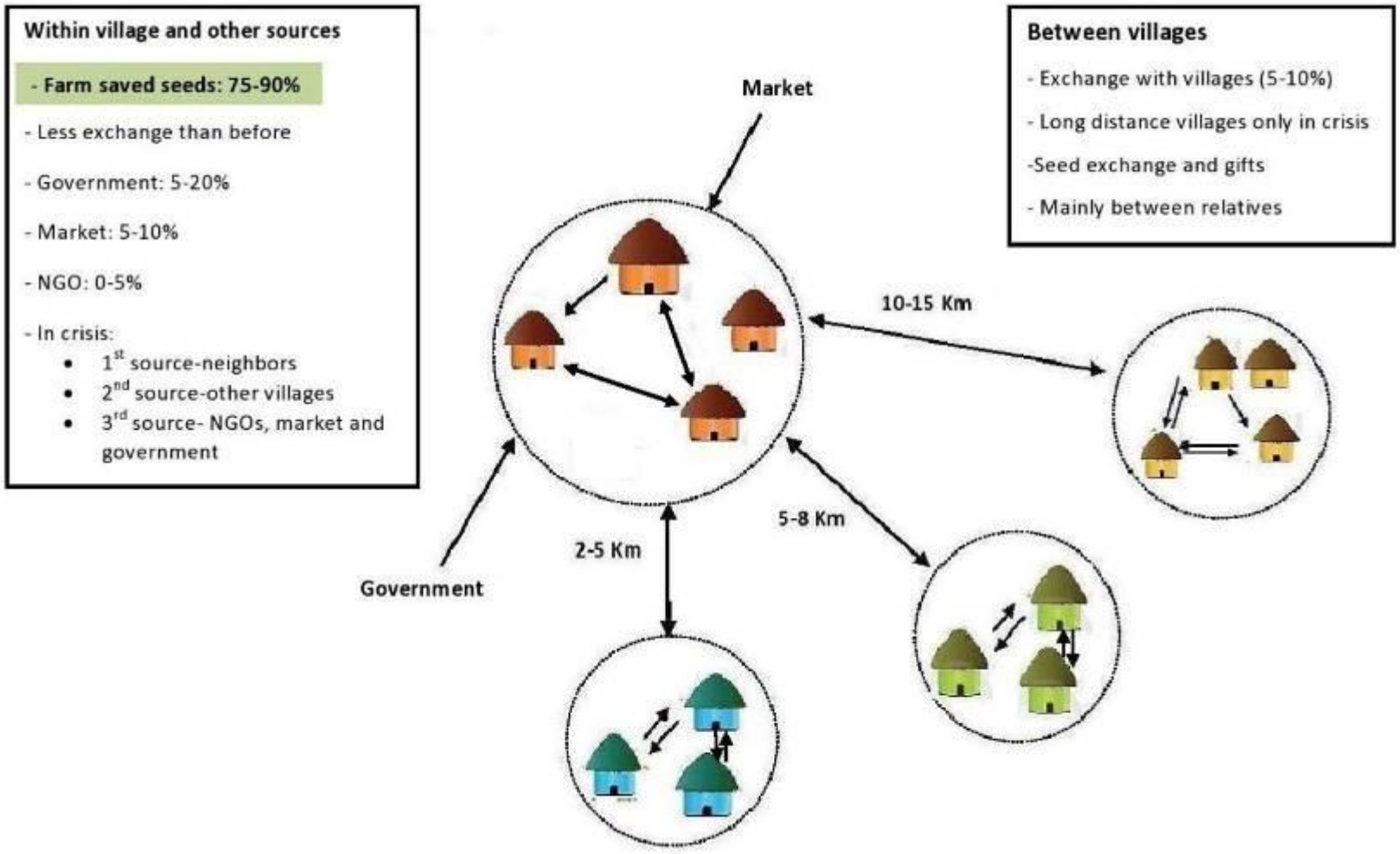
2. SEED SYSTEMS & INDIGENOUS KNOWLEDGE

UTTARAKHAND

Seed System – Past



Seed System – Present



Agro-biodiversity preference criteria

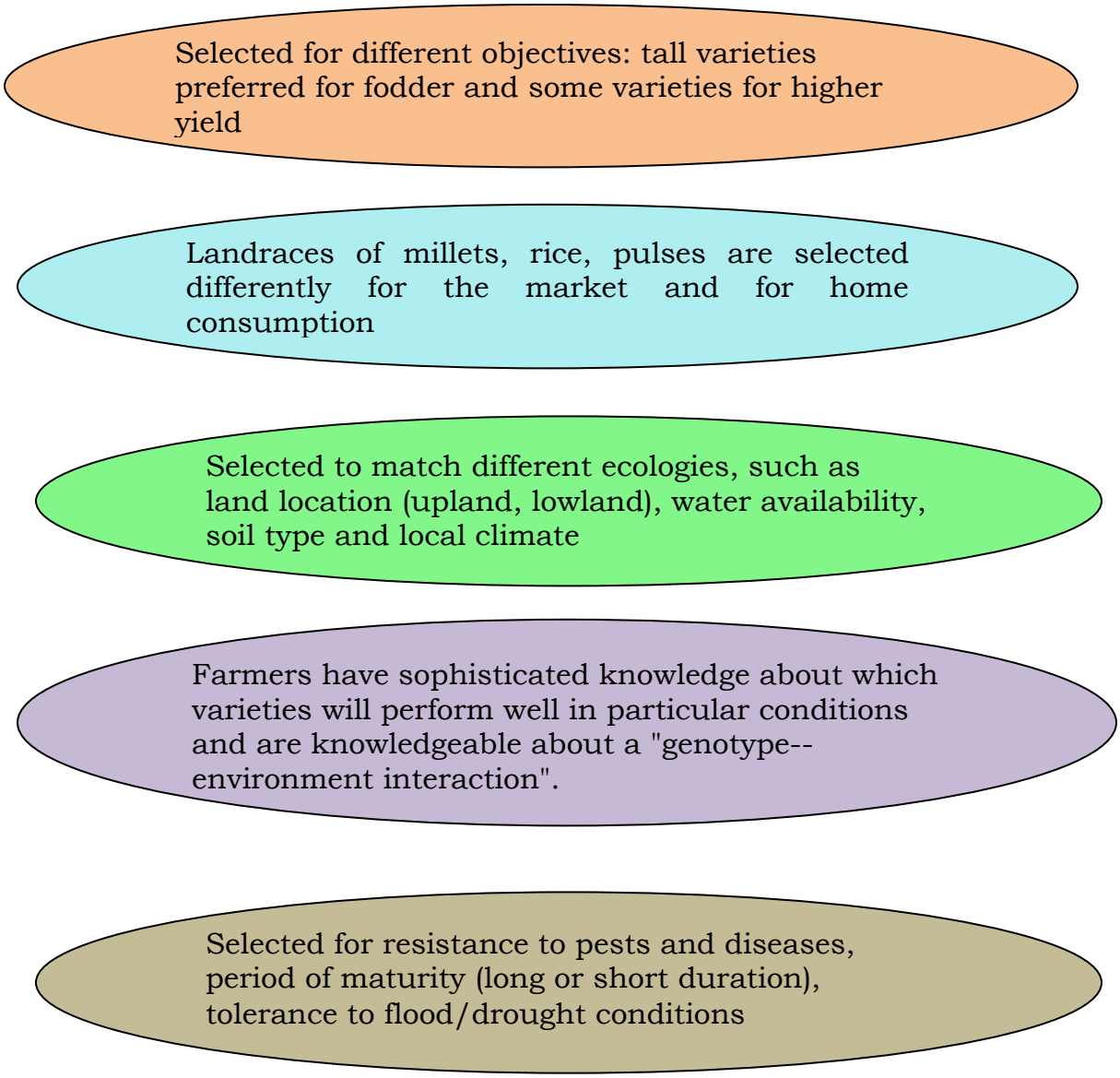
In Uttarakhand adoption of improved varieties has been minimal. Some improved varieties were introduced after the Green Revolution and have been maintained since then.

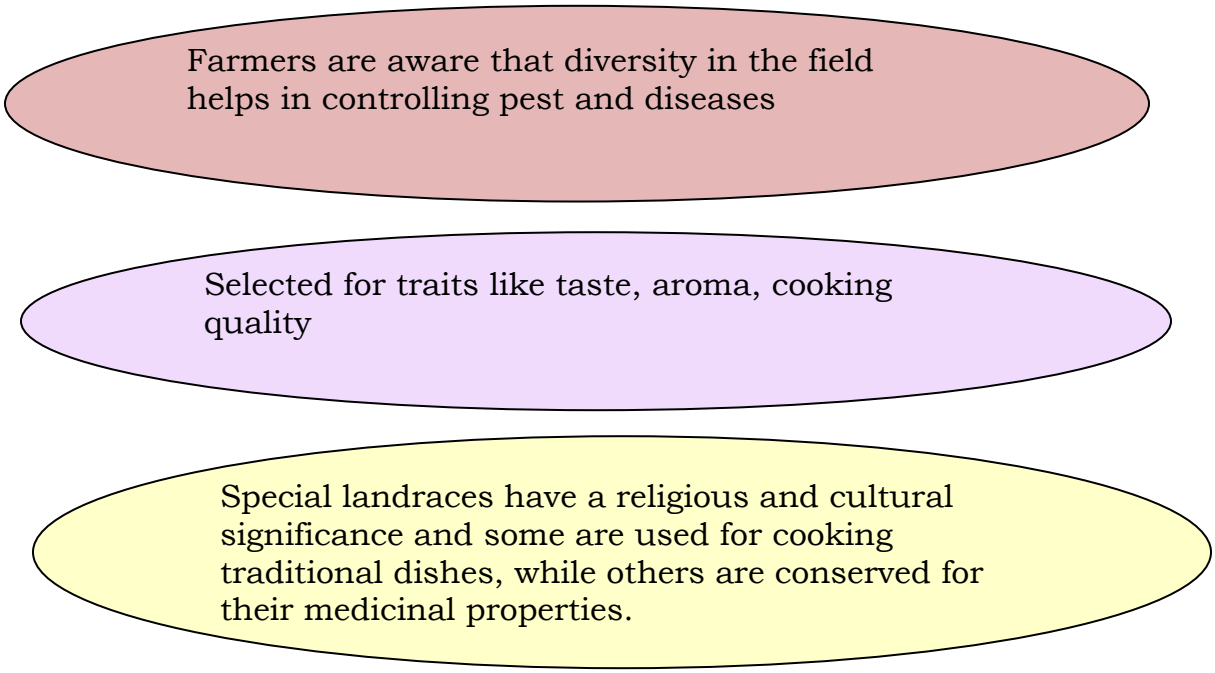
HYVs were introduced in the past, but not widely adopted due to their high dependence on external inputs and the low environmental and cultural adaptability.

This is the principal reason for genetic diversity still being a resource that people rely on to stabilize their food security and to cope with stress and uncertainty.

Both men and women value crop genetic diversity, sometimes for different reasons. By and large, it is the women who are the principal custodians of seed diversity and the knowledge associated with it.

Preference for landraces by both men and women cited as follows -





Women possess better knowledge about varieties, their characteristics and agro-ecological management.
Of the 29 agronomic, ecological, socio economic and cultural aspects of a variety that were studied, women had a view on 25 properties whereas men discussed just 14 aspects.
Awareness about the value of diversity to livelihoods was far greater in women than men who largely focused on agronomic characters and market value.

Seed system (source, selection, storage)

About 90% of farmers save and use their own seed of landraces and approx 10% buy seed from different sources in the village or from markets.

Exchanging seed through informal networks was common.

Seed is saved even when there is shortage of food.

This is a coping mechanism to deal with climate change, since it conserves adapted genetic material

Both farmers and scientists know that the longer a variety has been maintained, the more resilient it is to climatic disturbance and the adaptive capacity of the selected seed is high. The duration of use of rice varieties in Nainital district is on average around 40 years and in Bageshwar around 72 years.

Women primarily select the seeds before harvest, while men do this selection later. Nearly 80 % of women are engaged in seed selection and 73 % are responsible for seed storage.

Seed Transactions

Seed transactions in informal and formal networks include seed coming from outside (in-transactions), seed going outside (out-transactions)

Seeds received from informal networks are widely maintained (approximately 70 % in the last three years)

Seed transactions usually take place along familial or kinship lines, but seed exchanges between neighbors and between villages also happens

In the case of out-transactions in the informal system, monetary exchange is usually not involved

Seeds are exchanged as seed for seed given as gifts or through barter markets where seed may be exchanged for other goods and services

Women primarily select the seeds before harvest, while men do this selection later. Nearly 80 % of women are engaged in seed selection and 73 % are responsible for seed storage of seeds

Informal Seed Network

Informal seed networks are built upon pre-existing social networks, not necessarily only related to seed exchange. These networks could be based on

- marriage and inclusion of newly related families;
- on associates of common agricultural activities like sowing, harvesting, weeding etc;
- on women groups going to collect water, fuel and fodder;
- on women's organizations like Self Help Groups (SHGs) coming together for economic activities.

Informal seed networks are maintained for specific societal needs such as*:*

- Introducing new genetic material on the farm.
- Keeping alive the seed networks within and between villages as a safety net for times of crisis.
- Experimentation - indicating the farmer's scientific inclination for evaluating other varieties and landraces for potential use.
- Reinforcement of social capital within and between villages by keeping alive the tradition of collective action.

Formal seed systems

- ✓ Seed purchase from further away has increased (20 % of total seed bought).
- ✓ External markets accessed for seeds of new varieties especially of vegetables, where hybrids are the prevalent seed type.
- ✓ The subsidized seed from local government agencies (block or taluka office) was the second source especially during crises like diseases, drought, etc. (8 % of total seed procured).
- ✓ NGOs and research centers also contribute seed (about 2 %).

Recommendations to improve farmer access to greater diversity

- Supporting seed exchange networks
- Linking farmers to the formal seed sector through networks
- Linking to research institutions.
- Including landraces in extension packages and government seed outlets.
- Establishing community seed banks as easily accessible seed source.

Climate Impacts and Adaptive Response

Climate Impacts

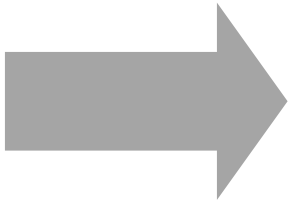
Biggest impact of higher temperature and longer dry periods is on the women who have to spend more time and walk longer distances to get the water, fodder for livestock and fuel wood from the forest as the resources are getting depleted at a very rapid pace

Longer and more intense dry periods due to rising temperature and marked decrease in snow and uncertain rains leading to less recharge of natural springs.

More frequent instances of pests and diseases

Climate variations impacting crop yield hence food availability.

The major stress in agriculture and livelihoods is created by climate change, which apart from upsetting the crop cycle, affects seed production.



Adaptive Response

The older integrated approach of crop, livestock, and forest management has been revived by farmers in some areas. This is helping to build sustainability into their food security.

Adaptive responses of the community to climate and other stress

- **Conservation of genetic diversity and saving own seeds are considered to be the most important coping mechanism to ensure food security during food crises due to climatic adversities.**
- **Diversifying varieties (usually through mutual exchange) enables cultivation at different locations. Using locally adapted seed minimizes risk of crop failure.**
- **Altering the crop rotation cycles of cereals, pseudo-cereals, and pulses as also changing the location of fields on which the crops are grown.**
- **Changing the cropping pattern to include cash crops and more intensive management is observed where water is available. The downside to this is progressive indebtedness, resulting from the high cost of agri inputs and more expensive seed. Sometimes this leads to selling of agricultural lands and migration to cities.**

Women and Agrobiodiversity

In Uttarakhand women take the decisions on seed-related activities and are responsible for seed processing, storage and seed exchange. They can be said to be the holders and conservers of primary knowledge and managers of genetic material on-farm.

Who are the Agrobiodiversity Experts?

Both women and men agreed that it's mainly women especially older women who are the true experts and who have the knowledge of genetic diversity.

Experts are those:

- ★ **Persons who have a cultural and spiritual understanding of seeds and farming.**
- ★ **Women/men who are the source of seed**
- ★ **Women who maintain varieties of different crops and have seeds to plant in a crisis situation**
- ★ **Older men and women who conserve and store their own seed and have the knowledge about seed conservation, different varieties and farming practices**
- ★ **Women who are usually the decision makers**

Gender dimension of activities related to seed and crop management

In Uttarakhand agriculture is still largely practiced along traditional lines. Women have a big role in decision making with respect to agricultural activities. They are the custodians of agro biodiversity and have knowledge of its properties, they are therefore the ones who select and maintain the genetic diversity and are responsible for seed selection and storage.

Households & richness of genetic diversity

High value for richness of genetic diversity	Low value for richness of genetic diversity
▪ Households where mainly women decided on seed use ▪ Households that are sources suppliers of seed ▪ HH which participate in farmer's groups and women groups and in formal trainings on agriculture. ▪ HH that participate in collective management structures ▪ HH that are part of seed networks and exchange and acquire seeds	▪ HH where mainly men decided on seed use. ▪ HHs who don't exchange seed ▪ HH that maintain seed individually without collective planning

Looking Ahead

The linkage between gender equity, agrobiodiversity conservation and adaptation to change and crisis needs to be better understood. Further research is needed to conceptually explore this relationship and direction of causality.

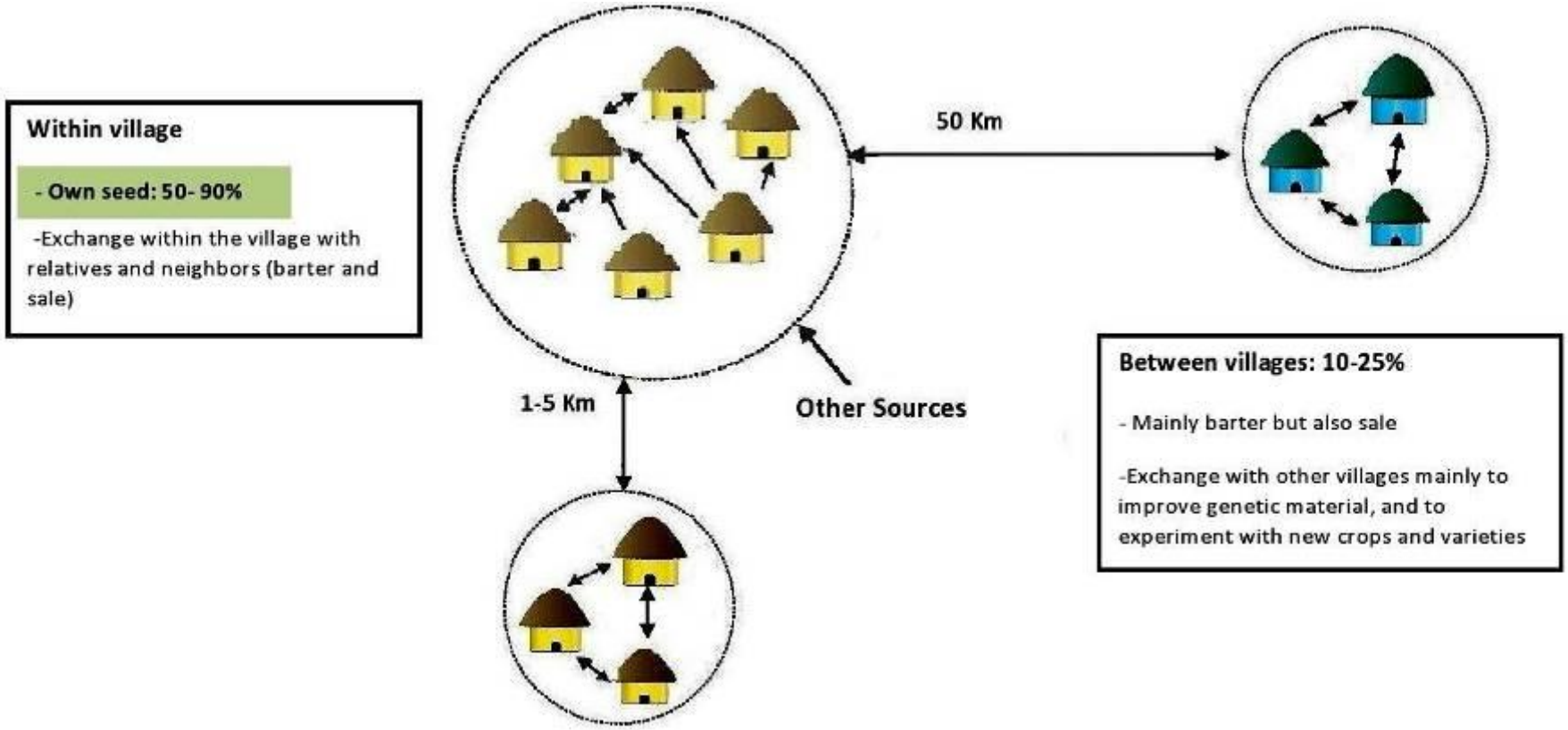
An inventory of agrobiodiversity and seed systems may serve as a basis to create a monitoring system to track agrobiodiversity loss at community level.

Keeping in mind the differences between sites regarding agro ecological, institutional and socio-economic conditions, a facilitation of germplasm conservation and exchanges can be attempted.

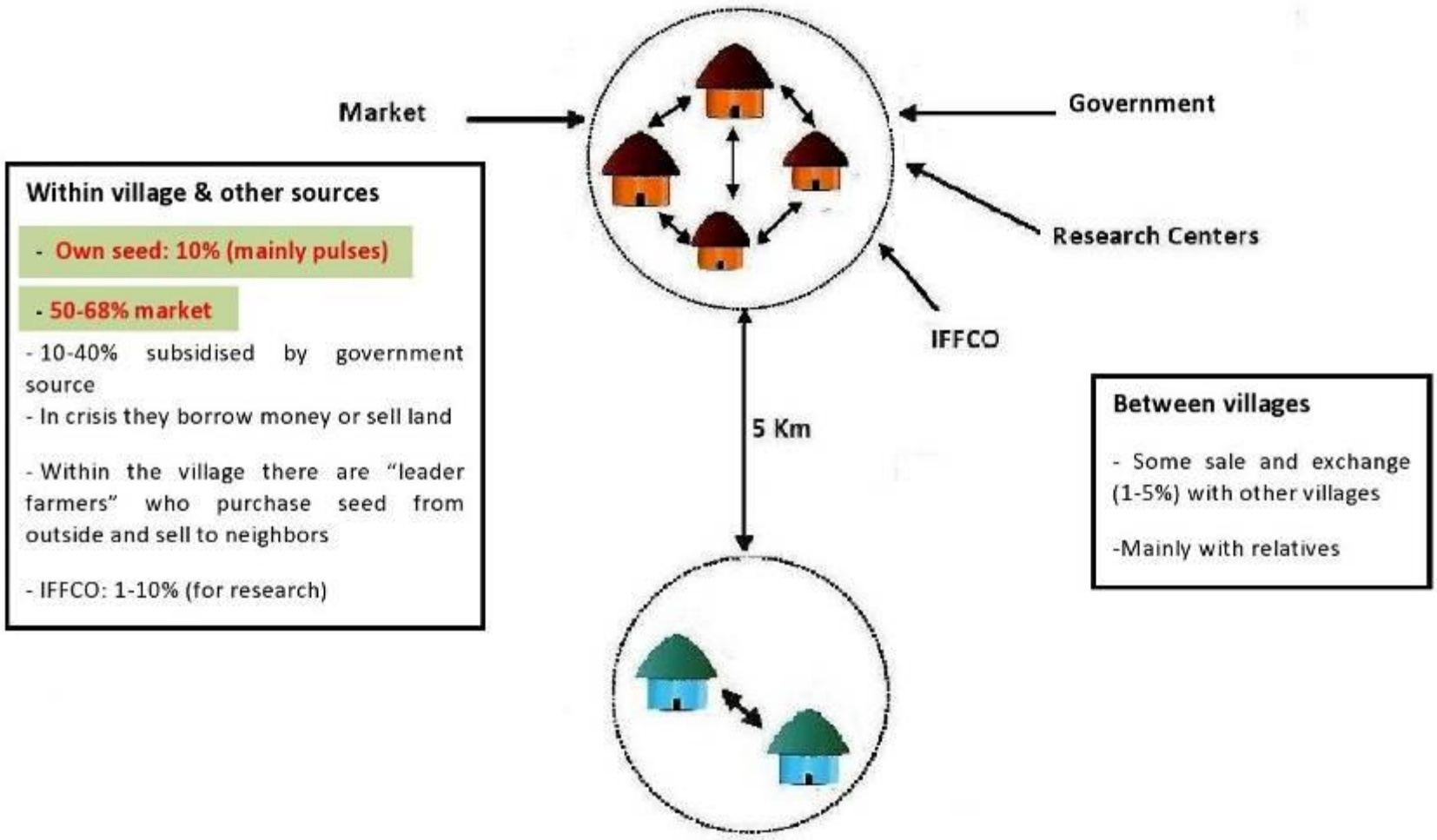
Women take the decisions on seed-related activities at household and community level and are responsible for seed selection, processing and storage and maintain informal collective exchanges in goods and services, including seed exchange. Hence reinforcing the institutions of women groups and facilitating information access will enable increased choices and opportunities to utilize a more diverse seed portfolio.

BIHAR

Seed System – Past



Seed System – Present



- The local seed systems directly reflect the way in which institutions at different scale adapt their cultivation, seed sources and selection and distribution of seed to the prevailing environmental changes. Indeed, a local seed system allows the dynamic change that characterizes crop landrace systems to help in coping with the uncertainty generated in agriculture by climate change.

- In regions like the Indo-Gangetic Plains (IGP), that have adopted the Green Revolution intensification of agriculture, local seed systems have been replaced by formal systems of seed distribution, transforming the complex seed systems with its inherent knowledge and social capital into merely one of many inputs along with water, fertilizer, pesticide etc.

- These diminished seed systems have a reduced capacity to maintain the multiple functions and services associated with agrobiodiversity. These weaknesses are exacerbated by economic changes, natural disasters and poor information management, affecting women and men differently.

Changes in the local seed system over time

- According to farmers, the structure of the seed system has completely changed in the last 20 years, with the collapse of the social seed networks, within and between villages.
- Farmers realize that multiple sources of seed introduce valuable genetic diversity, but the current system has become highly dependent on the market because of the widespread adoption of hybrids which are being promoted aggressively by government agencies.
- There are problems with seed quality and capture of local seed outlets by locally powerful actors, against which farmers feel helpless.
- These developments in the seed system may create a more vulnerable environment in case of shocks, specifically since farmers have failed to conserve traditional varieties adapted to local conditions.
- Handicapped by modest financial resources and lack of access to information that would enable them to seek better quality seed elsewhere, farmers are often caught in the trap of poor quality seeds from the market.
- Only 12% (Vaishali) and 18% (Muzaffarpur) of total households now use the informal seed exchange networks as source of seed.
- Very high number households depend on external sources of seed, mainly hybrid and modern varieties, and few HHs have seed exchanges or are sources of seed.

- Only 5-10% households in Muzaffarpur and Vaishali are in a position to supply seed to others whereas 75% of households depend on external seed.
- However, data from flood-prone villages showed farmers maintain a large number of local landraces of rice and engage frequently in seed exchange.
- Though farmers recognize that in the past, there were several reasons for exchanging seed within and between villages (e.g. new genetic material, assured access in crisis etc.), they do not find benefit in informal networks in main crops now.
- In most villages, farmers said that in a crisis, they usually take credit to buy seed, access the block office for seed or ask rich farmers in the village for a loan of seeds.

Current trends of on-farm agrobiodiversity

In the study area, farmers grow only between 1 to 3 varieties of each crop even though they know the names of several more.

The farmers felt that the progressive loss of diversity in landraces has been partially counterbalanced by introduction of HYV and hybrids.

Farmers said that HYV and landraces provide different useful traits to farmers under different conditions. HYVs and hybrids are appreciated for high yields above all but also for lodging resistance due to short height.

Preference criteria for agrobiodiversity

A convergence of preferences between men and women for landraces was observed

Diverse landraces can be grown to diversify the production objectives: tall varieties are preferred because they respond to self-consumption and fodder production; some varieties have better production and provide more for storage.

Diversity in landraces of millets, rice, pulses, etc. may have potential for marketing

There is a clear understanding that diversification of landraces is essential to improve production in different ecologies.

Farmers clearly exhibit what breeders call "genotype-by-environment interaction" and know that a variety that performs well in certain conditions is not likely to have the same response elsewhere.

Diverse landraces can be grown to minimize risk by increasing choice given their different characteristics like resisitance to pests and diseases, maturity time, tolerance to dry and drought conditions or resistance to submergence

Genetic diversity of crops and landraces support a diversity of flora and fauna in the field. A genetically diverse field helps in controlling pest and diseases

Landraces have a diversity of traits which are culturally appreciated, such as taste, aroma, softness of grain etc.

Special landraces have a religious and cultural value. Some are specifically used for cooking traditional dishes and some are conserved for their medicinal properties

Landraces have the diversity to fit into individual cropping patterns which in turn depend on the type of the farm, soil type, the inclusion of food or cash crops in the crop cycle, etc.

Farmers said that HYV and landraces provide different useful traits to farmers under different conditions.

HYV and hybrids are appreciated for high yields above all but also for lodging resistance due to short height.

Seed Source, Selection, Storage

In Bihar, the study showed a completely different picture of the seed system functioning, compared to Uttarakhand.

70 % of Muzaffarpur and 80% of Vaishali farmers depend completely on external sources of rice seed, either purchasing them from the market or borrowing them.

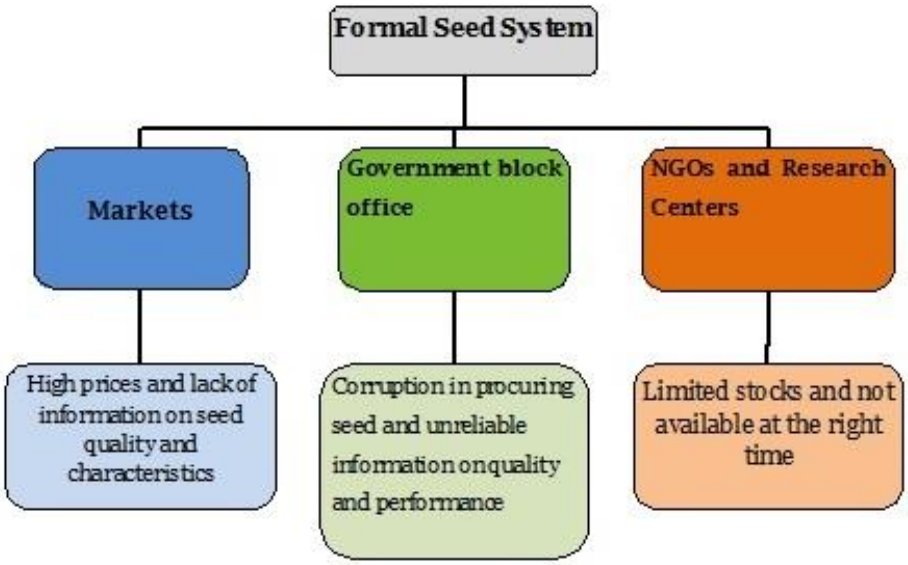
Very few farmers (around 8%) in both sites maintain their own rice seed.

Farmers who save seed say that in an emergency they may be forced to sell or consume their entire harvest.

Women have lost their predominant role in the seed system.

The selection process is mainly done at home by men (59%) or as a shared activity between men and women (29%).

Seed storage was quite elementary usually using plastic bags.

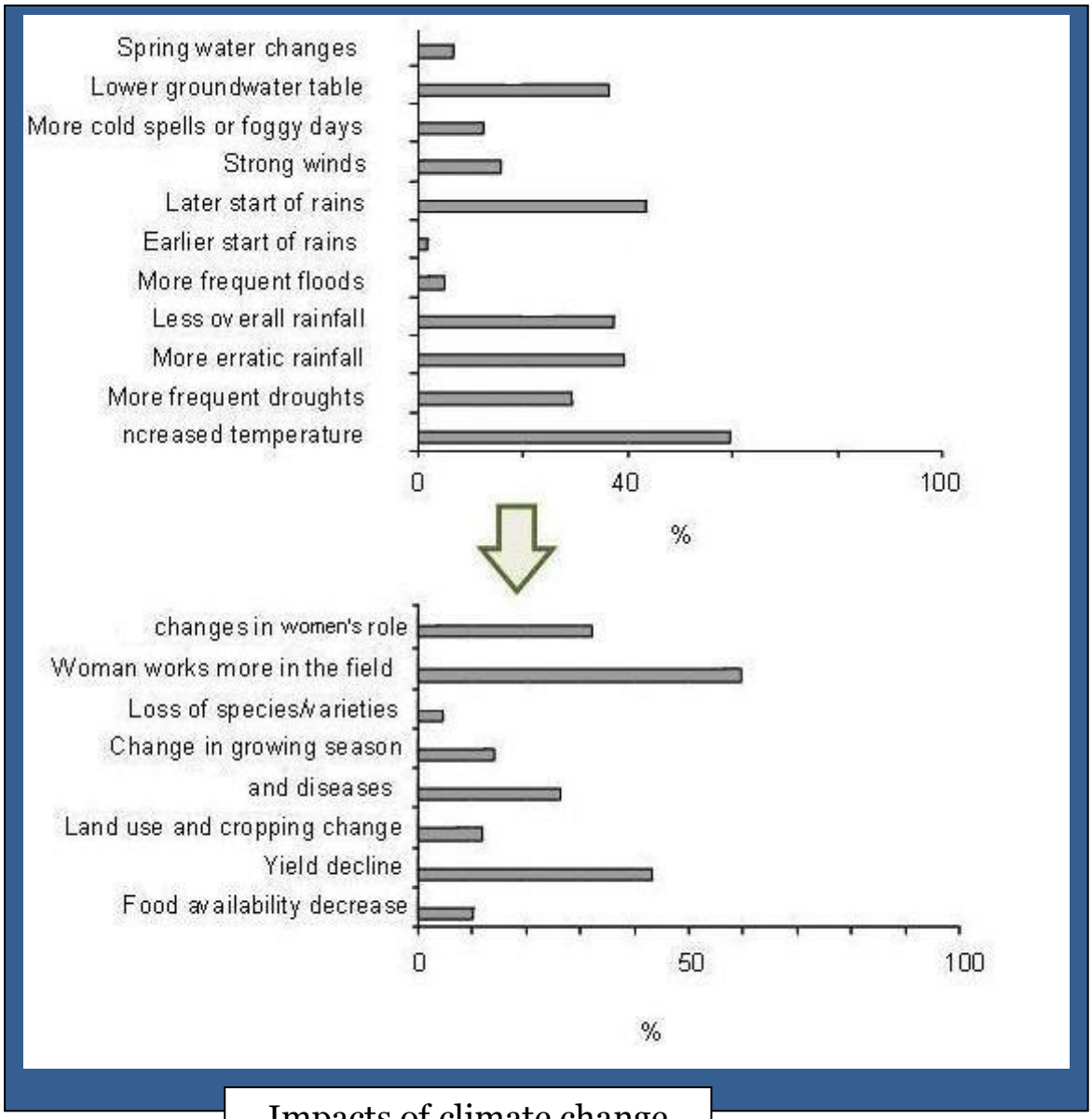


Changing Value of Agrobiodiversity

- Once regions adopt the Green Revolution model of intensive agriculture, the seed system becomes external and dependent on formal sources rather than on local sources and farmer initiative.
- This leads to the marginalisation of the role of women in decision making.
- Seed selection is predominantly in the hands of men and seed storage is a joint activity, with women playing a subsidiary role.
- Unlike Uttarakhand, in Bihar, women are rarely named as conservers and managers of agrobiodiversity.
- Women said that the market and external consultants are the true experts.
- Both men and women said that leading farmers are important because they have contact with formal sector seed sources and with research centers, considered the most trustful actor in the seed system.

Perceptions of Climate Change and its main impacts

Climate change is not the only stressor but an additional one that can negatively impact local livelihoods. Economic changes were the drivers of local vulnerability. In Bihar people perceived the dependence on external inputs, including seed as the main stressors. Specifically, people highlighted the problems of seed quality and the corruption in the seed and input distribution system as the main concern. Though yields have been increasing due to intensification in agriculture, land fragmentation and soil degradation are prioritized as problems.



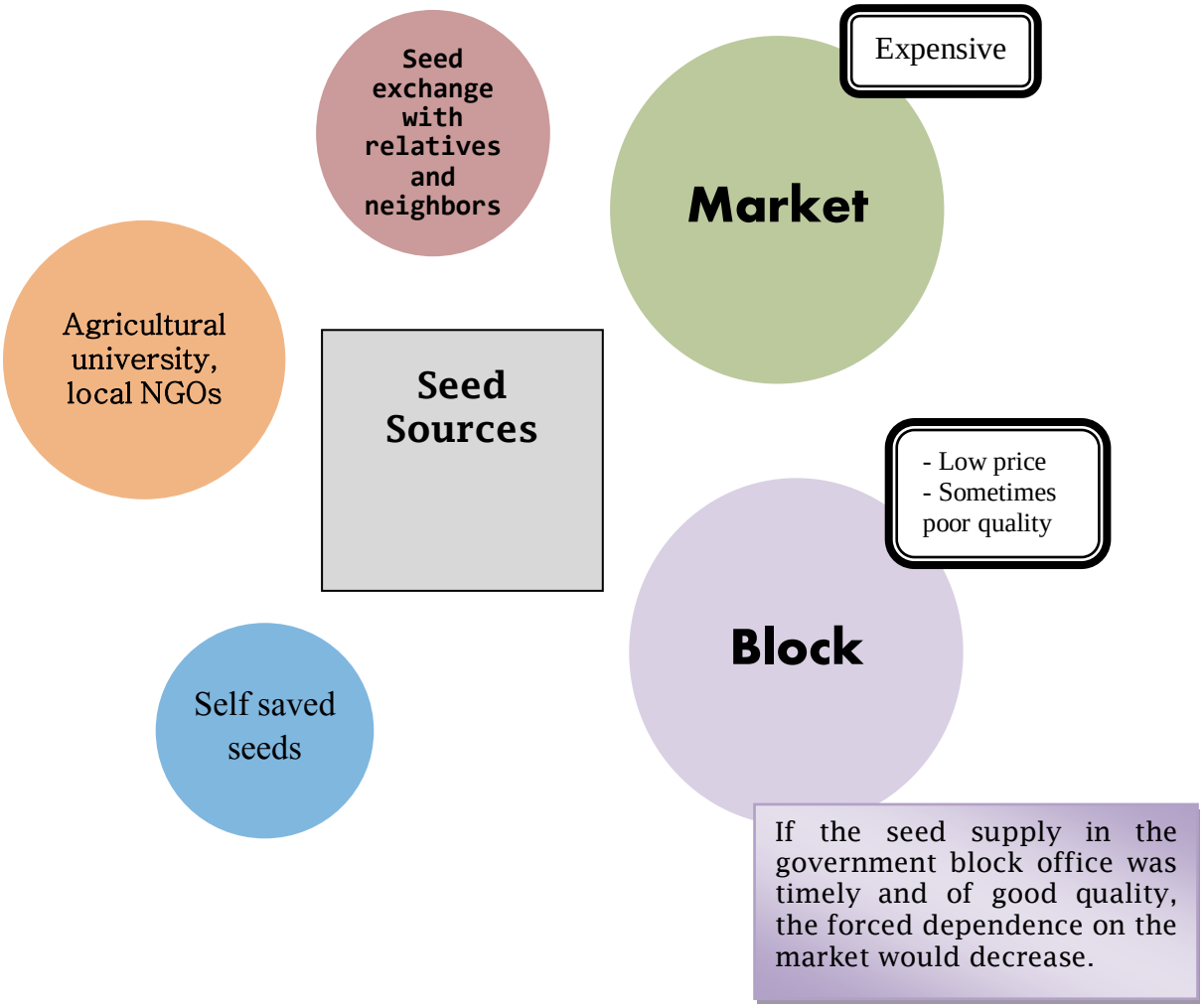
Impacts of climate change

Migration and diversity loss

- Where there is high male out-migration, the burden of day-to-day farm activities falls on women. As a response to the increased burden women have begun to cultivate fewer varieties of crops. There have been few labour-saving technological innovations to lighten their work.
- When women decrease their portion of work, this means a loss of their decision-making powers in the production process. Other women are marginalized to only provide manual labour. In a food crisis, women are the last individuals to eat in the family. Decreasing consumption and changing the food were mentioned during the FGD with women labourer as the relevant cultural responses in crisis situations.
- The study shows the relevance of managing a diversity of specific crops and varieties with nutritional and medicinal properties as a response to climatic crisis.
- The conservation of traditional knowledge and culture are important strategies to deal with changes. The preparation of traditional food, the rituals in traditional festivals (e.g. *Chhat Puja* in Bihar) conserves agrobiodiversity and reinforces the socio-cultural system.
- Women confirmed that their bargaining power being less, they work more and get lower garner lesser wages than men. Thus, the time available for selecting and storing seed, preserving local ecological knowledge and enhancing seed networks is scarce.

HIMACHAL PRADESH

Current Seed Sources in Himachal Pradesh



Seed Selection & Storage

In this study area seed selection and storage is done in different ways. In some villages it is a group activity and in others it is divided between men and women.

Seeds are selected during harvesting and threshing is done separately to avoid mixing with other grains. Healthy plants are selected with good size seeds and threshed separately.

Seed selection is done by men while storage is the responsibility of woman.

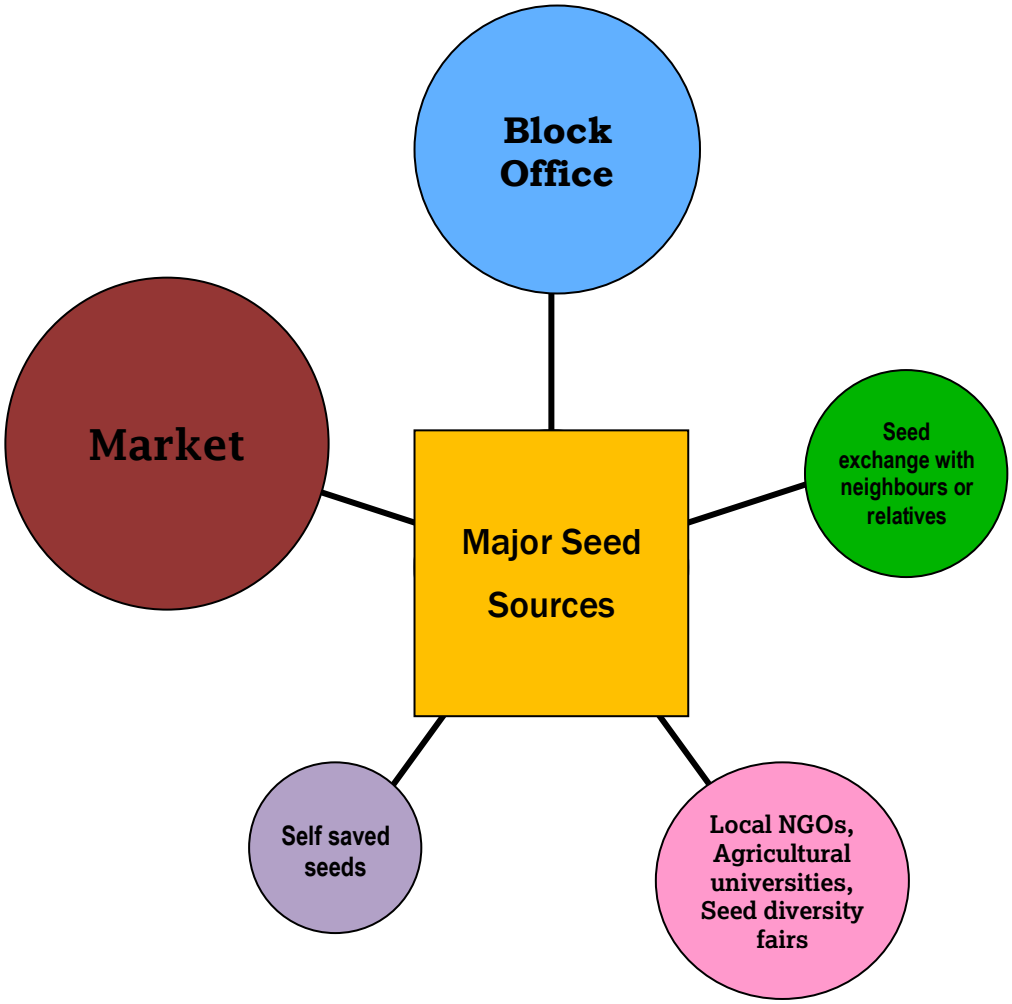
Methods of Seed Storage

UTTAR PRADESH

Most farmers are dependent on the market as their primary seed source and then on the government block offices. Many farmers complain about the seeds from both market and government.

- Seed supply from the block office is always inadequate and never meets the demand
- Seeds are distributed on the 'first come first serve' basis so many farmers who get information later do not get the seeds.
- The Block office is far (14-15 km away) from the village which makes seed procurement from there inconvenient.
- Preferred varieties are rarely available. Farmers complain that often the seed that comes from the Block office is not relevant to local cultivation so the seed is wasted.
    - *"The rice variety BPT 5204 is in demand in the area but the Block office gets only Sarju 52 and NDR 59 varieties which remain lying in the warehouse since no farmer wants to buy them"*
- Seeds, specially the vegetable seeds that farmers get from the market are sometimes spurious.
- Private seed dealers do not provide a proper receipt of the purchase to the farmers so if the seed fails, the farmer is unable to complain or claim compensation.
- Farmers cultivating paddy and wheat prefer the market since the seeds are usually available on time. The seed dealer is also the one stop shop for getting seeds, fertilizers, pesticides as well as credit. However, seed quality can be an issue, as can seed supply.
    - Farmer Ram Prakash: *"Seed dealers hold the seeds until a crisis and then sell them at higher rates. This year seed of the popular rice variety 'Gorakhnath' was not available in the block office so farmers had to buy the seeds from the market. The seed was spurious and in many cases there was not even a single panicle in the entire crop."*
- Farmers now say that the older system of farm saved seeds and seed exchange between other farmers and relatives was a much more reliable and cost-efficient system of seed access. In response to this Gene Campaign has started trainings and demonstrations in seed multiplication to foster self reliance in seed.

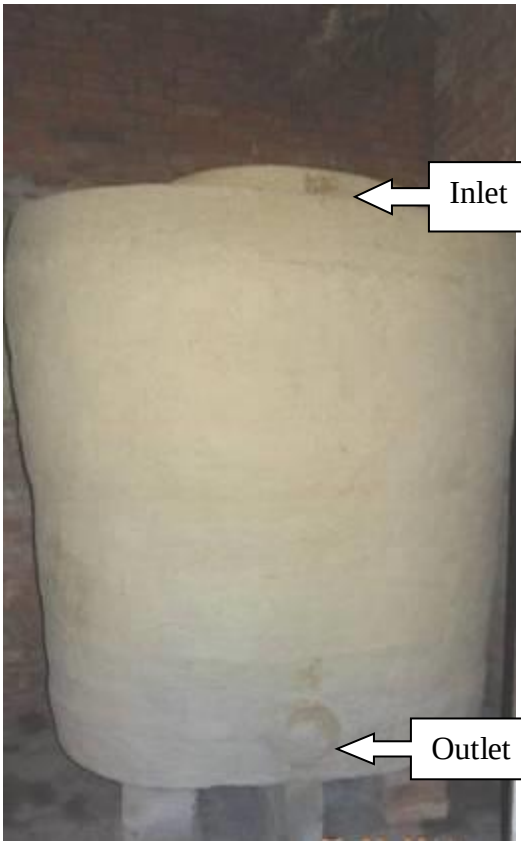
Current Seed Sources in Uttar Pradesh



In the Indo-Gangetic Plains (IGP) where traditional varieties have largely been replaced by HYVs, Gene Campaign adopted this strategy of broadening the genetic base by introducing a number of older HY varieties to the farmers. These varieties were identified through the list of suitable varieties from the All India Coordinated Trials (AICT). Their adoption will help to reduce the trend to monocultures based on just one or two varieties.

Gene Campaign distributing seeds of 14 paddy HYVs to increase farm diversity

Seed Storage: Then & Now



Then: Earthen Containers *(Dehri)* is a traditional method of seed storage

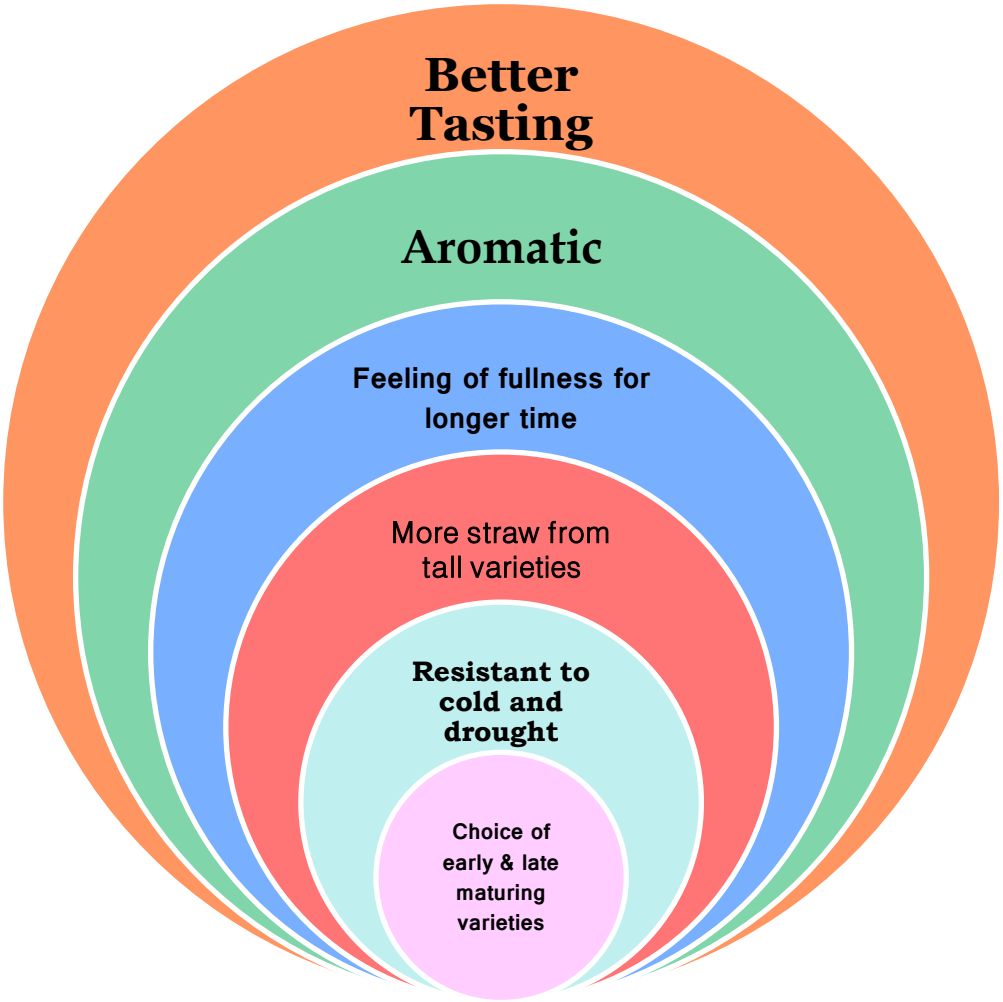
Now: Metal containers for seed storage

Now: Storing seeds in plastic sacks

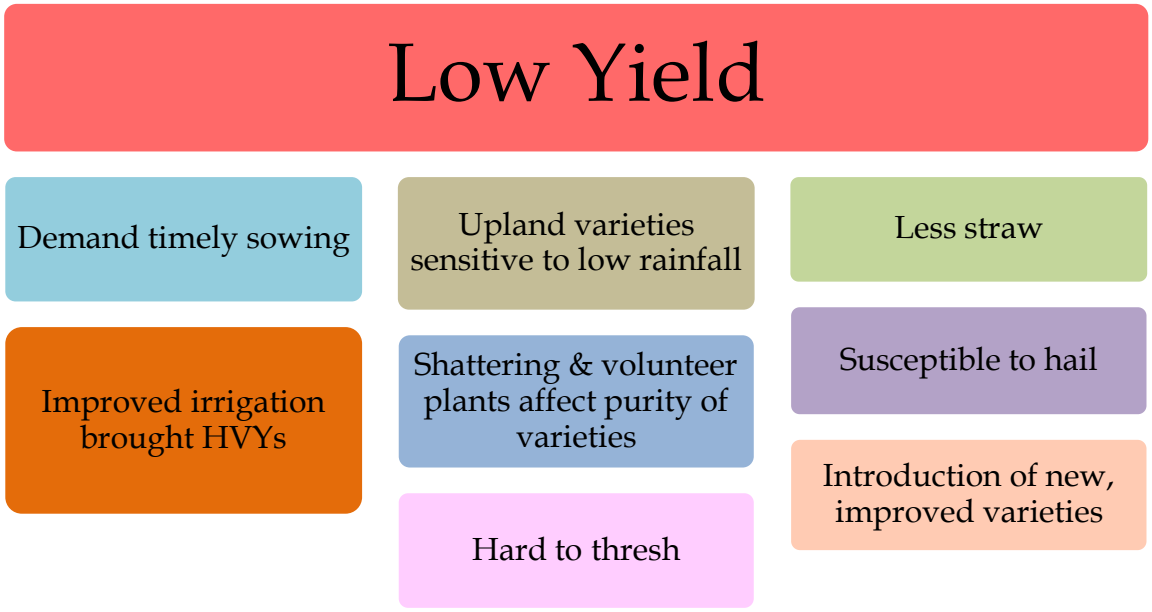
3. FARMER PERCEPTION OF AGROBIODIVERSITY/ TRADITIONAL VARIETIES

UTTARAKHAND

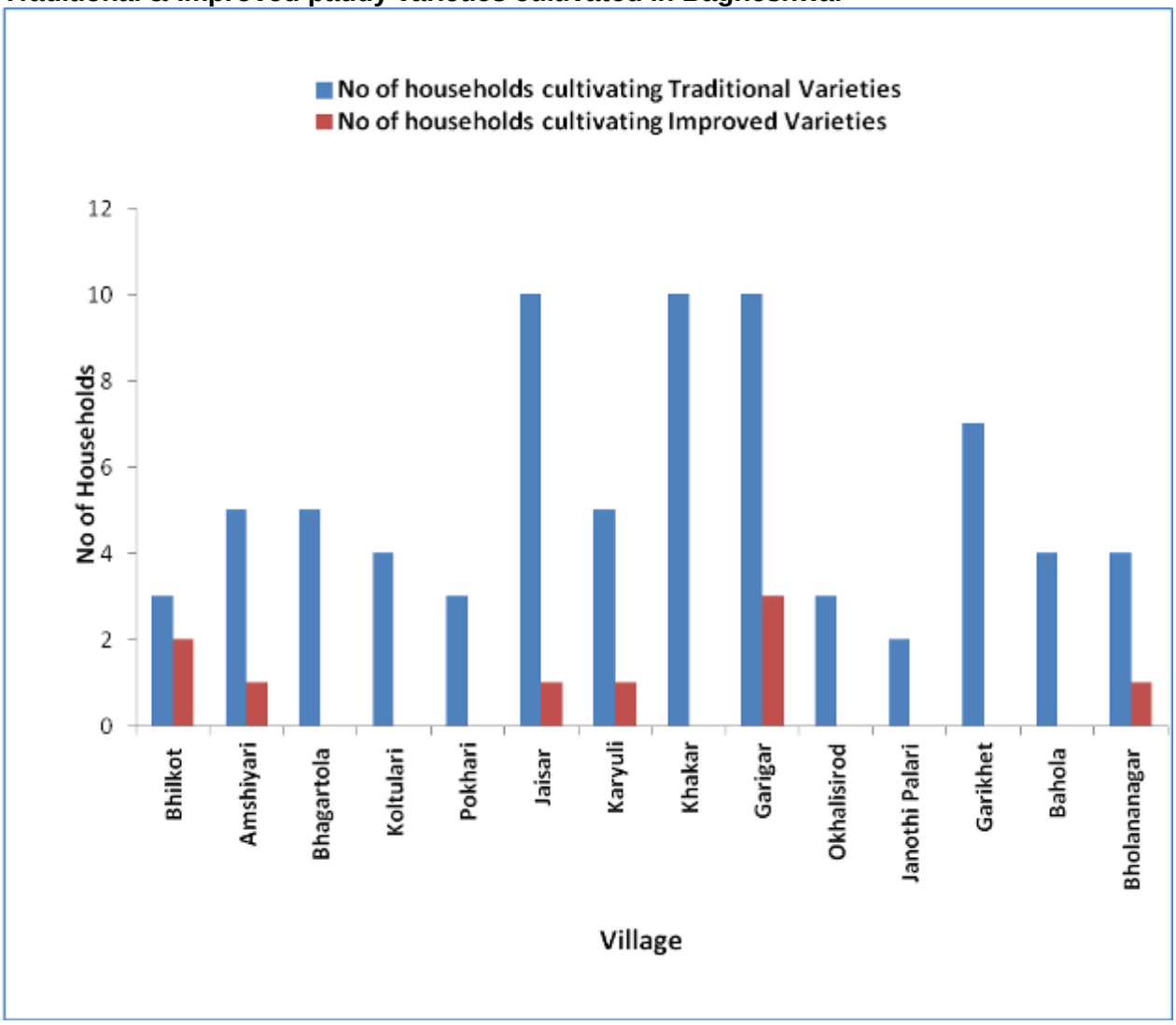
Why farmers find traditional varieties suitable



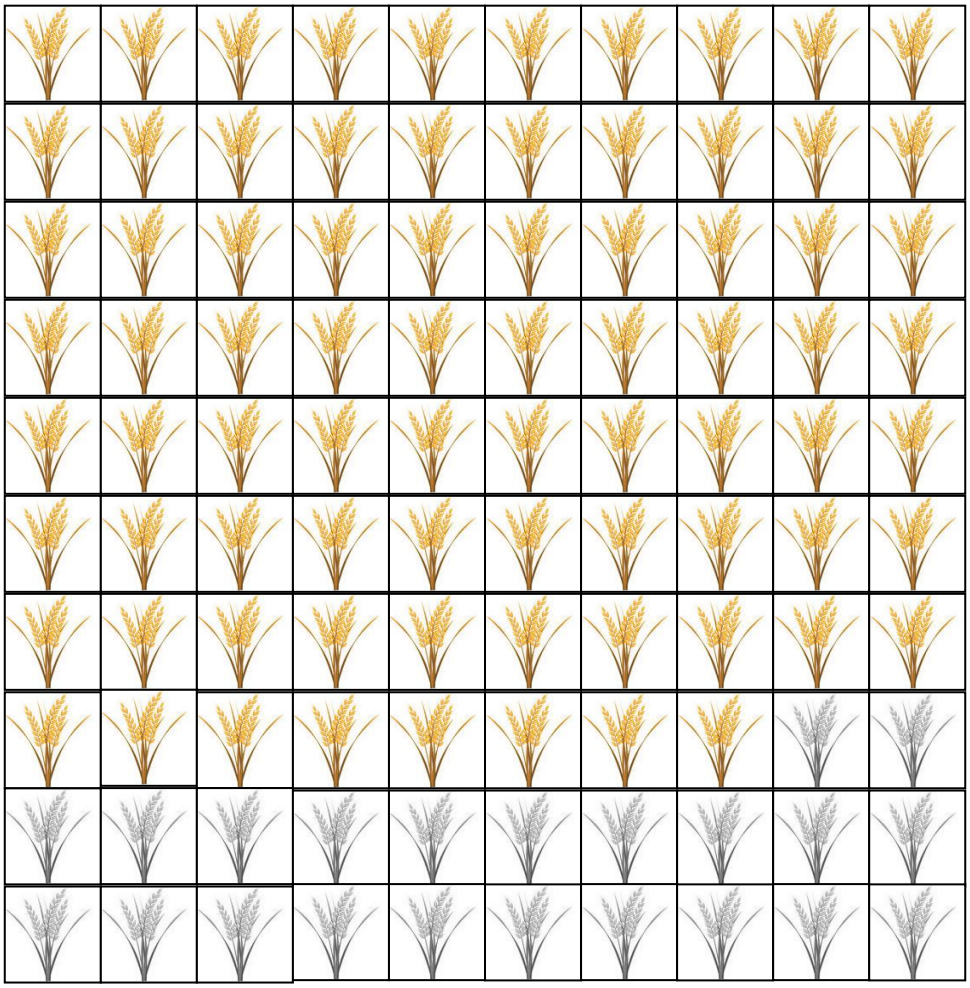
Why farmers do not find traditional varieties suitable



Traditional & Improved paddy varieties cultivated in Bagheshwar



Cultivation of traditional and improved varieties



Traditional variety

Improved variety

78% varieties cultivated in the area were found to be traditional while 22% of the varieties were improved.

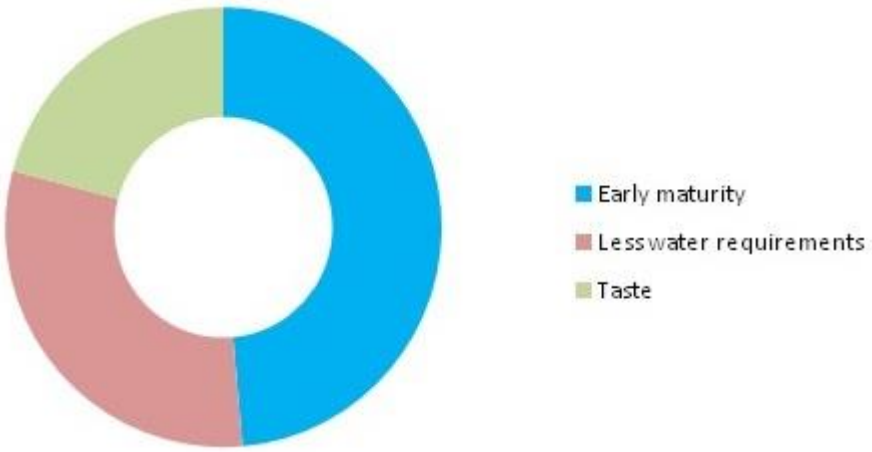
BIHAR

To understand farmers' preference for local varieties, three subjective questions were asked:

1. Reasons for liking the local varieties
2. Do you think local varieties will survive in the future? If they are extinct then what are the problems that will come?
3. What are the varieties that you used to grow earlier that you are not growing now? And why not?

1. Reasons for liking the local varieties

Many farmers liked local varieties due to taste (15%), due to less water requirement (22%) and many due to early maturity (35%). Very interestingly many farmers have rated *Bakol* as being very tasty so the taste preference guides their decision to keep the local varieties alive.



2. Do you think local varieties will survive in the future? If they are extinct then what are the problems that will come?

The major concern for the farmers in this aspect was monsoon. Monsoon patterns are changing across the country and globally and consequentially there is a shift in the cropping pattern as well. Changes in cropping pattern changes in the choice of varieties suited to the changed conditions. The farmers have deep concern about this change and fear that the local varieties may get affected due to this monsoon pattern change. They also have concern that they may lose some of the varieties due to the lack of monsoons.

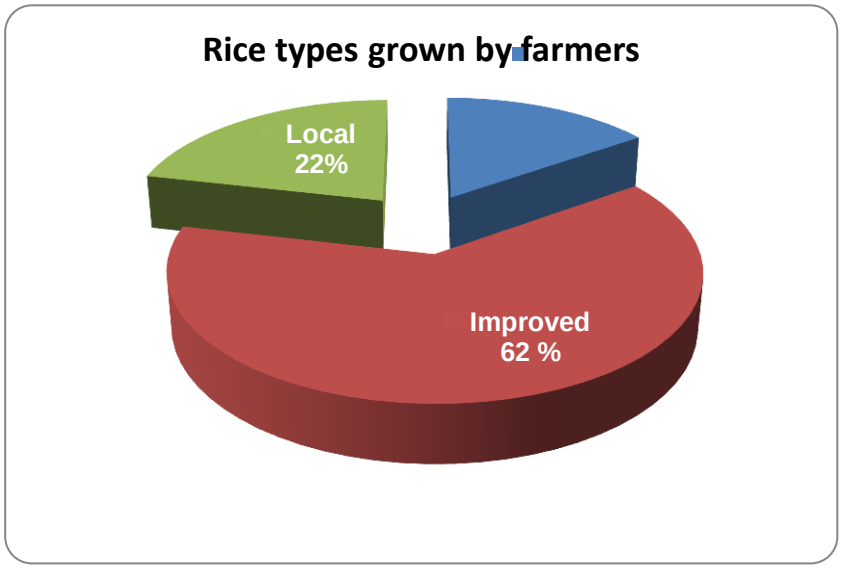
3. What are the varieties that you used to grow earlier that you are not growing now? And why not?

The improved varieties / hybrids often have a big yield advantages which lures farmers to abandon the local varieties. Still there are quite a lot of respondents who have faith in the local rice varieties for one or the other reason.

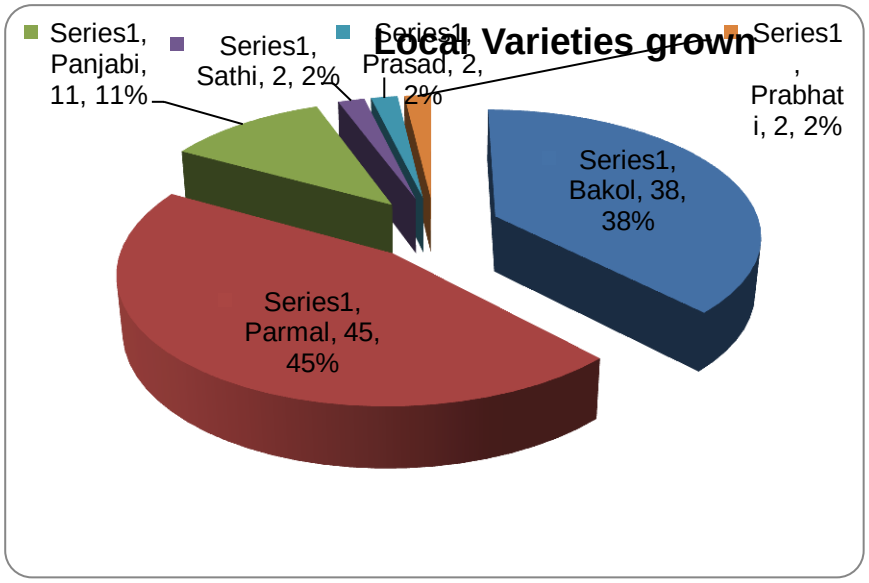
Farmers' responses to traditional Rice varieties

In a survey conducted in Muzaffarpur about the framers preferences towards traditional rice varities yielded some interesting findings. The farmers are growing traditional varieties like Bakol, Parmal, Panjabi, Pawa Parab, Sathi, Prabhati and Prasad. They were also inclined towards improved/research rice varieties and hybrids as well.

The distribution of local, hybrid and improved rice varieties grown by farmers of Muzaffarpur



Out of the 22% farmers growing local varieties, the below chart gives the popularity order of the local varieties

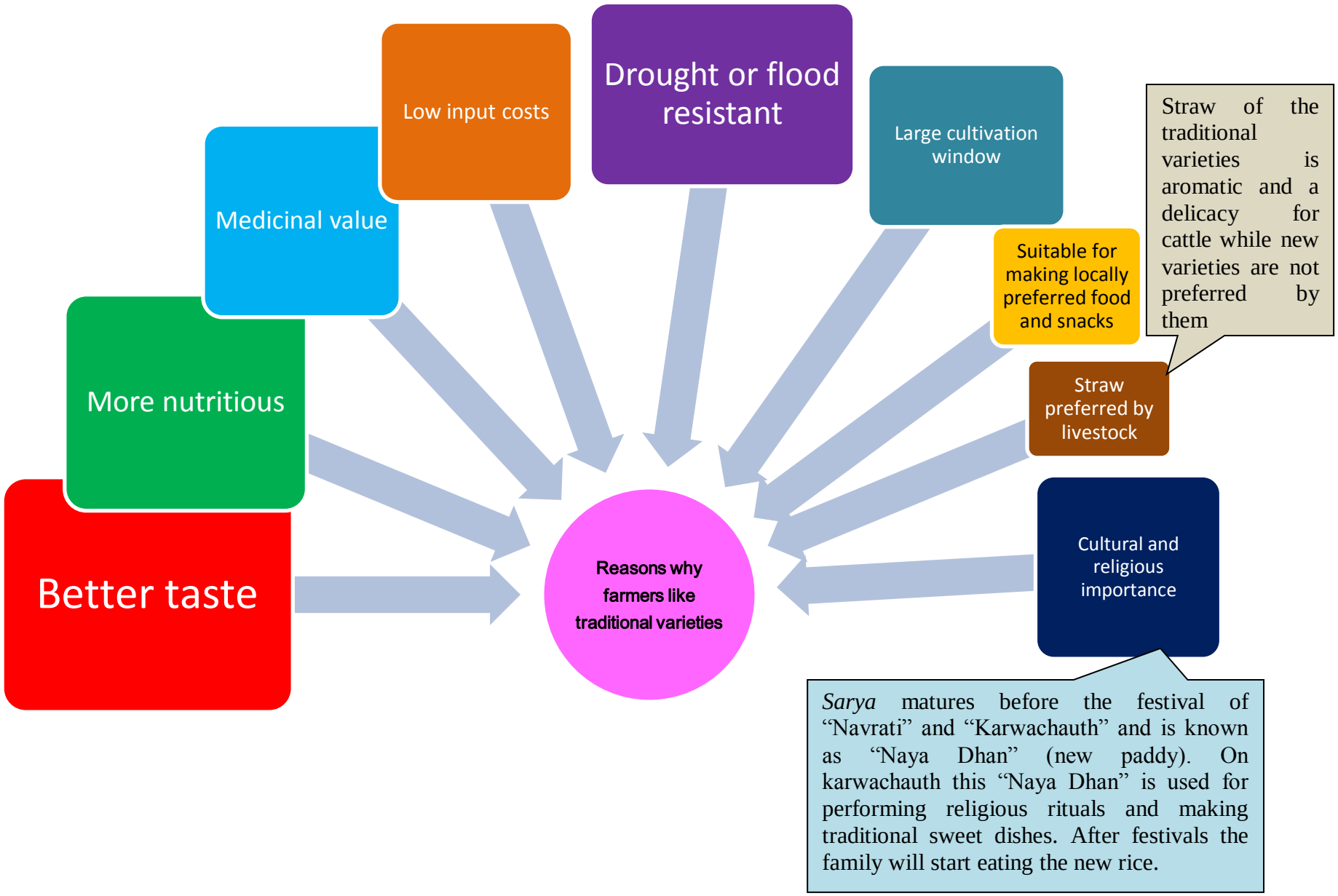


UTTAR PRADESH

Why farmers find traditional varieties suitable

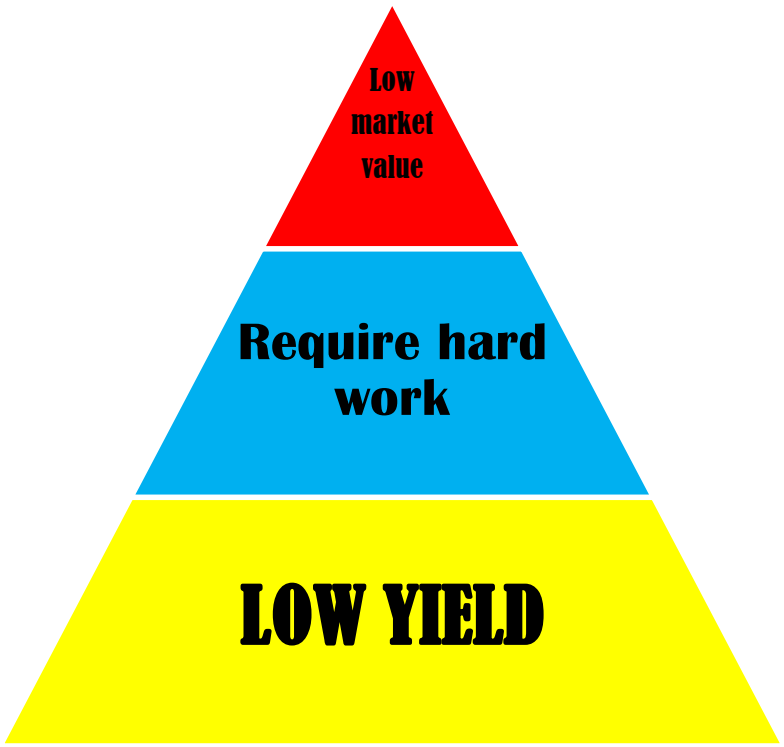
Even though majority of farmers have stopped cultivating traditional varieties some farmers are still cultivating them alongside new varieties in small patches. These farmers provided information on why traditional varieties are still important for agriculture. They named many traditional varieties which have climate resilient traits, medicinal properties and other qualities.

Status of women: During the study we observed that the social and economic condition of women is poor. Education is not considered important for girls and they are married off at a very early age. Women are not involved in decision making. However, we found that women have interesting information about rice varieties regarding their cooking quality, medicinal properties and other important characteristics.


Low input costs
Drought or flood resistant
Large cultivation window
Straw of the traditional varieties is aromatic and a delicacy for cattle while new varieties are not preferred by them
Medicinal value
Suitable for making locally preferred food and snacks
More nutritious
Straw preferred by livestock
Better taste
Reasons why farmers like traditional varieties
Cultural and religious importance
Sarya matures before the festival of "Navrati" and "Karwachauth" and is known as "Naya Dhan" (new paddy). On karwachauth this "Naya Dhan" is used for performing religious rituals and making traditional sweet dishes. After festivals the family will start eating the new rice.

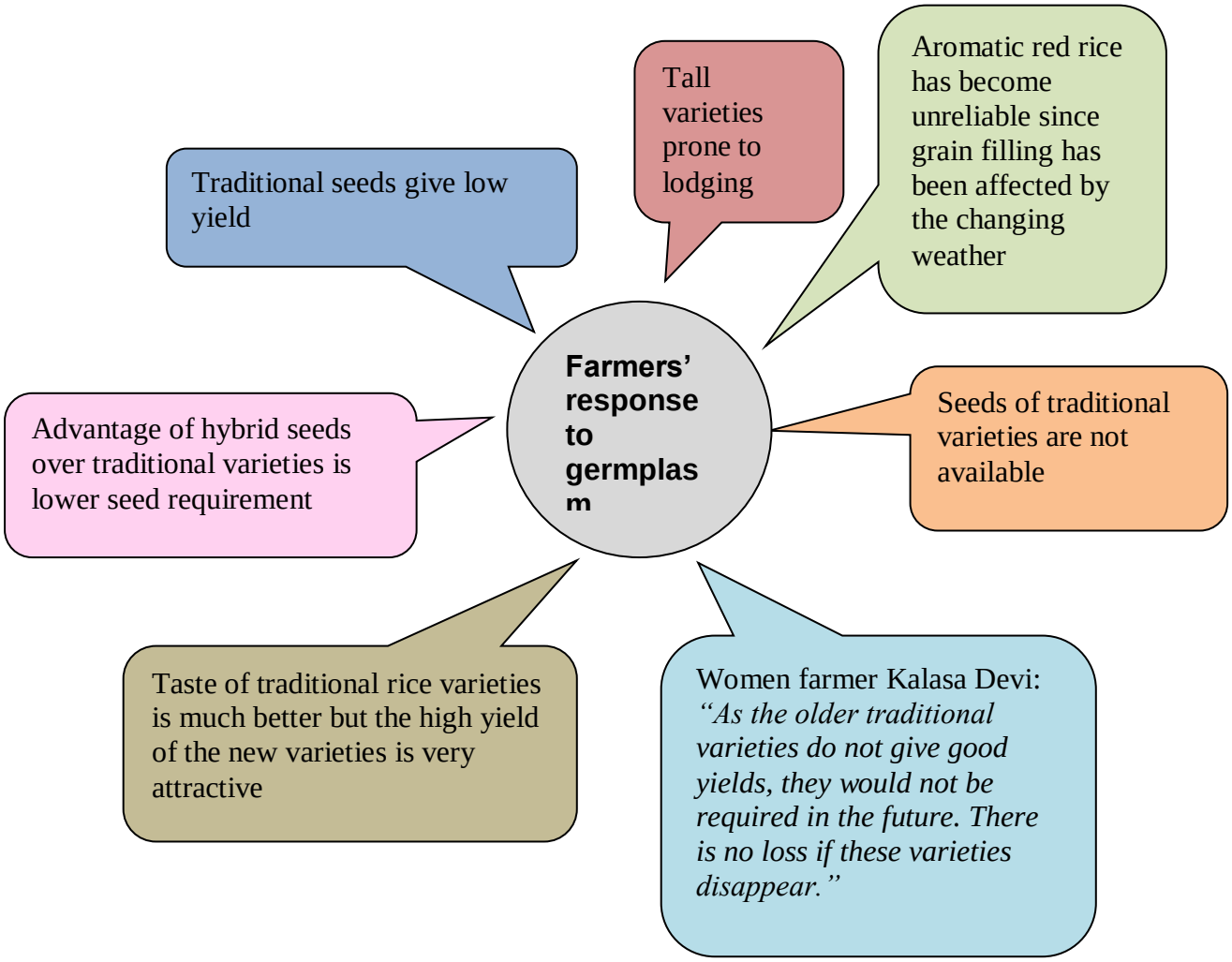
Why farmers do not find traditional varieties suitable

1. **Low Yield**
2. **Demand hard work:** Some of the traditional varieties are hard to thresh and cannot be harvested by machines.
3. **Difficult to sell:** The market demand is for long-grained rice so it becomes difficult to sell those traditional rice varieties which have short bold grains.



HIMACHAL PRADESH

In Kangra district of Himachal Pradesh we found that farmers did not have much interest in traditional varieties and there is almost negligible germplasm left in farms. Most of the farmers cultivate hybrids and do not even know the names of the varieties they cultivate.



Photos: Baseline surveys & Focus Group Discussions conducted by project staff

UTTARAKHAND

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HIMACHAL PRADESH

UTTAR PRADESH

OUTCOME 1: FARMERS IN THE SELECTED SITES HAVE INCREASED ACCESS TO RICE GENETIC DIVERSITY, CLIMATE INFORMATION AND STAKE THEIR CLAIM FOR EQUITABLE SHARING OF BENEFITS

Activities carried out:

a) GIS Modelling & Matching Sites:

Mapping Gene Campaign's Rice Collection and Predicting Future Adaptation Sites in 2020, 2040 & 2060

A total of 872 rice varieties from the Gene Campaign rice collection from Eastern India were analyzed in the study. The collections in the study were made from the 9 states/UT of Jharkhand, Bihar, Odisha, Chhattisgarh, Dadra and Nagar Haveli, Uttar Pradesh, West Bengal, Meghalaya and Assam with the maximum collection concentrated Jharkhand. In order to assign geographic coordinates to the rice collection, various external sources were consulted including the administrative database of the Survey of India and Google Earth. The rice collection database has location information including village, taluka/block, district and state. The location names were searched in the external sources and matching locations were noted at the village level where available in a table. Subsequently, the table with the geographic coordinates with location names was joined with the table listing the rice collection in the ESRI ArcInfo 10.0 software to assign geographic coordinates to the rice collection.

For the full report, see Annexure 4

b) Selection of Pilot Sites

In the 1st year, rice germplasm, about 400 varieties from the Gene Campaign collection and from & NBPGR were given to farmers in Karnal/Haryana and Budaun/UP. Traditional varieties were not acceptable to farmers as they were concerned only with high yields (favoured only HYV).

They rated these materials as 'poor' and declined to try them out both in Haryana and Central UP, hence we decided to change strategy and develop a new research model to study the relevance of genetic diversity to climate adaptation.

Our revised research methodology was to select two distinct agro ecological zones, two in the IGP: Uttar Pradesh and Bihar and two in the Himalayan region, a region like the IGP thought to be extremely vulnerable to climate change. These were the mountain states of Uttarakhand and Himachal Pradesh. In Uttar Pradesh we decided to move from Budaun in Central U.P. where there is very little interest in cultivating traditional varieties and selected District Siddarthnagar, in the terai belt bordering Nepal. This area still has traditional agriculture and grows some traditional varieties including the famed 'Kala Namak'.

Our new study approach was to work with both traditional varieties as well as improved varieties that had been released and accepted in the early years but were now obsolete. The effort was to increase the genetic diversity on farm so that the number of varieties in cultivation increased, sometimes with the adoption of traditional and sometimes with improved varieties.

c) Rice germplasm characterized for Climate Variation

Characterization of Existing Rice Diversity

UTTARAKHAND

Sl.no	Variety	Plant Height	Maturity in days	Straw quality	Aroma	De-husking	Shattering	Awn/ Awnless	Production Qtl/ Nali
1	Lal Jiruli	Medium	100-105	Soft	No	Easy	Yes	Awnless	1.5-2.0
2	Kareshi Dhan	Tall	100-105	Soft	less	Easy	No	Awnless	1.5-2.0
3	Amri	Tall	100-105	Hard	Medium	Difficult	No	Awnless	2.0
4	Thapchin	Tall	100-110	Thick	No	Easy	No	Awnless	1.5-2.0
5	Control	Tall	130-136	Soft & abundant	Mild	Easy	No	Awnless	2.0-2.5
6	Lal Dhan	Tall	100-107	Soft & abundant	Mild	Easy	Yes	Awnless	1.5-2.0
7	Sathi Dhan	Tall	60-78	Soft	No	Easy	No	Awnless	1.2-1.25
8	Kala Dhan	Tall	100-105	Soft	High	Easy	Yes	Awnless	1.5- 2.0
9	Garhwali	Medium	90-100	Soft & abundant	No	Easy	No	Awnless	2.0-2.5
10	Rajmati patli	Medium	90- 100	Soft	High	Easy	Yes	Awnless	2
11	Kavthungi	Medium	90- 100	Medium	No	Easy	No	Awnless	2-3

12	Kavita dhan	Short	110-114	Medium	No	Difficult	No	Awnless	2-3
13	Rajula dhan	Tall	90- 100	Soft	High	Difficult	Yes	Awn	2-3
14	Jouli or Juli dhah	Tall	90-100	Soft & abundant	Mediu m	Easy	Some	Awnless	3-4
15	Dehraduni basmati	Mediu m	130-140	Soft	Mediu m	Easy	High	Awn	2-3
16	Sona Dhan	Short	130-140	Less and Soft	No	Easy	No	Awnless	3-4
17	Jiruli dhan	Tall	120-129	High and Soft	Mediu m	Easy	No	Awnless	1 - 2
18	Jamayee Dhan	Tall	150-160	Abundant and Soft	No	Easy	No	Awnless	1 - 1.5
19	Rajmati-Karyuli	Tall	90-92	Abundant and Soft	Less	Easy	No	Awnless	1
20	Sunkhari or sunkharch	Tall	100-108	Abundant and Soft	No	Easy	No	Awnless	1.5
21	Mimbari Dhan	Tall	100-108	Abundant and soft	Less	Easy	No	Awnless	1
22	Govind Dhan	Short	100-108	Soft and less t	Mediu m	Easy	No	Awn	2-2.5
23	Kavnoyee	Tall	130-140	Soft and abundant	NO	Easy	Yes	Awnless	0.5 -0.6
24	Pinou Dhan	Mediu m	130-140	Soft	No	Easy	No	Awnless	1.0-1.5
25	Kashmiri Dhan	Tall	95-100	High an d Soft	No	Easy	Yes, less	Awnless	1.0-1.5
26	Lal-Safedi Dhan	Short	100-110	Sufficient and Soft	High	Easy	No	Awnless	1.0 -1.25
27	Nani dhan	Mediu m	100-110	Sufficient and Soft	No	Easy	No	Awnless	1.0-1.5
28	Nouliya dhan	Tall	150-153	Sufficient and Soft	High	Difficult	Yes, less	Awnless	1.5-2.0

29	Dhur bashmati	Tall	120-129	High / Soft	Mediu m	Easy	No	Awn	2.0-2.5
30	Rajmati dhan	Tall	120-129	High/Soft	Low	Easy	No	Awn	1.5-2.0
31	Bourar	Tall	120-129	High and Hard	Less	Easy	No	Awnless	1.0-1.5
32	Chhoti or chhotiya	Short	90-98	Less and Soft	Mediu m	Difficult	No	Awn	1.0-1.50
33	Hagoli dhan	Short	100-106	Less and Soft	Less	Easy	Yes, less	Awnless	1.0-2.0
34	Ghori dhan	Tall	100-106	High and hard	High	Difficult	No	Awnless	0.5-0.7
35	Thuli Chhoti	Tall	100-110	High and soft	No	Easy	No	Awnless	1.0-1.5

Sl.no	Variety	Avg height	Avg no of tillers	Avg panicle length (cm)	Avg panicle width (Cm)	Avg no of node	Avg root length (Cm)	Avg of flag leaf length (cm)	Avg of Flag leaf width	Avg sheath length	Awn distribution	Avg Awn length (mm)	Avg grain length mm	Avg grain width	Seed weight/ panicle (g)	100 seed gram weight (g)	Threshibility	Apiculus colour	Lemma colour	Rice colour	Colour of Grain
1	Amri	102.5	2.9	19.2	2	3.3	9.4	25.6	2.5	31.2	absent	-	7.2	3	3.5	2.4	Difficult	purple	yellow purple	Light Red	purple yellow
2	Bourar	114.8	3.3	20.5	1.8	3.4	11.2	40.5	2.5	34.9	absent	-	8	2	2.4	2.2	Easy	Yellow	Golden brown	white	yellow brown
3	Chhoti or Chotiya	81.1	3.6	17.3	1.5	2.8	8.9	25.9	1.4	25.8	Tip only	9.2	8	1.9	2.3	2.6	Difficult	Black	Light brown	White	Golden brown
4	Controli	118	4.3	20.5	2.3	3.8	9.6	38.8	2.3	31	Tip only	12	8.2	3	3.6	2.7	Easy	light yellow	light yellow	white	Light yellow
5	Dana Or Dhur Bashmati	114.3	3.3	16.7	1.7	4	11.4	23.2	1.9	26.9	upper half	33	9.2	2.8	2.2	2.8	Easy	Light yellow	Yellow brown	white	light yellow
6	Dehraduni Basmati	121.5	5.8	21.5	2	3.4	13.3	34.5	2.1	32.3	upper quarter	18.4	9	2.2	3.6	2.6	Easy	Light yellow	light yellow	white	light yellow
7	Garwali	113.4	2.8	20.7	1.6	3	10.8	36.1	1.2	29.8	absent	-	8	3	1.3	2.6	Easy	Light yellow	Light yellow	White	Light yellow
8	Ghori dhan	92	4.6	25.1	1.5	3.3	10.8	29.5	2.4	27.6	absent	-	8.2	2	-	2.5	Difficult	Brown	brown apex	white	golden
9	Govind Dhan	71.4	4	19.6	1.7	2	7.9	34.7	1.1	29.4	whole length	28.6	8.8	2	1.9	2.6	Medium	Light yellow	light yellow	white	light yellow
10	Hagoli	94.8	9	18.4	1.6	3	8.6	24.3	1.5	25.8	-	-	7.8	3	-	2.8	Easy	Yellow	yellow	white	yellow
11	Indrasan	102.4	3.9	19.6	1.5	3	9.6	30.4	1.5	30.8	Tip only	3.7	8.6	2	2	1.8	Easy	Brown	Golden	Cream colour	Golden brown
12	IR-8	52.3	3.1	23	2.3	3.8	8.5	29.9	2.0	37.1	Tip only	6.6	7.8	2	-	2.5	Difficult	Light yellow	light yellow	white	light yellow
13	Jamai Dhan	121.3	3.6	20.3	2.1	3.8	10.7	31.8	2.0	36	absent	-	7.4	3	6.6	2.3	Easy	purple	Golden Yellow	white	Golden Yellow
14	Jeeruli	-	-	-	-	-	-	-		-	Tip only	7.6	8	2.6	-	1.8	Easy	Brown	white brown	Light Red	Light brown
15	Juli	126.3	8.9	23.7	2	3	15.9	42.7	2.5	36	Tip only	10	8.6	3	3.2	2.7	Easy	Black	light golden	white	light golden
16	kala dhan	117.5	4.9	19.2	2	3.3	10.6	34.1	2.2	32.6	Tip only	8.8	8.4	3	2.2	2.5	Easy	purple	Black apex	White	Light brown
17	Kareshi Dhan	123.1	3.5	24.1	2	4	9.9	33.5	2.4	35.8	absent	-	8.4	3	4.6	2.3	Easy	Black	Light yellow	white	yellow-brown

18	Kashmiri	98.5	4	18.2	2.2	4	12.1	35.2	2.0	30	absent	-	7.2	2.8	2.4	2.8	Easy	Yellow	yellow	white	yellow
19	Kav Thungi	107.5	3	18.6	1.5	3	10.7	30.9	1.8	31.8	absent	-	7.2	2.7	3.4	2.6	Easy	purple	purple apex	Light Red	purple yellow
20	Kavita	96.4	5.4	19.9	1.5	3	12.3	27	1.7	27.3	Tip only	10	8.6	2	1.8	2.7	Difficult	light yellow	light yellow	White	yellow
21	Kavnoyee	0	0	0	0	0	0	0	-	0	-	-	7.6	3	2.6	2.3	Easy	Black	purple apex	Red	Light yellow and purple
22	Lal Dhan	145.3	6.4	26.1	2	3.4	13.4	43.7	1.7	38.2	Tip only	4.2	8.2	2.82	1.4	2.2	Easy	purple	purple apex	White	golden brown
23	Lal Giruli Dhan	107.4	4.8	17.6	1.7	3	13.1	30.6	2.2	28.6	Tip only	14	8.2	2.92	2.9	2.6	Easy	Brown	Brown	white	Brown
24	Lal Safedi	0	0	0	0	0	0	0	-	0	absent	-	7.4	3	-	2.5	Easy	Light brown	Brown	white	brown
25	Mimbari	0	0	0	0	0	0	0	-	0	absent	-	6.8	2.8	-	2.1	Easy	Black	light yellow	Light Red	light yellow
26	Nani chhoti ya chhotuli	124.9	3.6	19.5	1.8	3.8	9.3	40	1.5	37.5	absent	-	9.6	2	0.8	2.3	Easy	Yellow	yellow	white	yellow
27	Nani dhan	0	0	0	0	0	0	0	-	0	absent	-	8.2	2.6	-	2.5	Easy	Yellow	Light yellow	Light Red	light yellow
28	Nauliya	127.1	4	19.6	2.3	4.3	10.1	29.8	1.8	32.7	absent	-	8.4	1.5	2.5	1.8	Easy	Light brown	Light brown	white	light brown
29	Pinau	110.4	4.1	19.8	1.9	3.9	10.5	28.4	1.8	32.4	absent	-	7.4	3	2.5	2.5	Easy	Yellow	yellow	white	yellow
30	Rajmati	119	2.4	18.8	1.9	3.5	10.4	30.8	2.1	27.5	absent	-	7.6	1.7	4.2	2.6	Easy	Yellow	golden	white	light brown
31	Rajmati Karyuli	0	0	0	0	0	0	0	-	0	Tip only	17.8	9	2	-	1.7	Easy	Light yellow	light yellow	Light Red	yellow
32	Rajmati Patli	106.4	3.8	22	2	3	10.1	40.6	2.0	32.8	absent	-	7.2	1.6	2.1	1.8	Easy	Golden	Light Brown	White	golden brown
33	Rajula	130	4.9	23	2.2	3.3	12.1	57.3	2.0	35.9	Tip only	17	8.8	3	3.6	2.5	Difficult	brown	brown apex	white	golden brown
34	Sati dhan	109.1	5.4	21.1	1.7	3.5	9.9	29	1.9	27.2	absent	-	7.4	3	2	2.5	Easy	Light yellow	Light yellow	White	Light yellow
35	Sona	84.6	6.5	19.4	1.7	2.9	12.3	26.3	1.8	62.9	Tip only	9.4	8.6	2.2	2.2	2.4	Intermediate	light yellow	light yellow	white	light yellow
36	Sunkhari	0	0	0	0	0	0	0	-	0	absent	-	7.4	2.4	-	2.1	Easy	Light yellow	brown apex	white	light yellow

37	Thapchin or chinthap	103.3	5	19.6	2	3.6	9.4	23.7	1.7	27.3	Tip only	2.4	7.2	3	3.2	2.6	Easy	light-Brown	Light yellow	Red	yellow
38	Thuli choti	0	0	0	0	0	0	0	-	0	-	-	-	0	4.2	2.5	-	-	-	White	-
39	VL-154	0	0	0	0	0	0	0	-	0	-	-	-	0	-	3	-	-	-	white	-
40	VL-155	0	0	0	0	0	0	0	-	0	absent	-	8.4	2.6	-	2.4	Easy	light yellow	Light yellow	white	light yellow
41	VL-9	0	0	0	0	0	0	0	-	0	-	-	8.8	2.6	-	2.8	Difficult	Light yellow	light yellow	white	light yellow

BIHAR

Name of Variety	Average of No of productive tillers per sq.mt	Average of Plant height (cm)	Average of Panicle length , cm	Average of No. of Grain / Panicle	Average of 1000 Grain wt	Average of Yield (Q./ha)
HKR-47	457.0	53.0	16.7	51.7	13.3	29.9
IR-64	282.0	47.3	16.7	55.0	18.3	33.7
PNR-381	401.7	60.3	14.7	56.0	14.7	31.0
Prabhat	355.3	39.0	13.3	45.0	15.7	28.3
Pusa Basmati -1121	401.3	64.7	17.0	57.7	17.3	29.7
Pusa-1176	408.3	52.0	22.7	54.0	22.7	26.7
Pusa-44	404.0	29.0	19.7	50.7	17.0	35.9
Rajendra Bhagwati	438.3	54.7	12.3	60.0	17.7	32.9
Rajendra Mashuri	395.7	64.7	14.0	55.7	19.0	26.4
Rajendra Suwasini	450.3	54.7	18.0	61.3	15.0	33.5
Rajshree	334.0	64.7	18.0	60.3	21.0	31.0
Sugandh-3	433.7	62.7	16.3	57.7	16.7	33.5
Sugandh-5	444.0	63.3	20.3	55.0	16.3	32.4
CD (P=0.05)	**94.1**	**6.92**	**2.1**	**4.5**	**2.1**	**3.3**

UTTAR PRADESH

(i) Shorathgarh

Five early maturing, three medium maturing and six late maturing rice varieties were put in trial in six villages of Shorathgarh. The varieties were evaluated using standard descriptions and farmer preferences were noted. Both qualitative and quantitative assessment of paddy was conducted using descriptor such as Number of tillers, Seed weight, Length of Flag leaf, Plant height, Maturity period, Size of panicle, seed shape, Aroma, Incidence of diseases etc.

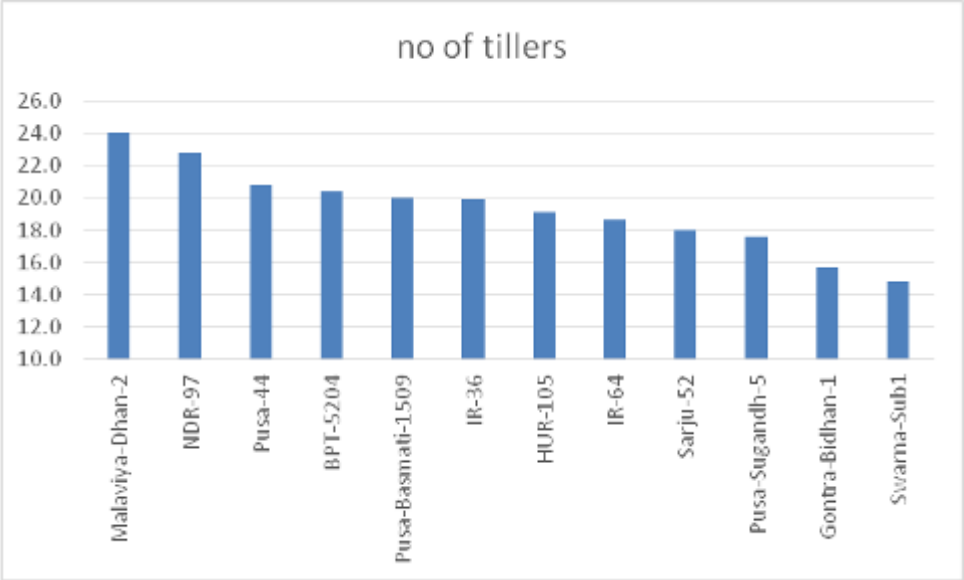
Type	Variety	Range of Plant Height (cm.)	Range of tiller number	Panicle length (cm.)	Flag Leaf Length (cm.)	Range of Grain Yield (kg)
Early maturing	HKR47, PNR 381, Prabhat, Rajendra Bhagwati, Rajendra Suwasini	26-110	14-31	19.58-20.20	40-70	26-116
Medium maturing	Sugandha 5, IR 64, PR113	56-117	6-25	56-117	6-56	15-40
Late maturing	Pusa 44, Rajshree, Pusa 1176, Rajendra Mansoori, Sugandha 3, Pusa Basmati 1121	66-120	14-30	14-40	38-75	20-55

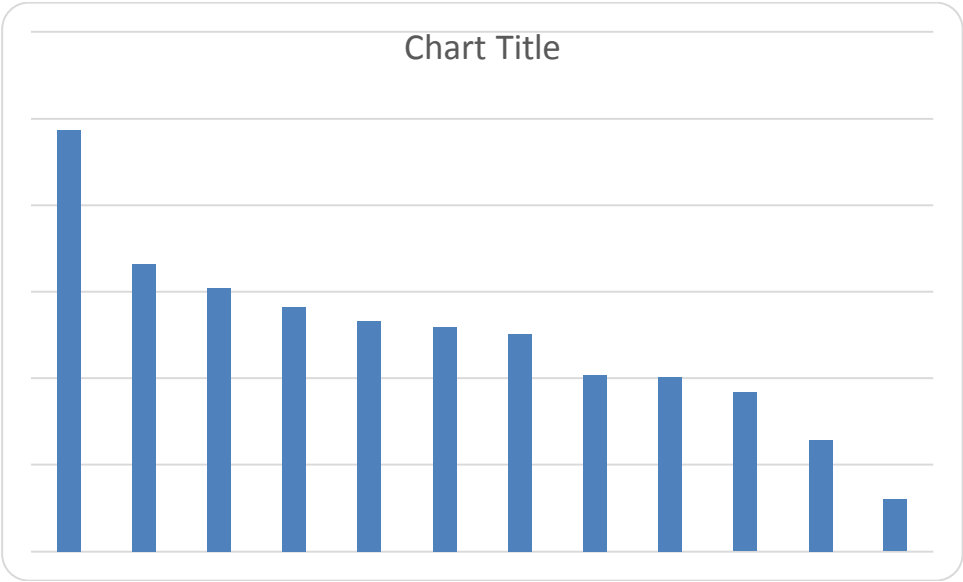
(ii) BADAUN

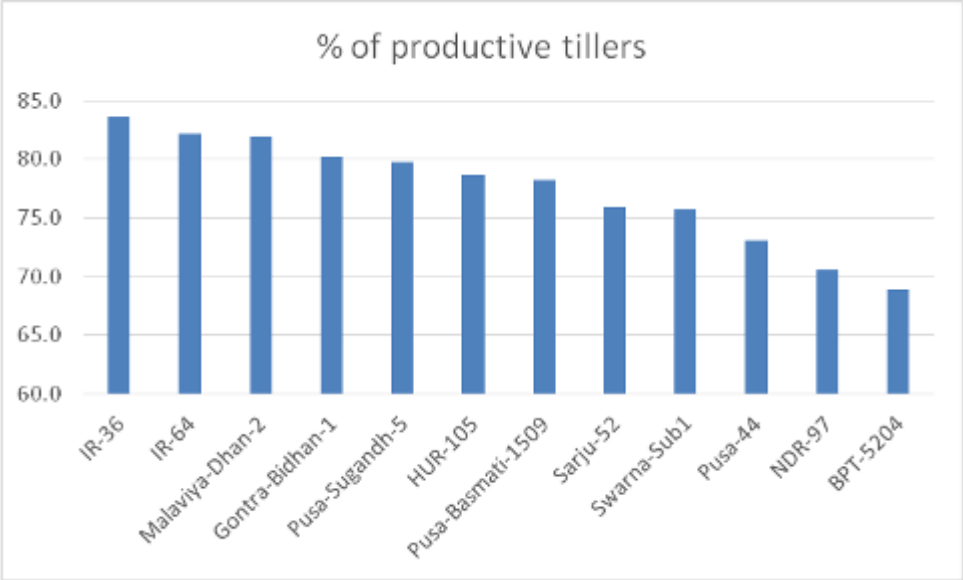
In Badaun, we had 12 varieties among 20 farmers viz BPT-5204, Gontra-Bidhan-1, HUR-105, IR-36, IR-64, Malaviya-Dhan-2, NDR-97, Pusa-44, Pusa-Basmati-1509. Pusa-Sugandh-5, Sarju-52 and Swarna-Sub1.

Variety	no of tillers	No of productive tillers	mean plant height	mean panicle length	mean grains per panicle	1000 Grain wt (gm)	Yield, q/ha
BPT-5204	20.4	14.1	81.7	19.9	100.0	27.3	29.1
Gontra-Bidhan-1	15.7	12.6	96.1	18.7	100.0	23.1	26.4
HUR-105	19.1	15.0	96.2	23.3	100.0	21.1	21.7

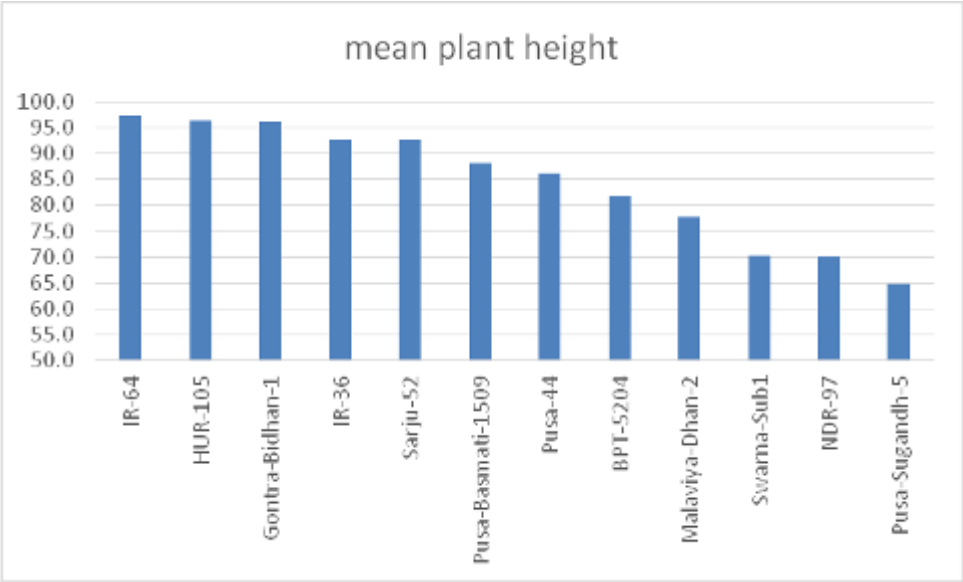
IR-36	19.9	16.6	92.7	20.8	96.9	20.1	27.2
IR-64	18.7	15.3	97.3	22.1	99.8	19.8	25.2
Malaviya-Dhan-2	24.1	19.7	77.8	23.1	99.8	26.6	32.2
NDR-97	22.8	16.1	69.9	21.9	99.5	19.9	30.5
Pusa-44	20.7	15.2	86.2	21.3	99.5	22.7	42.7
Pusa-Basmati-1509	20.0	15.7	88.1	25.1	98.0	24.6	19.7
Pusa-Sugandh-5	17.6	14.0	64.8	24.0	99.9	22.3	25.6
Sarju-52	18.0	13.7	92.7	23.7	99.7	26.4	17.1
Swarna-Sub1	14.8	11.2	70.3	18.6	100.0	19.1	18.3
CD (P=0.05)	***7.2***	***6.3***	***8.8***	***1.5***	***2.4***	***1.0***	***4.7***

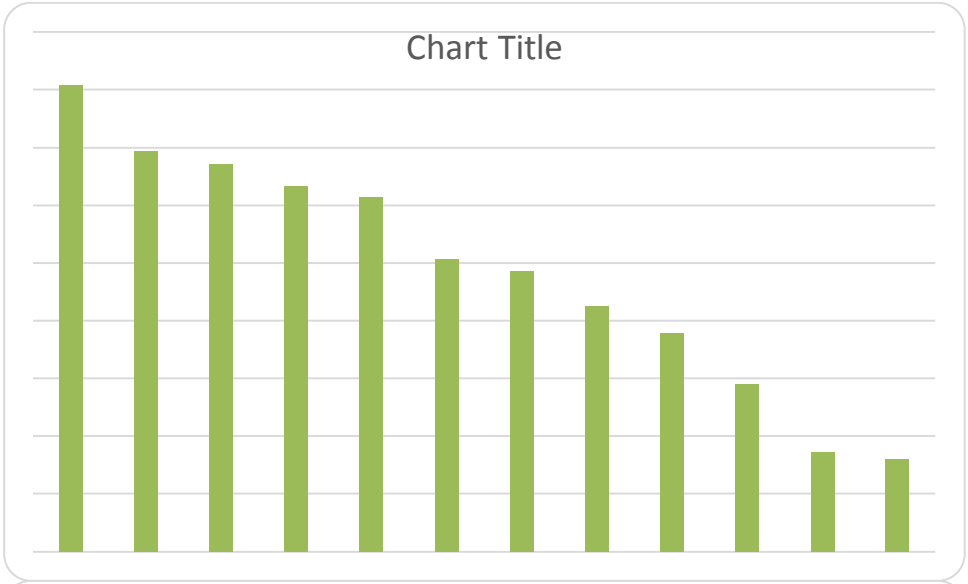






Seeing to the % of productive tillering, we do conclude that IR 36 and IR 64 is the best in tillering capacity.

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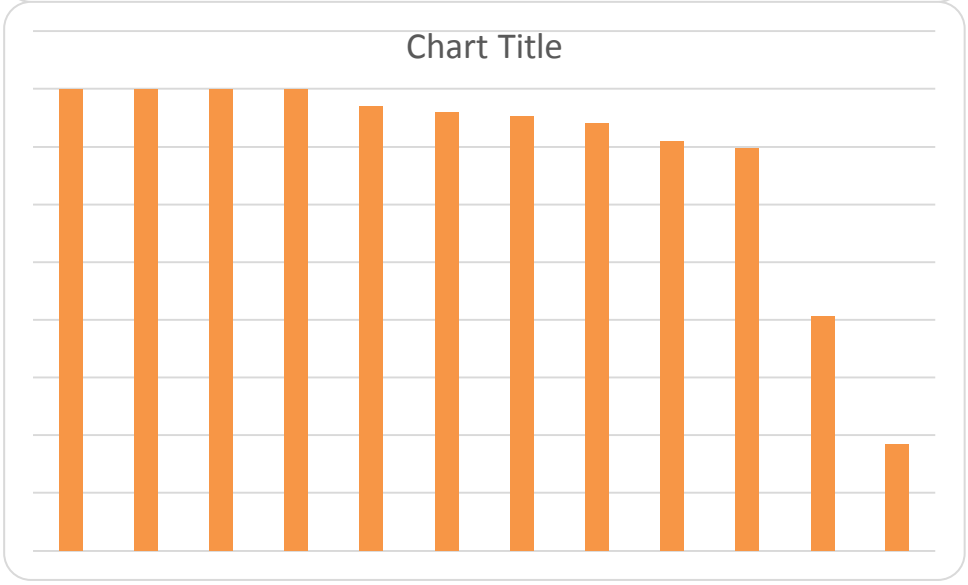
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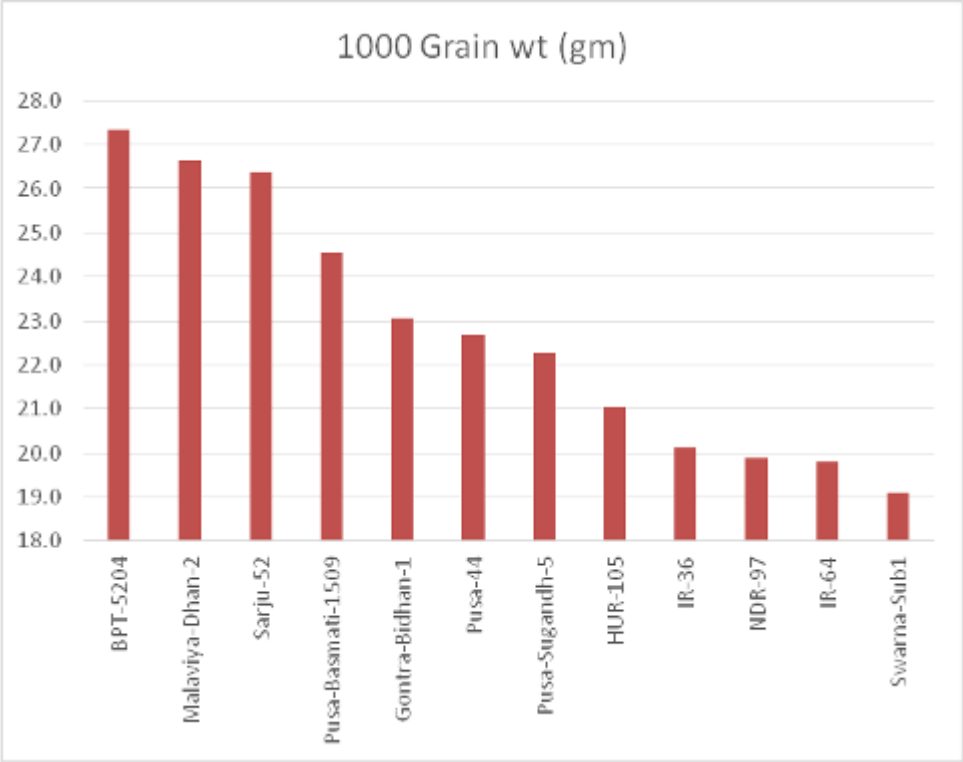
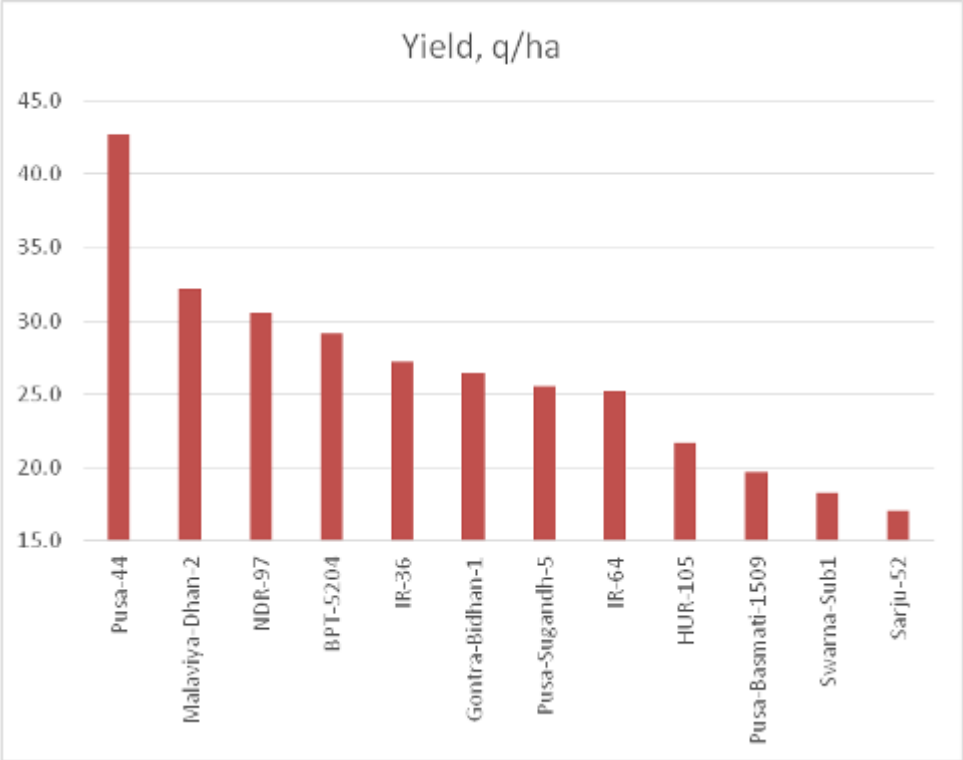
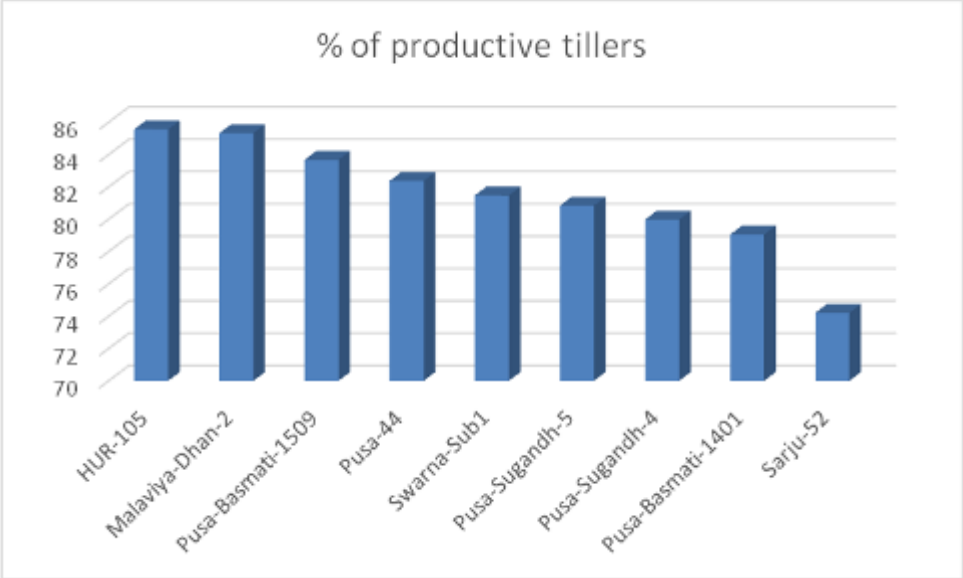


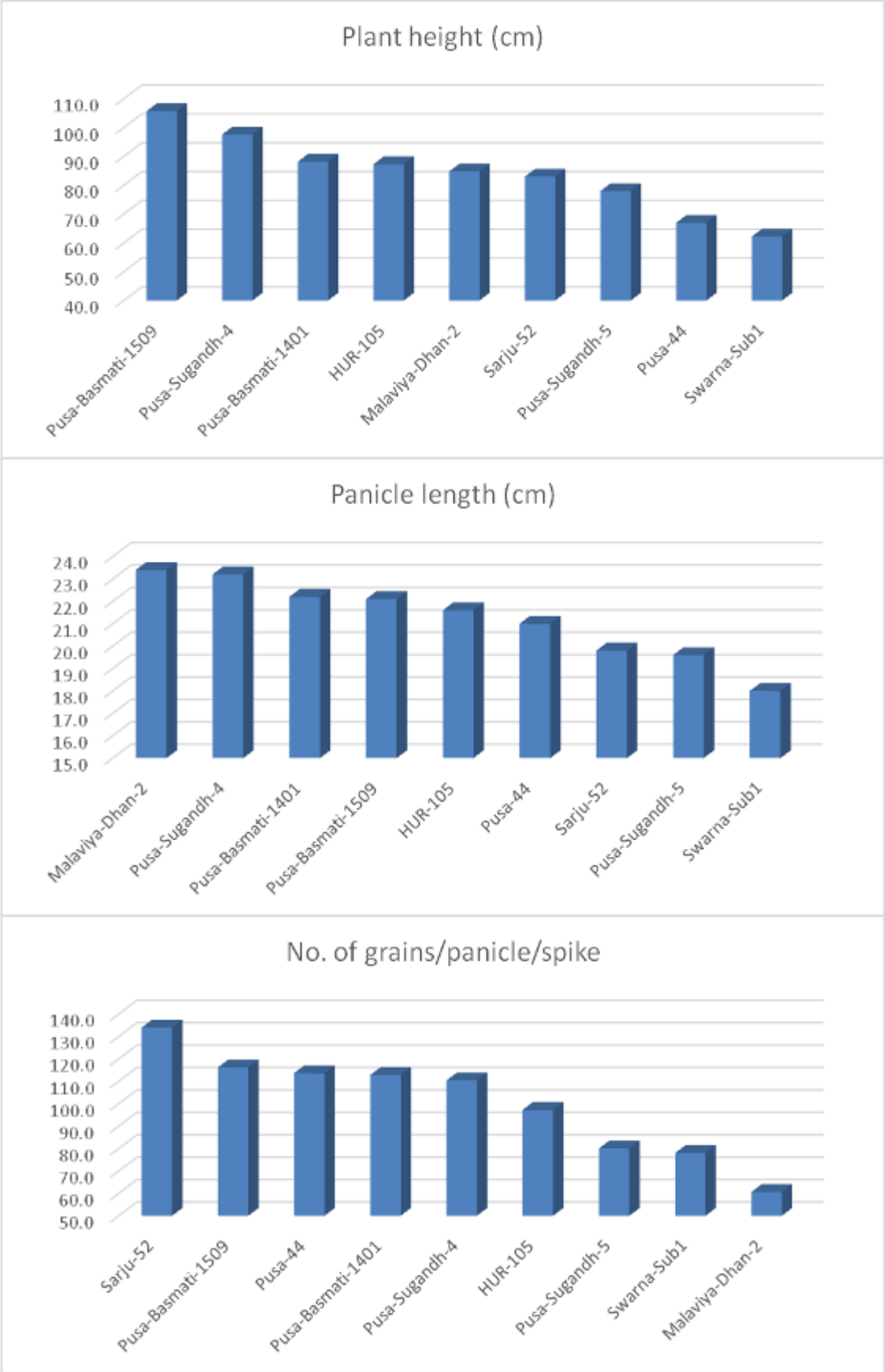


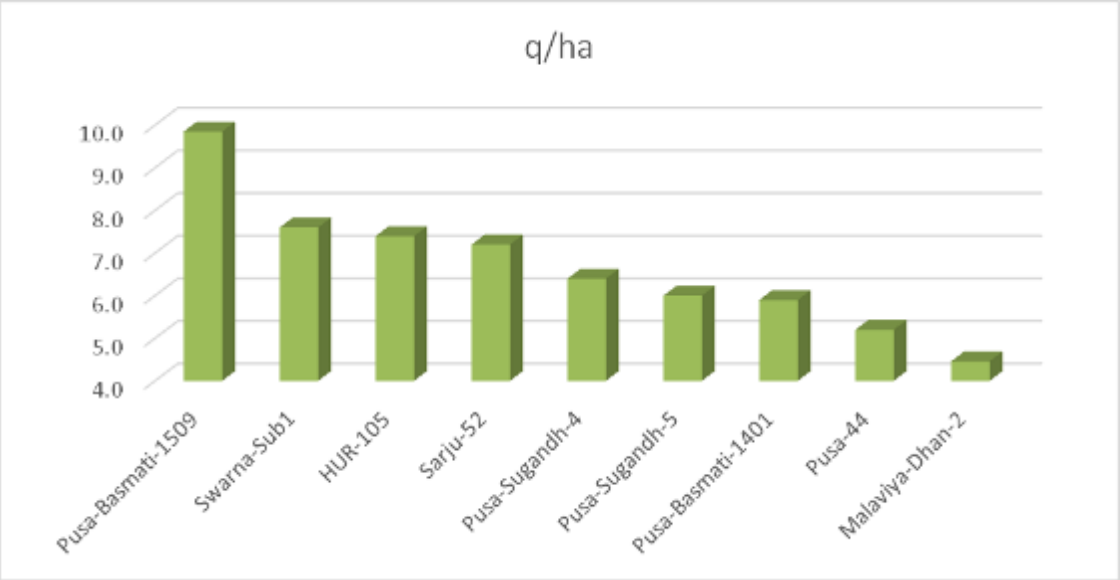
In Badaun, the yield of Pusa 44 was the highest while Sarju 52 and Swarna sub 1 was the least and this may be due to the absence of any submerging condition.

(iii) UNNAO

varieties	No. of Tillers	No of productive tillers	Plant height (cm)	Panicle length (cm)	No. of grains/panicle/spike	q/ha
HUR-105	192.6	164.8	87.3	21.6	97.3	7.4
Malaviya-Dhan-2	220.8	188.4	84.8	23.4	60.6	4.5
Pusa-44	148.6	122.4	67.0	21.0	113.6	5.2
Pusa-Basmati-1401	144.2	114.0	88.2	22.2	112.8	5.9
Pusa-Basmati-1509	187.4	156.8	105.7	22.1	116.2	9.9
Pusa-Sugandh-4	156.8	125.4	97.6	23.2	110.4	6.4
Pusa-Sugandh-5	162.8	131.6	78.0	19.6	80.0	6.0
Sarju-52	145.0	107.6	83.0	19.8	134.0	7.2
Swarna-Sub1	130.6	106.4	62.2	18.0	78.0	7.6




Plant height (cm)
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
Pusa-Basmati-1509
Pusa-Sugandh-4
Pusa-Basmati-1401
HUR-105
Malaviya-Dhan-2
Sarju-52
Pusa-Sugandh-5
Pusa-44
Swarna-Sub1
Panicle length (cm)
24.0
23.0
22.0
21.0
20.0
19.0
18.0
17.0
16.0
15.0
Malaviya-Dhan-2
Pusa-Sugandh-4
Pusa-Basmati-1401
Pusa-Basmati-1509
HUR-105
Pusa-44
Sarju-52
Pusa-Sugandh-5
Swarna-Sub1
No. of grains/panicle/spike
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
Sarju-52
Pusa-Basmati-1509
Pusa-44
Pusa-Basmati-1401
Pusa-Sugandh-4
HUR-105
Pusa-Sugandh-5
Swarna-Sub1
Malaviya-Dhan-2



HIMACHAL PRADESH

A total 30 varieties were characterized. Nineteen varieties of Himachal red rice varieties, out of which 6 varieties were improved selections and 13 varieties were traditional, were characterized using DUS characters. In addition, 5 improved varieties and 6 traditional locally adapted white rice varieties were also characterized.

S.No	Designation
1	Jatto (Red Red)
2	Deva (Red Rice)
3	Matali (Red Rice)
4	Chhohartu (Red Rice)
5	Sukara (Red Rice)
6	Karad (Red Rice)
7	AC 19164 (Red Rice)
8	AC 19180 (Red Rice)
9	AC 19186 (Purple base) (Red Rice)
10	HPR 2143
11	AC 19186 (Green base) (Red Rice)
12	Achhoo Red (Red Rice)
13	Desi Dhan (Red Rice)
14	Begmi (Red Rice)
15	Kaluan (Red Rice)
16	Roda Dhan (Red Rice)
17	Bhirgu Dhan(Red Rice)
18	Suakra Improved (Red Rice)
19	HPR 2800 (Red Rice)
20	RP 2421
21	R 575

22	Totu
23	Lal Nakanda
24	Lal Zhini
25	Krishan Dhan
26	HPR 2668
27	RJ 100
28	Achhoo
29	Kalizini (Red Rice)
30	HPR 1156

Characterization of Rice Germplasm

S. No	Name of variety	Sheath colour	pubescence	Leaf Auricle	Anthocynin Auricle colour	Leaf Ligule	Shape of Ligule	Colour of Ligule	Ligule length in cm
1	Jatto	Green	Medium	Present	Colourless	Present	Split	Green	1.2
2	Deval	Green	Strong	Present	Colourless	Present	Split	Green	0.5
3	Matali	Green	Medium	Present	Colourless	Present	Split	Green	1
4	Chhohartu	Green	Weak	Present	Colourless	Present	Split	Green	0.7
5	Sukara	Purple	Weak	Present	Colourless	Present	Split	Green	1.3
6	Karad	Green	Medium	Present	Colourless	Present	Split	Green	1.5
7	AC 19164	Green	Weak	Present	Colourless	Present	Split	Green	1.8
8	AC 19180	Purple	Weak	Present	Purple	Present	Split	Green	1.8
9	AC 19186(purple based)	Purple	Medium	Present	Purple	Present	Split	Green	2.8
10	HPR 2143	Green	Weak	Present	Colourless	Present	Split	Green	1.5
11	AC 19186(green based)	Green	Weak	Present	Colourless	Present	Split	Green	2.5
12	Achoo Red	Green	Absent	Absent	Colourless	Present	Split	Green	1.5
13	Desi Dhan	Green	Medium	Present	Colourless	Present	Split	Green	2
14	Begmi	Purpl	Strong	Prese	Purple	Presen	Split	Green	2.4

		e		nt		t			
15	Kaluna	Green	Medium	Present	Colourless	Present	Split	Green	1.3
16	Roda Dhan	Green	Weak	Present	Colourless	Present	Split	Green	1.3
17	Bhrigu Dhan	Green	Strong	Present	Colourless	Present	Truncate/ Acute	Green	0.5
18	Suara Improved	Green	Weak	Present	Colourless	Present	Split	Green	2.3
19	HPR 2800	Purple	Medium	Present	Purple	Present	Split	Purple	0.7
20	RP 2421	Green	Medium	Present	Colourless	Present	Split	Green	1.5
21	R 575	Purple	Medium	Present	Colourless	Present	Split	Purple	2.5
22	Totu	Purple	Medium	Present	Colourless	Present	Split	Purple	1.5
23	Lal Nakanda	Purple	Weak	Present	Colourless	Present	Split	Purple	1.7
24	Lal Zhini	Purple	Medium	Present	Colourless	Present	Split	Purple	1.7
25	Krishan Dhan	Purple	Medium	Present	Purple	Present	Split	Purple	2.0
26	HPR 2668	Purple	Strong	Present	Purple	Present	Split	Purple	2.0
27	RJ 100	Green	Weak	Present	Purple	Present	Split	Green	1.6
28	Achhoo	Green	Absent	Absent	Colourless	Present	Split	Green	2.4
29	Kalizini	Purple	Medium	Present	Purple	Present	Split	Purple	2
30	HPR 1156	Green	Weak	Present	Purple	Present	Split	Green	1.5

Lenght of ligule: Small: <1cm Medium: 1-2 cm Long: >2 cm

Sr.No	Name of variety	Length of Flag leaf in cm	Width of Flag leaf in cm	Leaf collar	Anthocynin Coller Colour	Date of Flowering
1	Jatto	42	1.8	Present	Absent	17-9-13
2	Deval	30	1.5	Present	Absent	5-9-13
3	Matali	36	1.3	Present	Absent	10-9-13
4	Chhohartu	33	1.5	Present	Absent	13-9-13
5	Sukara	40	1.9	Present	Absent	18-9-13
6	Karad	25	1.3	Present	Absent	16-9-13
7	AC 19164	45	2.3	Present	Absent	18-9-13
8	AC 19180	41	2.1	Present	Present	19-9-13
9	AC 19186(purple based)	40	1.8	Present	Present	18-9-13
10	HPR 2143	38	2.2	Present	Absent	23-9-13
11	AC 19186(green based)	50	2.1	Present	Absent	20-9-13
12	Achoo Red	47	2.4	Present	Present	23-9-13
13	Desi Dhan	40	1.8	Present	Absent	18-9-13
14	Begmi	35	2	Present	Absent	23-9-13
15	Kaluna	40	1.5	Present	Absent	15-9-13
16	Roda Dhan	41	1.4	Present	Absent	14-9-13
17	Bhrigu Dhan	31	1.4	Present	Absent	16-9-13
18	Suara Improved	60	1.5	Present	Absent	24-9-13
19	HPR 2800	32	1.7	Present	Present	20-9-13
20	RP 2421	40	1.4	Present	Absent	11-9-13
21	R 575	49	2.5	Present	Absent	23-9-13
22	Totu	36	1.5	Present	Absent	23-913
23	Lal Nakanda	35	1.7	Present	Absent	23-9-13
24	Lal Zhini	35	1.7	Present	Present	22-9-13
25	Krishan Dhan	45	2.0	Present	Present	23-9-13
26	HPR 2668	46	2.0	Present	Present	24-9-13
27	RJ 100	40	1.6	Present	Absent	23-9-13
28	Achhoo	42	2.4	Present	Absent	20-9-13
29	Kalizini	36	2.0	Present	Present	16-9-13
30	HPR 1156	43	1.5	Present	Absent	20-9-13

Flag leaf length: Short: <20 cm Medium: 20-30 cm Long: >30 cm
Flag leaf width: Narrow: <1 cm Medium: 1-1.5 cm Broad: >1.5 cm

Name of variety	Leaf Anthocyanin Colour	Distribution of Anthocyanin colour in leaf	Culm	Lema Anthocyanin of apex	Lemma Anthocyanin colour below Apex	Anthocyanin colour of keel	Spiklet colour of stigma
Jatto	Absent	Absent	Semi-erect	Absent	Absent	Absent	White
Deval	Absent	Absent	Erect	Absent	Absent	Absent	White
Matali	Absent	Absent	Erect	Present	Present	Present	White
Chhohartu	Absent	Absent	Semi-erect	Present	Present	Absent	White
Sukara	Absent	Absent	Erect	Present	Absent	Absent	White
Karad	Absent	Absent	Semi-erect	Present	Present	Present	Purple
AC 19164	Absent	Absent	Open	Present	Absent	Absent	White
AC 19180	Present	On margins	Semi-erect	Present	Absent	Absent	White
AC 19186(purple based)	Present	On margins	Erect	Present	Absent	Absent	Purple
HPR 2143	Absent	Absent	Erect	Absent	Absent	Absent	White
AC 19186(green based)	Absent	Absent	Erect	Present	Absent	Absent	White
Achoo Red	Absent	Absent	Open	Absent	Absent	Absent	White
Desi Dhan	Absent	Absent	Open	Absent	Absent	Absent	White
Begmi	Present	In blotches	Spread	Present	Absent	Absent	Purple
Kaluna	Absent	Absent	Erect	Absent	Absent	Absent	White
Roda Dhan	Absent	Absent	Erect	Present	Absent	Absent	White
Bhrigu Dhan	Absent	Absent	Erect	Present	Absent	Absent	White
Suara Improved	Absent	Absent	Spread	Absent	Absent	Absent	White
HPR 2800	Present	In blotches	Semi-erect	Present	Present	Present	Purple
RP 2421	Absent	Absent	Erect	Absent	Absent	Absent	White
R 575	Present	Uniform	Open	Present	Absent	Absent	Purple
Totu	Present	In blotches	Open	Absent	Present	Present	White
Lal Nakanda	Present	In blotches	Spread	Absent	Absent	Present	White
Lal Zhini	Present	In blotches	Spread	Present	Present	Present	White
Krishan Dhan	Present	In blotches	Spread	Present	Absent	Absent	White
HPR 2668	Present	In blotches	Open	Present	Absent	Absent	Purple
RJ 100	Absent	Absent	Erect	Absent	Absent	Absent	White
Achhoo	Absent	Absent	Spread	Present	Absent	Absent	Purple
Kalizini	Present	On margins	Spread	Present	Present	Present	Purple
HPR 1156	Absent	Absent	Erect	Absent	Absent	Absent	White

Sr.No	Name of variety	Steam length including Panicle in cm	Panicle length in cm	Number of tillers in cm	Tillers with panicle in cm	
1	Jatto	113	25.7	12	11	
2	Deval	105	25	13	13	
3	Matali	94	18	14	12	
4	Chhohartu	110	21	15	14	
5	Sukara	90	20	10	8	
6	Karad	120	24	14	13	
7	AC 19164	145	26	6	5	
8	AC 19180	130	25	6	6	
9	AC 19186(purple based)	97	25	8	8	
10	HPR 2143	90	26	13	12	
11	AC 19186(green based)	135	23	10	9	
12	Achoo Red	135	26	8	7	
13	Desi Dhan	105	24	10	10	
14	Begmi	97	24.5	7	7	
15	Kaluna	95	19	17	17	
16	Roda Dhan	123	22	11	10	
17	Bhrigu Dhan	95	20	8	7	
18	Suara Improved	127	29	8	6	
19	HPR 2800	77	23	13	13	
20	RP 2421	100	25	7	7	
21	R 575	114	28	6	6	
22	Totu	135	26	6	5	
23	Lal Nakanda	126	25	7	6	
24	Lal Zhini	137	27	6	5	
25	Krishan Dhan	127	25	6	6	
26	HPR 2668	67	28	12	12	
27	RJ 100	97	23	18	17	
28	Achhoo	135	28	7	7	
29	Kalizini	106	23	11	11	
30	HPR 1156	105	25.5	15	15	

Panicle: length of main axis Short: <25cm Medium: 25-30 cm Long: >30cm
Stem length (excluding panicles): Short: <100cm Medium: 100-110 cm Long: >110 cm

d) Characterized farmer varieties with climate resilient trait (s) for registration with PVA

List of traditional rice varieties for PVA registration

(i) UTTAR PRADESH

Farmers' name	Village	District	Name of the variety
Kashinath	Jiviya	Baanki	Mungfalia
Ram Sajjan	Dubripur	Birdpur	Kala Namak
Sita Devi	Jomiya	Naugarh	Bagri
Rudra Prakash	Dubripur	Birdpur	Sarya

(ii) BIHAR

Farmers' name	Village	Block	District	Name of the variety
Aklanand Ram	Baghi	Tajpur	Samastipur	Rajshree
Prajesh Kumar	Baghi	Tajpur	Samastipur	Purnima
Manish Kumar Divakar	Baghi	Tajpur	Samastipur	Sahbhagi
Shankar Ram	Manyari	Sakra	Muzaffarpur	Bakol
Jugeshav Ram	Mehendipur	Sakra	Muzaffarpur	Prabhat
Kamlesh Paswan	Mukundarpur	Jatwarpur	Samastipur	Dudhiya Bakol

(iii) HIMACHAL PRADESH

Farmers' name	Village	Block	District	Name of the variety
Madhu Bala	Panjyal	Pudwa	Kangra	Kala dhan
Bina Devi	Unred	Palampur	Kangra	Chida

(iv) UTTARAKHAND

Name of variety	Name of farmer	Seed Source
Lal Dhan	Hema Negi	Village-Chaani, PO-Chaani, Teh and Dist-Bageshwar
Choti Dhan	Hema Negi	Village-Chaani, PO-Chaani, Teh and Dist-Bageshwar
Lali Safedi	Hema Negi	Village-Chaani, PO-Chaani, Teh and Dist-Bageshwar
Rajmati Sugandhit	Hema Negi	Village-Chaani, PO-Chaani, Teh and Dist-Bageshwar
Nandhani	Gopal Singh	Village- Karalagaon, Block- Bageshwar, Teh & Dist- Bageshwar
Thapchin	Gopal Singh	Village- Karalagaon, Block- Bageshwar, Teh & Dist- Bageshwar
Junmaraya	Umesh Chandra Singh	Village-Saung, Po-Loharkhet, Teh-Kapkot, Bloc- Bageshwar, Dist-Bageshwar
Kalpara	Umesh Chandra Singh	Village-Saung, Po-Loharkhet, Teh-Kapkot, Bloc- Bageshwar, Dist-Bageshwar

List of traditional millet varieties for PVA registration

(i) UTTAR PRADESH

Farmers' name	Village	Block	District	Name of the variety
Chaya Devi	Bhudiya	Jogiya	Shoratgarh	Kodo

(ii) HIMACHAL PRADESH

Farmers' name	Village	Block	District	Name of the variety
Deyi devi	Bantu	Chamba	Chamba	Black Koni (Barnyard millet)

(iii) BIHAR

Farmers' name	Village	Block	District	Name of the variety
Jagh Mohan Rai	Sundarpur	Darbhanga	Darbhanga	Mandua (Finger millet)

(iv) UTTARAKHAND

Farmers' name	Village	Block	District	Name of the variety
Bhavan Singh	Chapad	Ramgarh	Nainital	Black Mandua
Prema Negi	Chapad	Ramgarh	Nainital	Chitrwa Mandua
Hema Negi	Chapad	Ramgarh	Nainital	Lal Muthiya Mandua
Padma Negi	Chapad	Ramgarh	Nainital	Lal Chirag Mandua
Sundari Mehta	Kabda	Bagheshwar	Bagheshwar	Mandua Gharwali
Dev Singh Bisht	Bunga Khyali	Champawat	Champawat	Nangchuiya Mandua
Kunwar Singh Karki	Devli	Lamgadak	Almore	Lambali Mandua
Nandan Singh Bora	Paitna	Okhalkanda	Nainital	Jhapri Mandua
Hyat Singh Rautela	Karala	Bhageshwar	Bhageshwar	Red Madira (Barnyard Millet)
Bhagwati Kandpal	Oklisirod	Bhageshwar	Bhageshwar	Koni (Foxtail millet)

e) Documented information on the identified accessions

Traditional Rice Varieties Best Adapted to Local Conditions and Changing Climate are attached with the report. For the rice list see **Annexure 5**

OUTCOME 2: AGRICULTURAL SYSTEMS IN THE HIMALAYAN & INDO-GANGETIC PLAINS REGION OF INDIA ARE MORE RESILIENT TO CLIMATE CHANGE

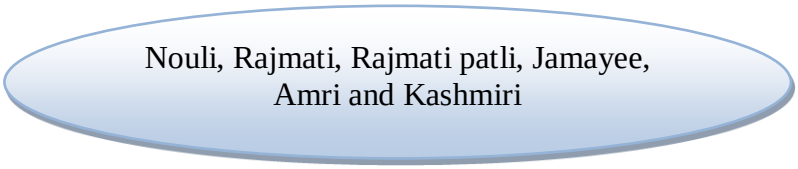
Activities carried out:

a) **Undertook on-farm trials to identify varieties/landraces suitable for climatic variations**

Varieties selected for adaptation to climate variation

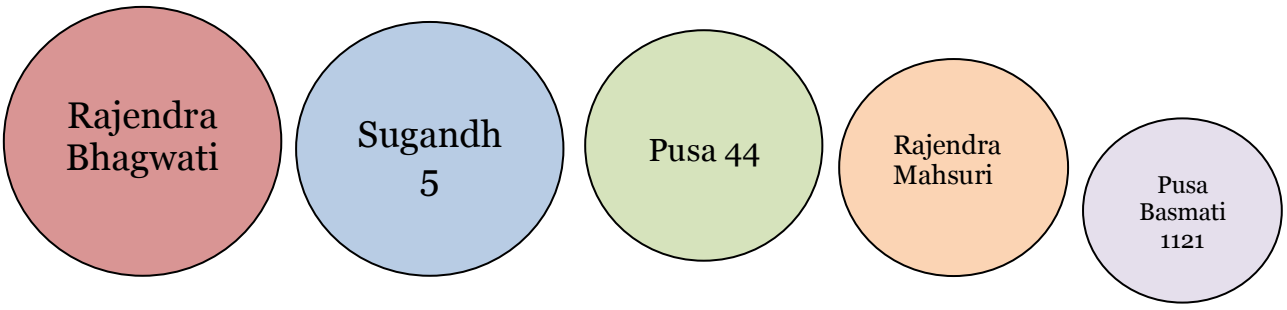
UTTARAKHAND

The six varieties selected by farmers as the best adapted to climate variations are:



BIHAR

Based on inputs from crowdourcing and participatory varietal selection with farmers, the five varieties selected as the most suited for cultivation under local conditions were Rajendra Bhagwati, Sugandh 5, Pusa 44, Rajendra Mahsuri and Pusa Basmati, in that order. The criteria that farmers chose for selection were tillering capacity, maturity, grain quality (aroma/ taste), resistance to pests and diseases and grain yield.



UTTAR PRADESH

The six varieties preferred by farmers as best suited to climate variation were

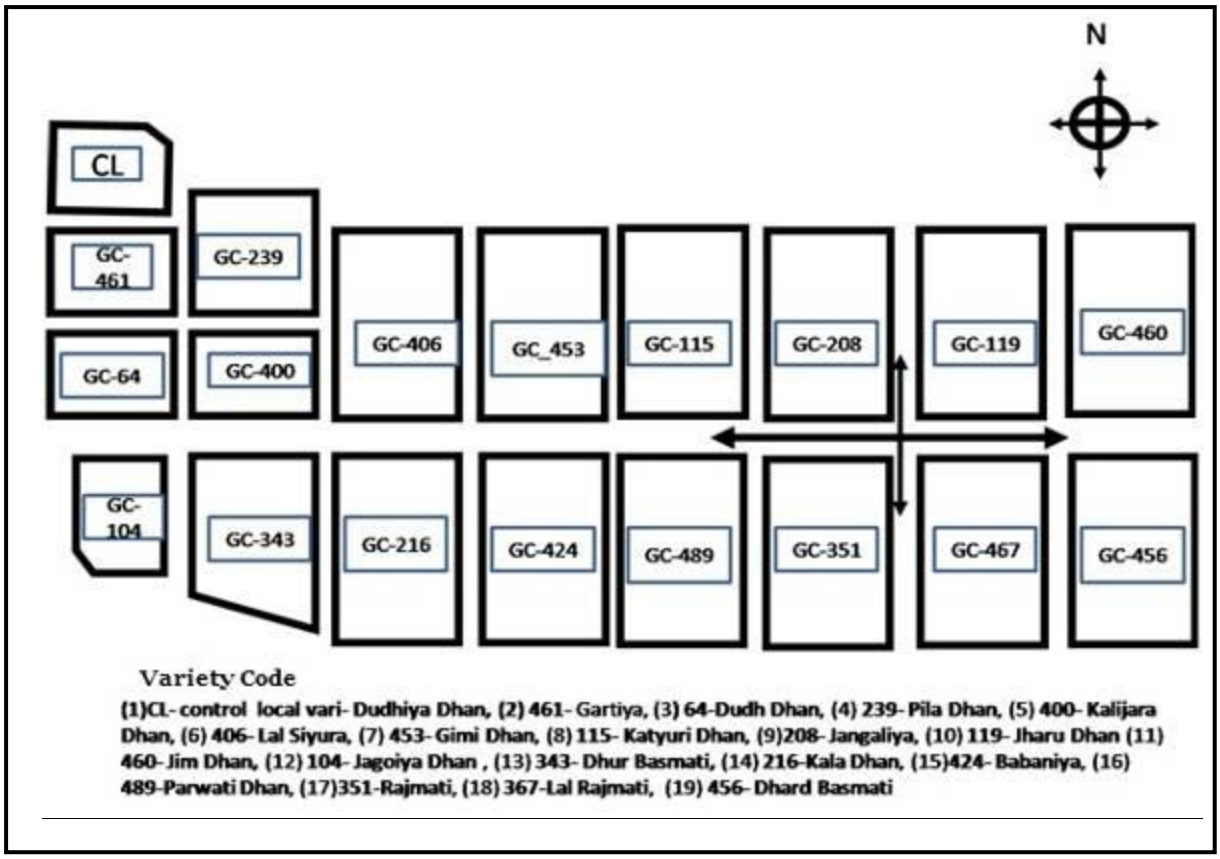
- 3 long duration varieties Rajendra Mansoori Pusa 44 and Pusa 1176
- 3 short duration varieties HKR 47, PNR 381 and Rajendra Bhagwati.

b) Initiated participatory variety selection programmes based on farmers' preferences

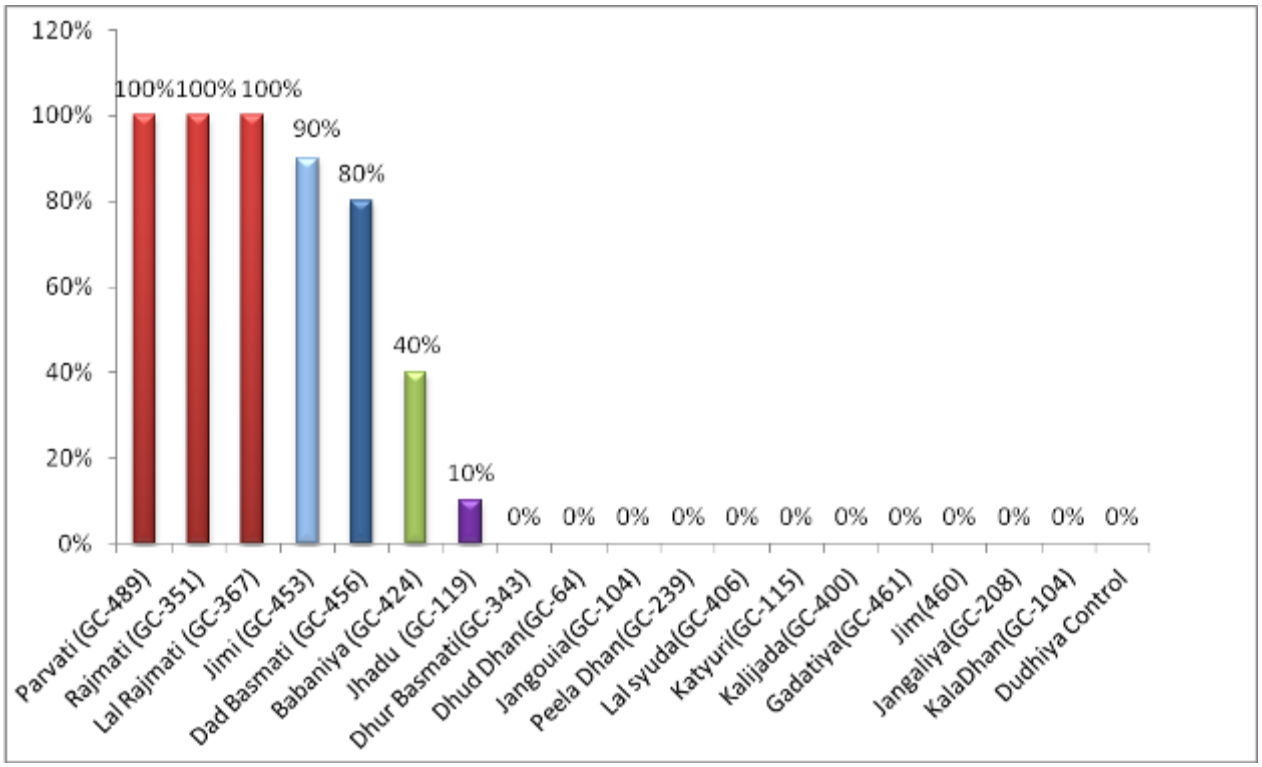
PARTICIPATORY VARIETAL TRIALS WITH RICE

UTTARAKHAND

Trial Layout for Participatory Varietal Selection with Rice



Traditional rice varieties were collected from several locations in the Kumaon, Uttarakhand. Twenty varieties cultivated under rainfed conditions from Bagheshwar, Champawat, Okhalkanda, Almora and Nainital were laid out in trials for participatory varietal selection.



Farmer preferred varieties

Of the 20 varieties tested in participation mode with farmers, they selected six varieties as well-adapted to the current conditions. 'Parvati', 'Rajmati' and 'Lal rajmati' were selected as the best suited by all farmers. 90% of the farmers selected 'Jimi', 80% selected 'Dad Basmati' and 40% farmers thought 'Babaniya' would perform reasonably well.

Reasons for selecting the varieties:

- **Parvati** was selected since it is used in religious rituals and festivals. It has short bold grains and is mildly aromatic.
- **Rajmati** is disease-resistant, has a decent yield and has long, slender grains.
- **Lal Rajmati** is a good yielder and being tall, it provides adequate straw for fodder.
- **Jimi** has a very good yield, is easy to thresh, straw is medium and plants are resistant to diseases.
- **Dad Basmati** was liked for its good yield even though the grains are small.
- **Babaniya** is a long-duration variety with aromatic grains. If the rains are good, the yield can be quite high and the plant grows tall, providing a good amount of straw

NOTE

The PVS program was greatly appreciated by farmers. They said they have participated in training programs offered by the government agencies and NGOs but have never participated in such a useful and relevant program.

"The opportunity to see several varieties from different places in cultivation at one place and being asked to select what we like was very empowering. We got the chance to choose according to our needs. Now we want seeds of the varieties we have selected. This kind of exercise should be done regularly."

PVS Trials of Paddy in Uttarakhand

PARTICIPATORY VARIETAL TRIALS WITH RICE
UTTAR PRADESH

Five early maturing, three medium maturing and six late maturing rice varieties were put in trial in six villages. The varieties were evaluated using standard descriptions and farmer preferences were noted. Both qualitative and quantitative assessment of paddy was conducted using descriptor such **as Number of tillers, Seed weight, Length of Flag leaf, Plant height, Maturity period, Size of panicle, seed shape, Aroma, Incidence of diseases etc.** 14 different varieties were distributed to 28 farmers for participatory varietal selection and scientific evaluation.

Seven most preferred varieties

Variety	Type
Rajendra Mansoori	Long Duration
Pusa 44	Long Duration
Pusa1176	Long Duration
Sungandha 5	Medium Duration
HKR47	Short Duration
PNR 381	Short Duration
Rajendra Bhagwati	Short Duration

Most of the farmers preferred either short or long duration varieties but not medium duration. Out of 14 varieties farmers selected only 7 varieties for future use. Rajendra Mansoori was most preferred variety because of highest yield and long grain.
On aroma, none of the 14 varieties, including the famed aromatic rice Pusa Basmati was assessed favourably compared to Kalanamak

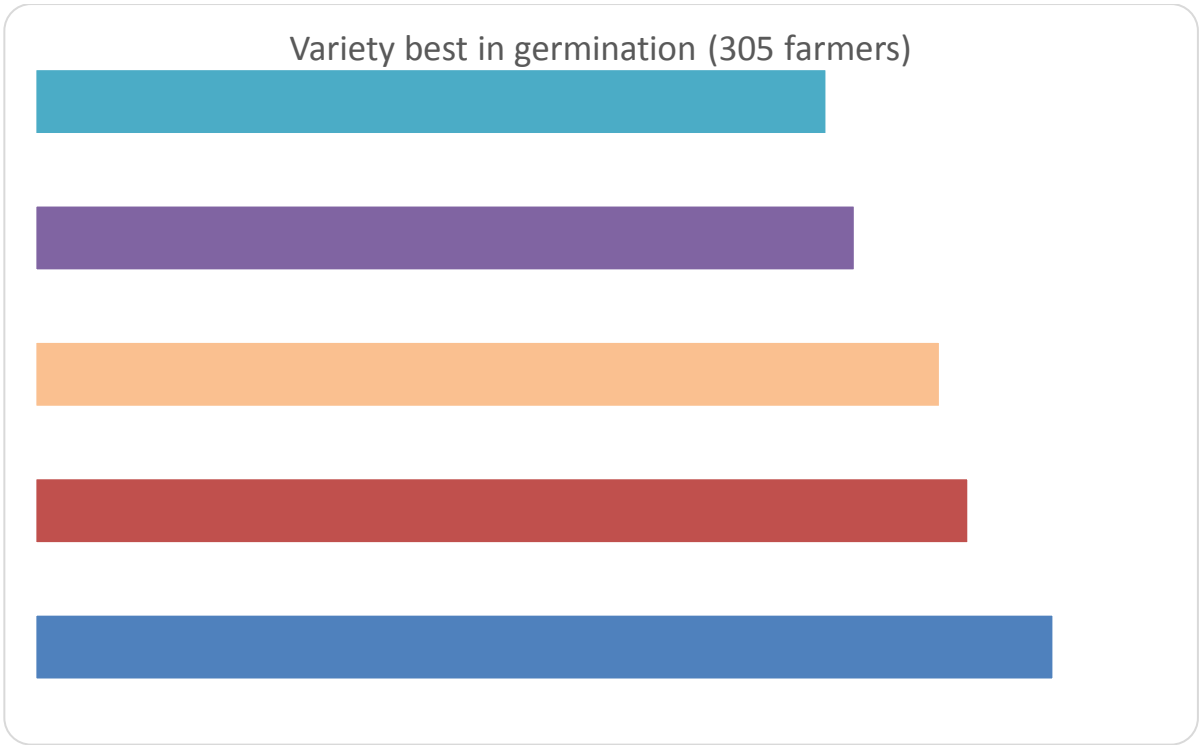
Farmers participating in PVS Trials at Uttar Pradesh

CROWDSOURCING TRIALS
UTTAR PRADESH

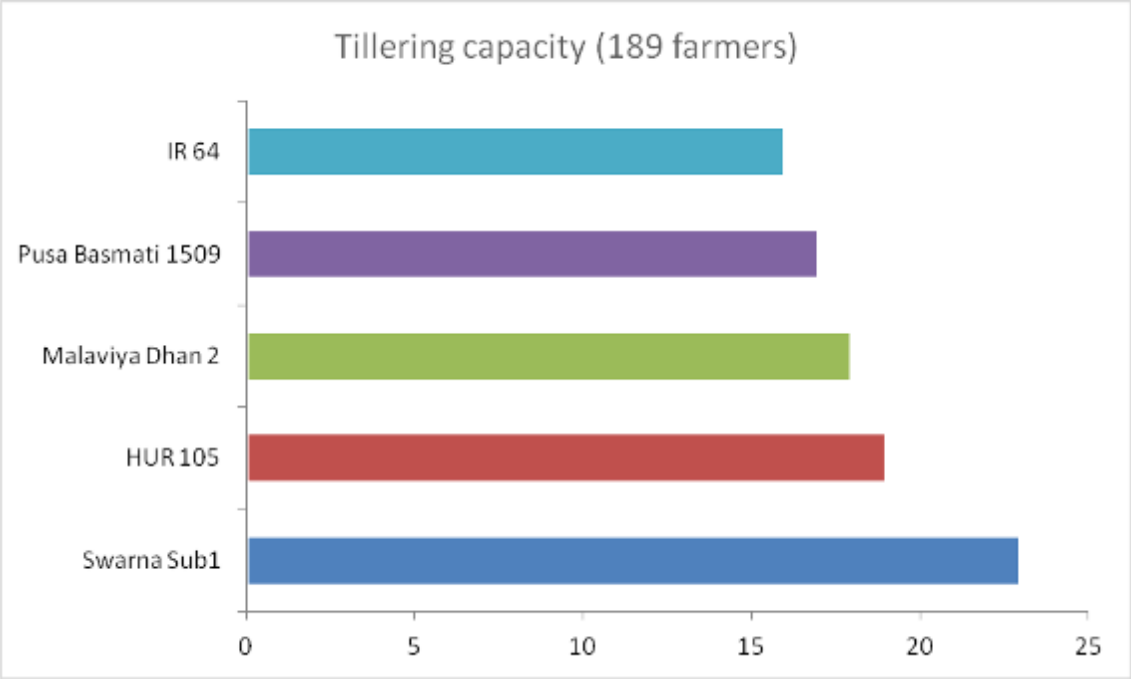
Trials in Badaun

IN Badaun, we had 12 rice varieties (HUR 105, IR 36, IR 64, Malaviya Dhan 2, NDR 359, Pusa 44, Pusa Basmati 1509, Pusa Sugandh 4, Pusa Sugandh 5, Sarju 52 and Swarna Sub1) distributed among 500 farmers in sets of 3 varieties each of 400g. There were questionnaires asked on certain traits like

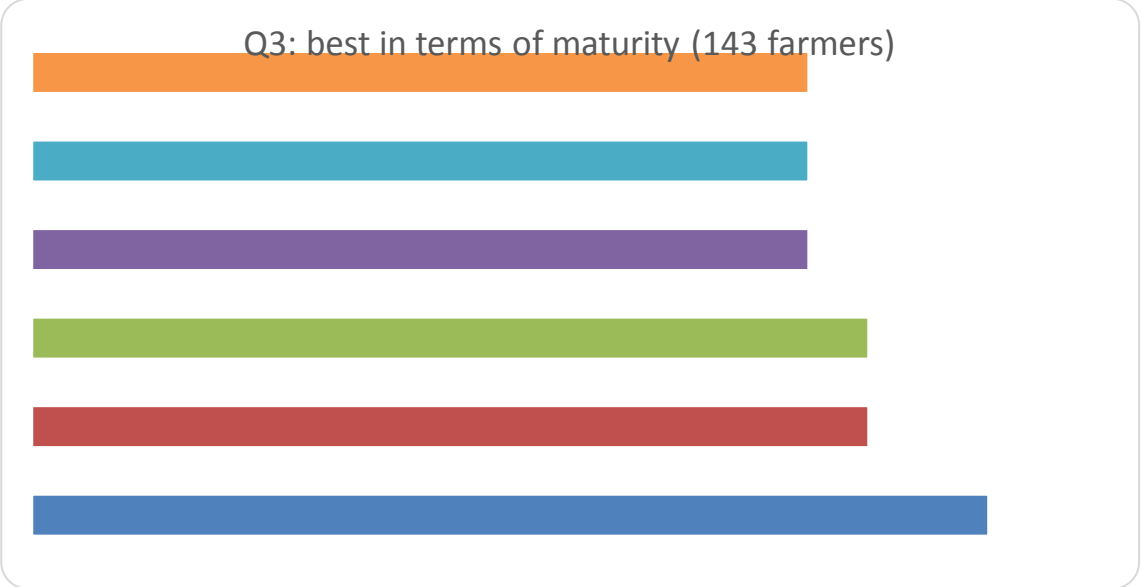
1. Which variety had the best germination and emergence?
2. Which variety had the maximum tillering capacity?
3. Which variety was best in terms of maturity?
4. Which variety had the best seed quality (color, aroma, taste)?
5. Which variety was most resistant to pests and diseases?
6. Which variety had the maximum grain yield?
7. Which variety will you rank overall best plant quality?
8. Which variety you would like to plant again in the next season?



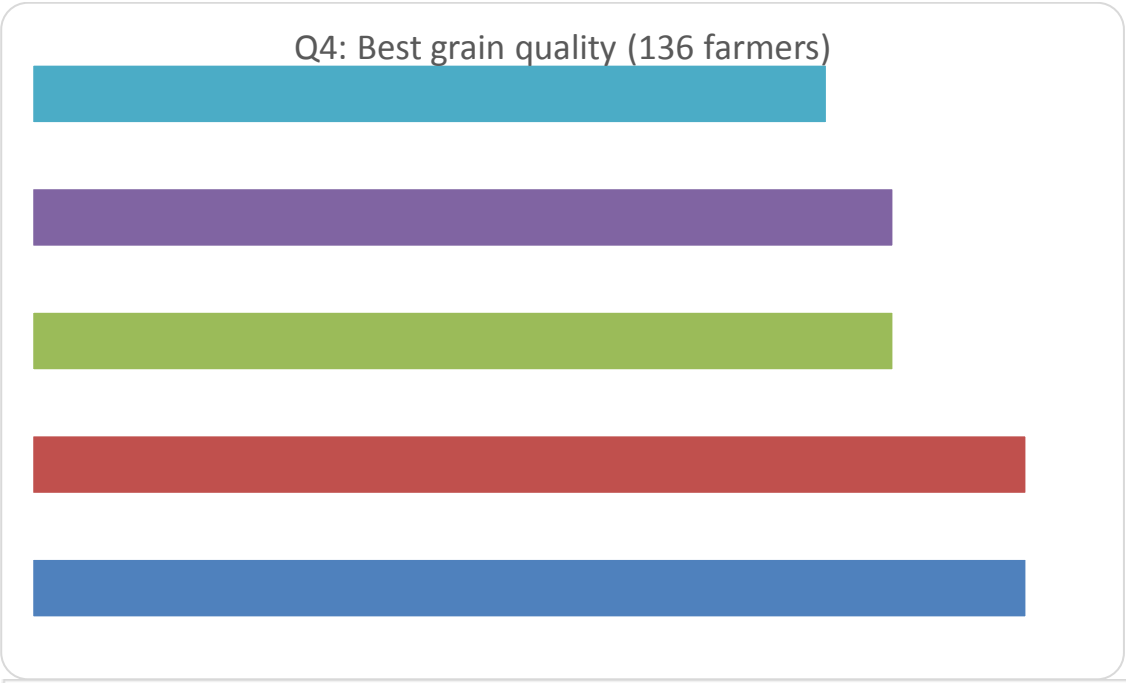
The top 5 varieties in terms of germination and initial vigour were , Pusa Basmati 1509, IR 64, Pusa Sugandh 5HUR 105 and IR 36.

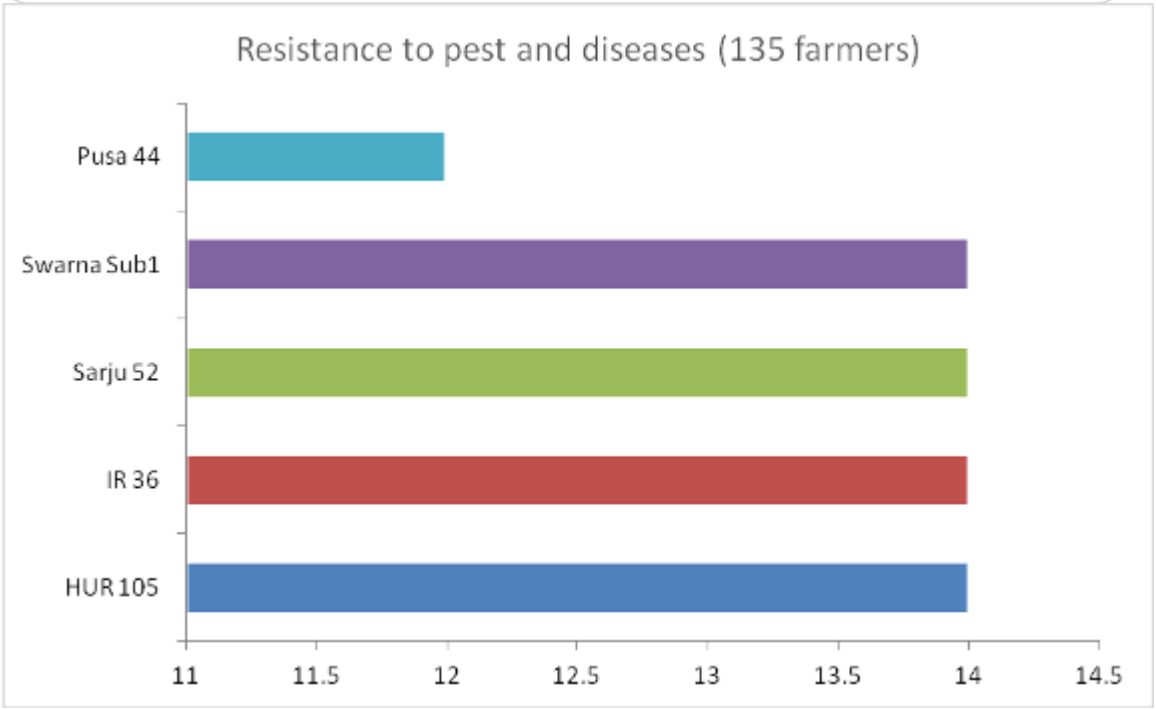


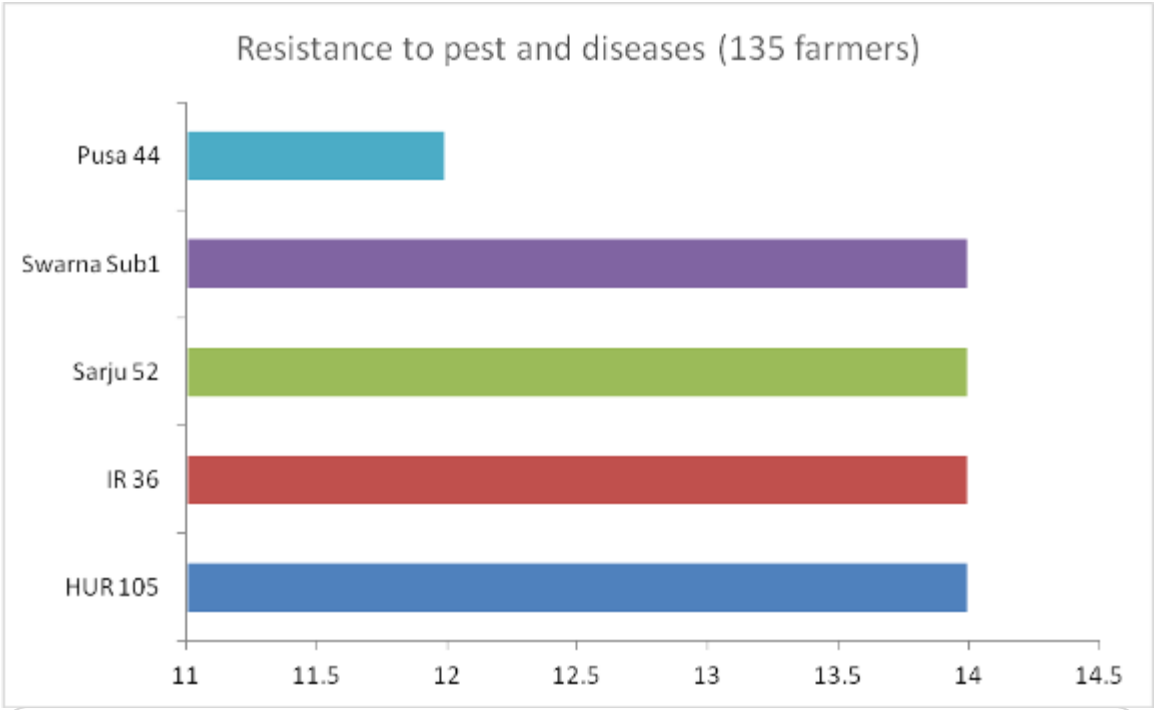
In terms of tillering capacity the top 5 varieties were Swarna Sub1, HUR 105, Malaviya Dhan 2, Pusa Basmati 1509 and IR 64.

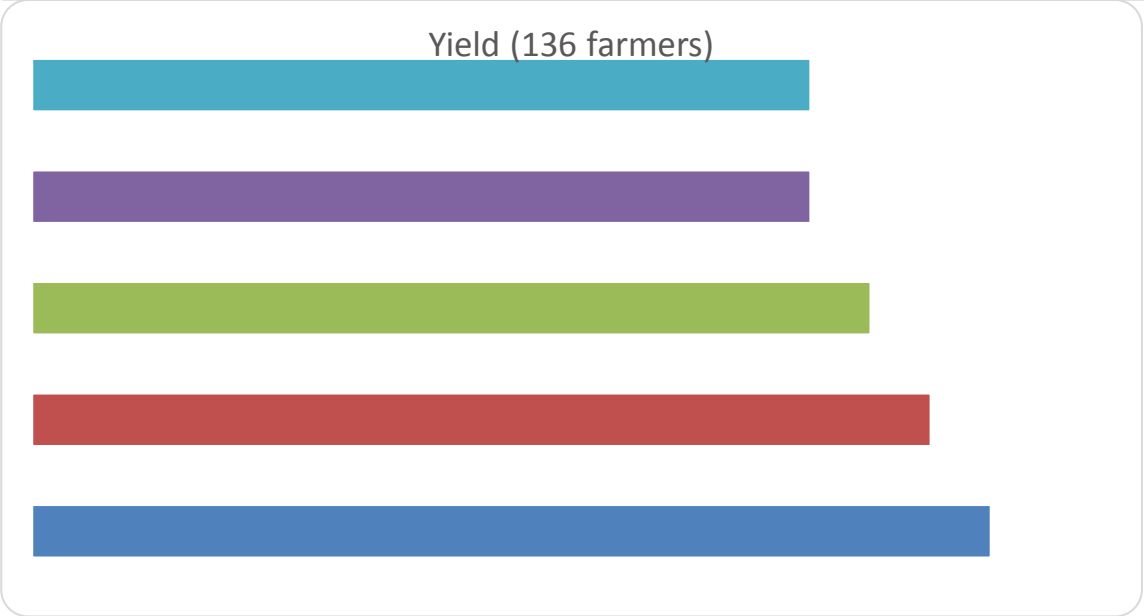


In terms of maturity the top 6 varieties as ranked by the farmers were HUR 105, BPT 5204, Pusa Sugandh 5, IR 36, NDR 97 and Swarna Sub1.

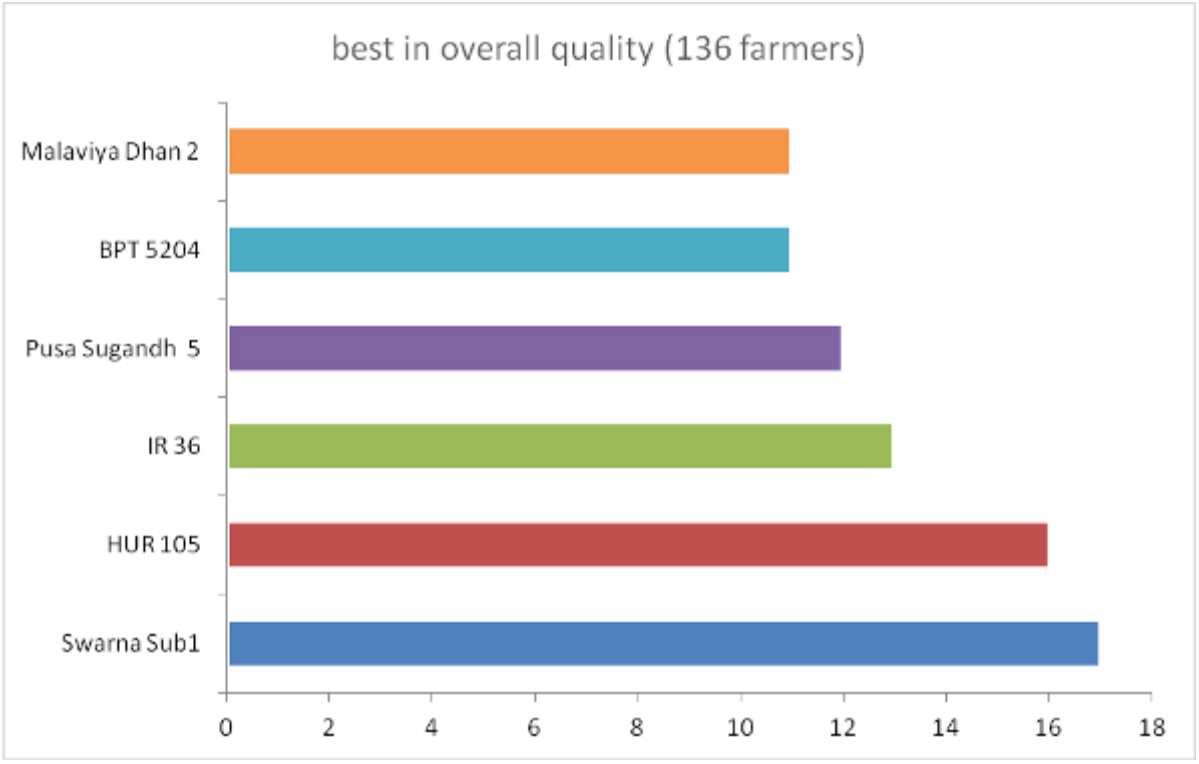

Q4: Best grain quality (136 farmers)

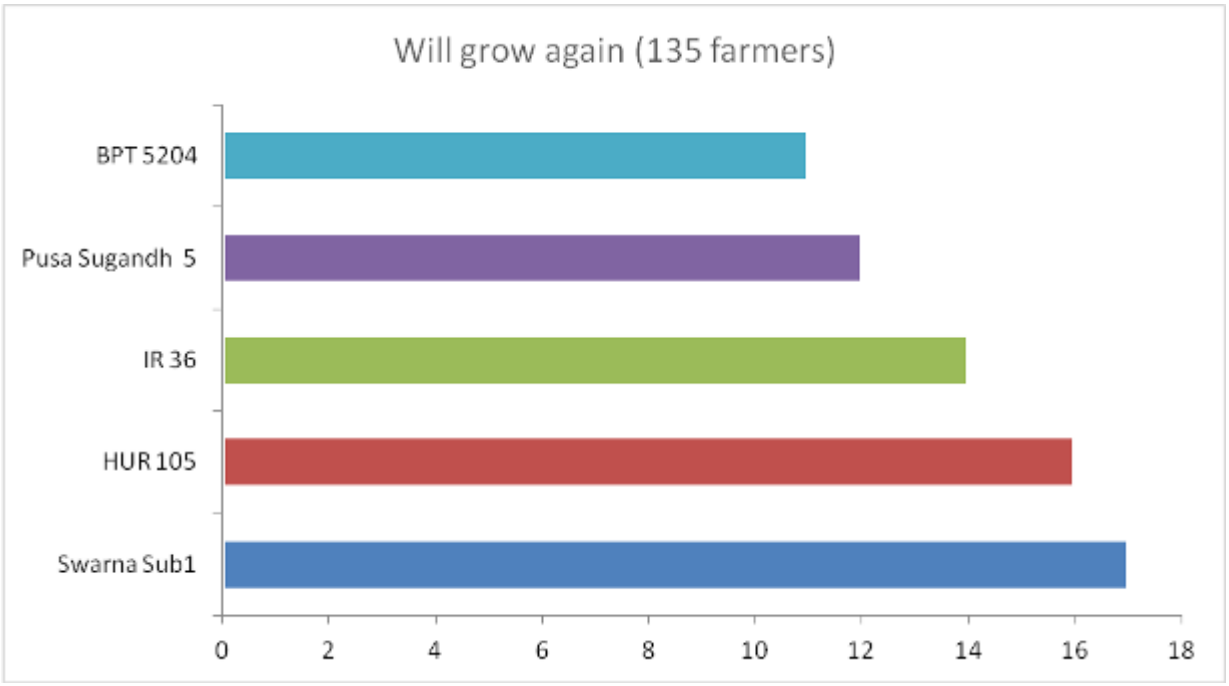

Resistance to pest and diseases (135 farmers)
Pusa 44
Swarna Sub1
Sarju 52
IR 36
HUR 105
11
11.5
12
12.5
13
13.5
14
14.5





As per the yield was concerned the farmers liked the following 5 varieties the most out of the 12 varieties viz Swarna Sub1, HUR 105, IR 36, Pusa 44 and Pusa Sugandh 5


best in overall quality (136 farmers)
Malaviya Dhan 2
BPT 5204
Pusa Sugandh 5
IR 36
HUR 105
Swarna Sub1
0
2
4
6
8
10
12
14
16
18

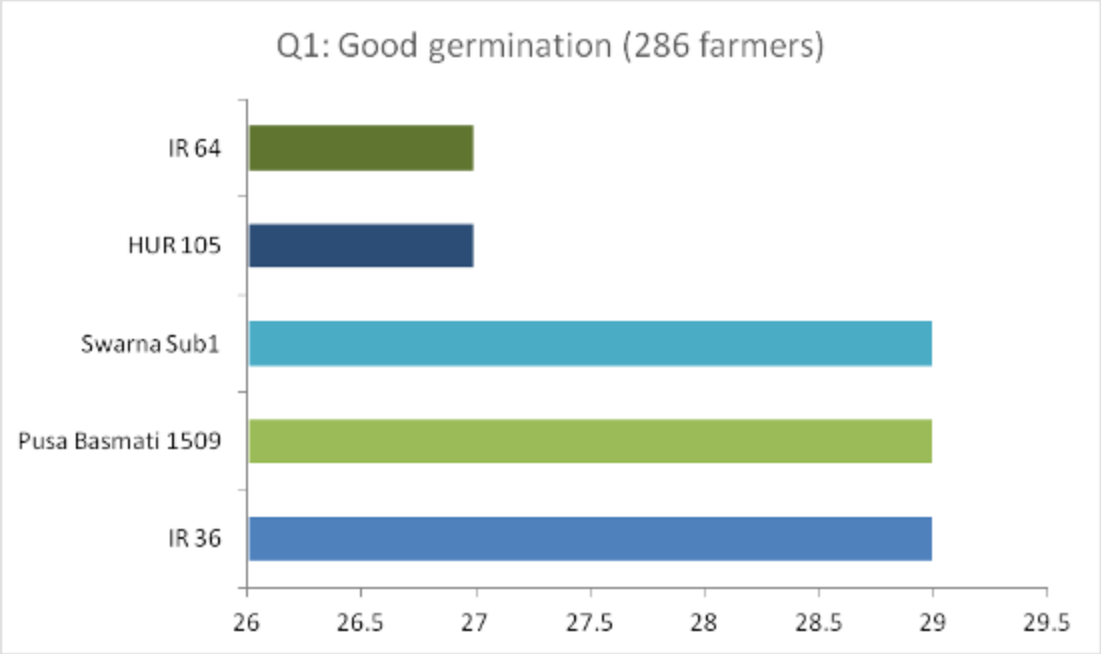

Will grow again (135 farmers)
BPT 5204
Pusa Sugandh 5
IR 36
HUR 105
Swarna Sub1
0
2
4
6
8
10
12
14
16
18

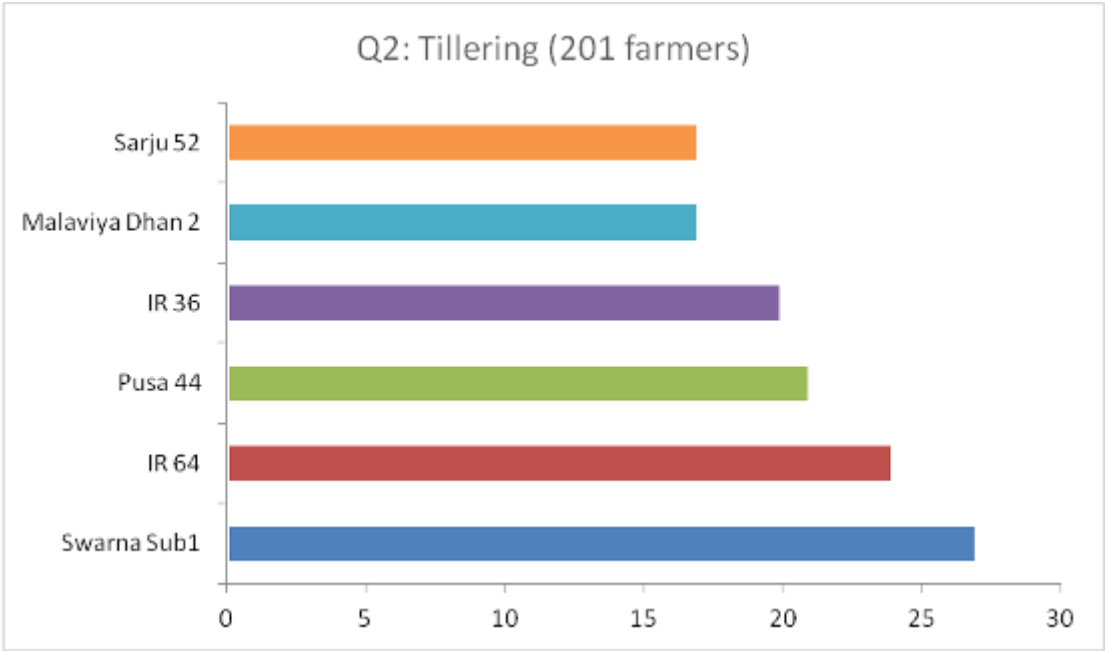
Trials in Unnao

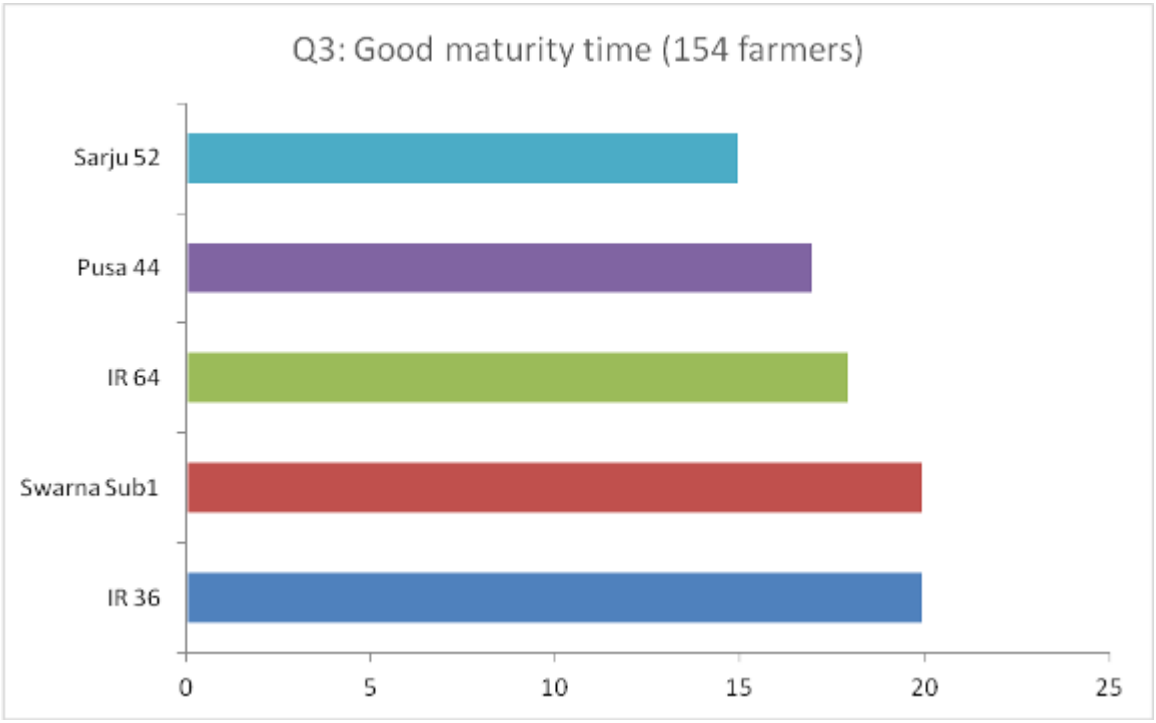
In Unnao, we had 12 rice varieties distributed among 500 farmers in sets of 3 varieties each of 400g. There were questionnaires asked on certain traits like

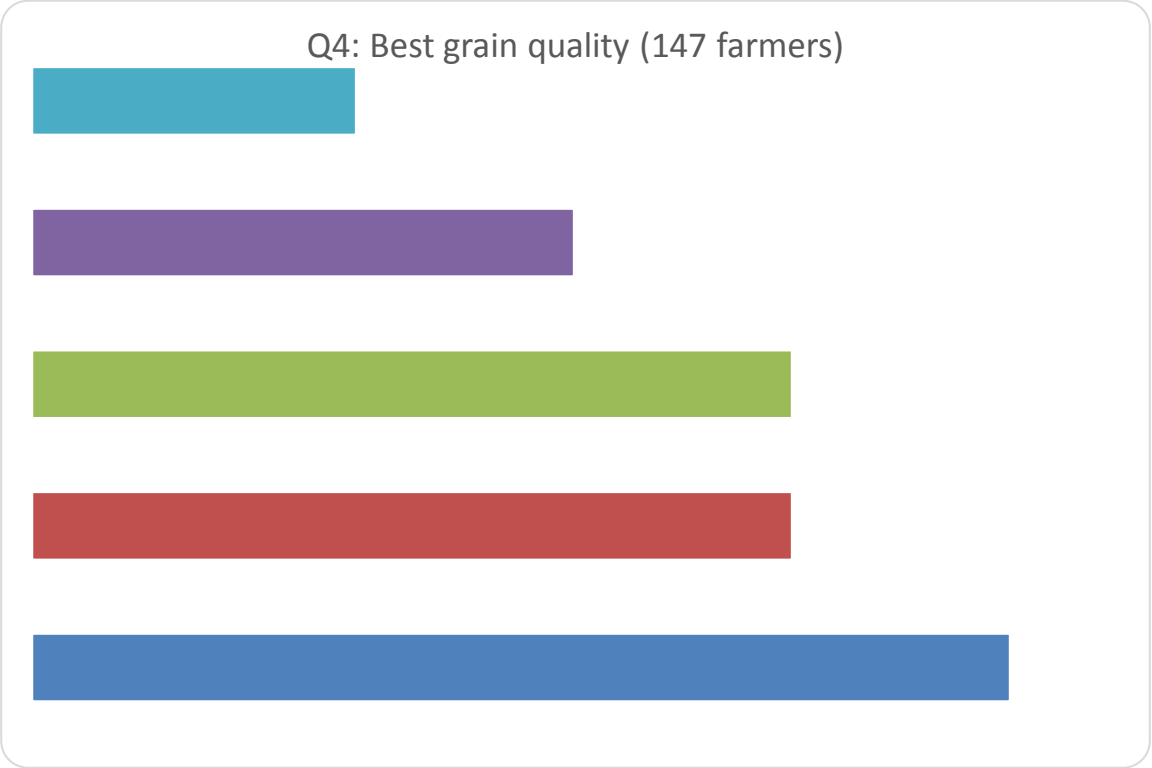
1. Which variety had the best germination and emergence?
2. Which variety had the maximum tillering capacity?
3. Which variety was best in terms of maturity?
4. Which variety had the best seed quality (color, aroma, taste)?
5. Which variety was most resistant to pests and diseases?
6. Which variety had the maximum grain yield?
7. Which variety will you rank overall best plant quality?
8. Which variety you would like to plant again in the next season?

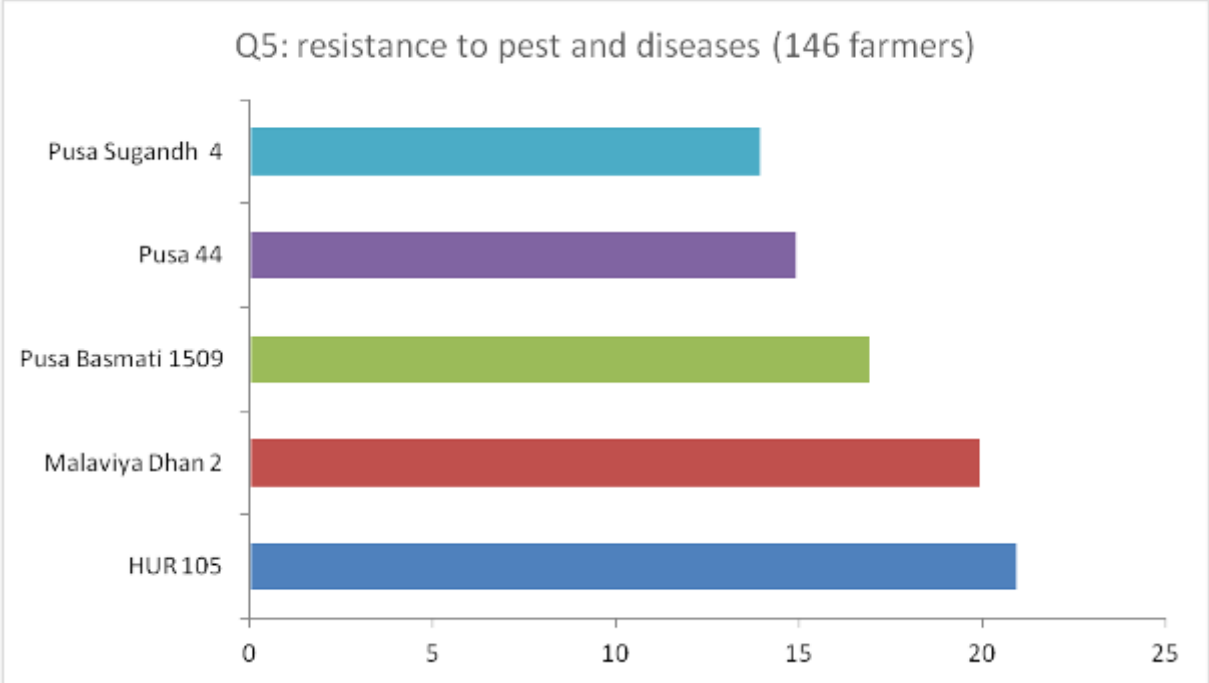
The varieties were HUR 105, IR 36, IR 64, Malaviya Dhan 2, NDR 359, Pusa 44, Pusa Basmati 1509, Pusa Sugandh 4, Pusa Sugandh 5, Sarju 52 and Swarna Sub1



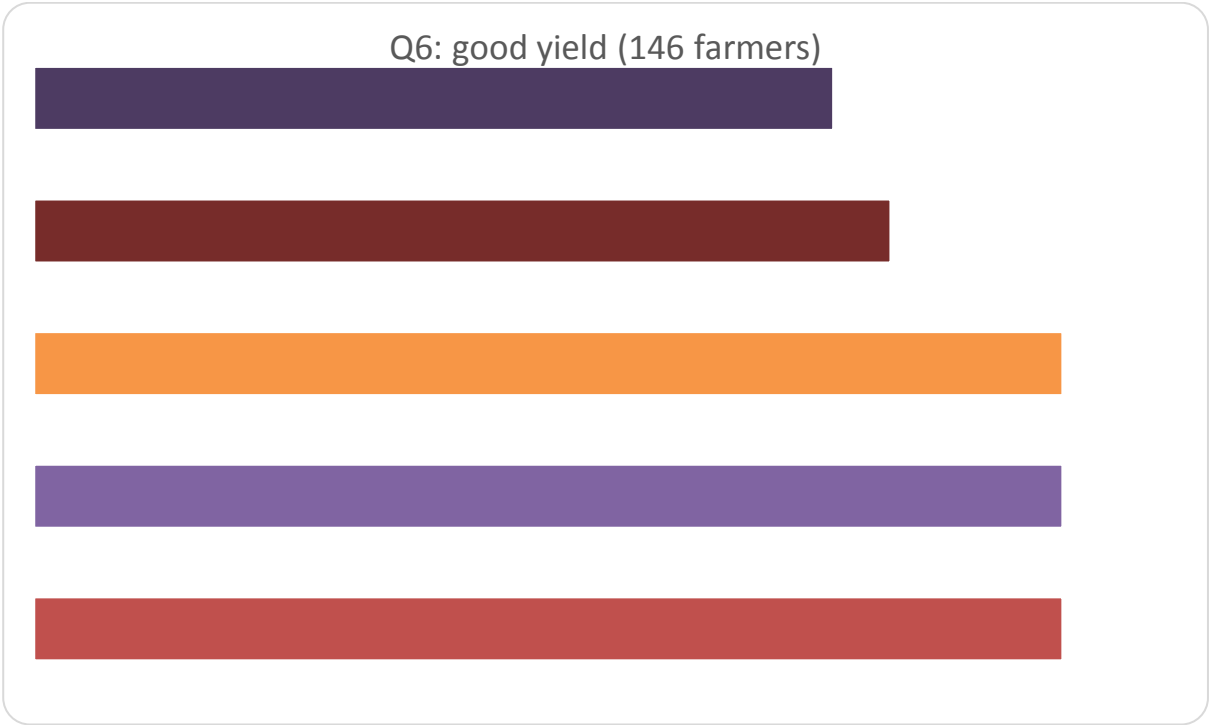

Q2: Tillering (201 farmers)
Sarju 52
Malaviya Dhan 2
IR 36
Pusa 44
IR 64
Swarna Sub1
0
5
10
15
20
25
30

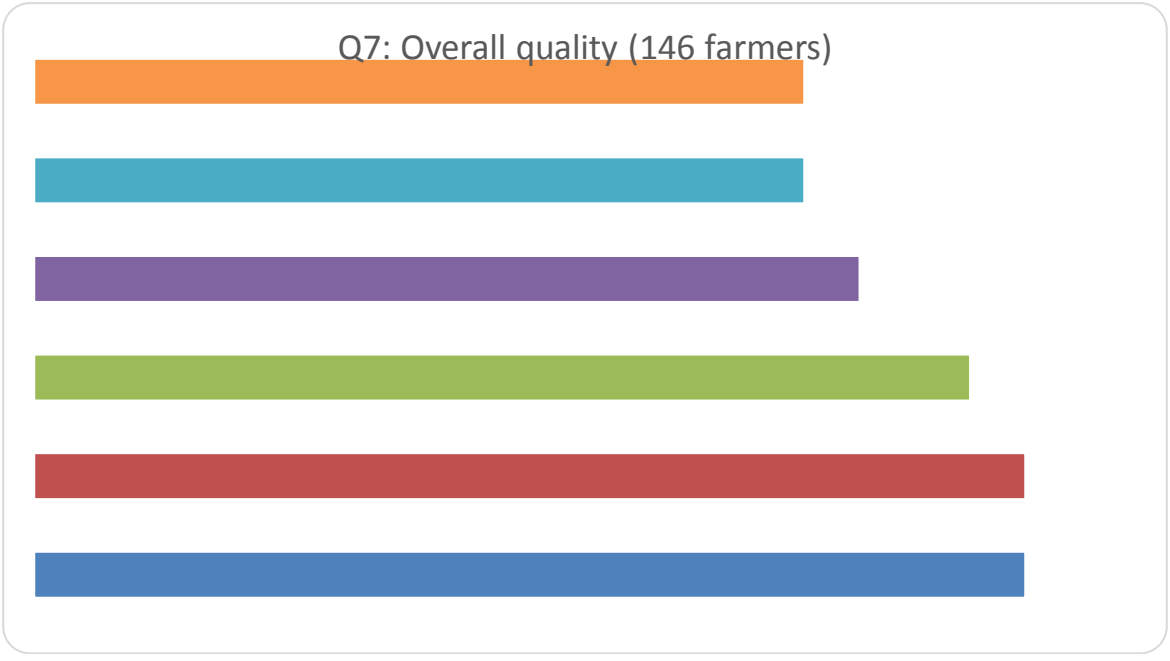

Q3: Good maturity time (154 farmers)
Sarju 52
Pusa 44
IR 64
Swarna Sub1
IR 36
0
5
10
15
20
25

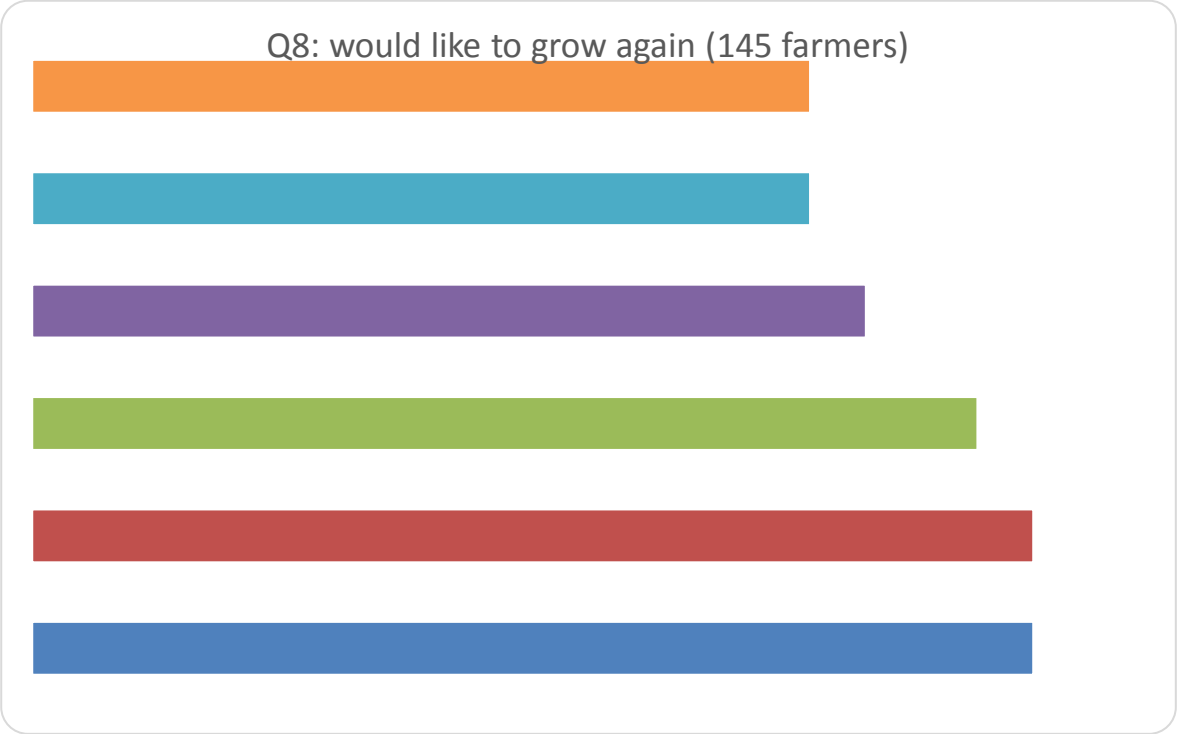




Just like in Badaun, HUR 105 was liked by the farmers as the best resistance to pests and diseases.


Q6: good yield (146 farmers)


Q7: Overall quality (146 farmers)


Q8: would like to grow again (145 farmers)

Crowdsourcing and Participatory Varietal Trials (PVS)
BIHAR

Crowdsourcing is a novel concept where farmers are the decision makers for the trials. For ages, seed houses have been bringing in new high yielding varieties and farmers have mostly little choice to choose for their farming. This scenario is now reversed as they will be given small amounts of seeds of many varieties that they have to grow in small plots so as to analyze the performance under a given set of climatic conditions. The climatic data are recorded by deploying advanced sensor-based data logging hardware's (eg: iButtons^{TM}). The PVS (Participatory Varietal Selection Trials) are more technical and scientific in nature where there are 20-30 varieties trialed at different villages in a region. All these data are analyzed and feedback was taken for the farmers and they were asked which are the varieties they found promising and were outperforming their original cultivated varieties.

In this project period we had two sets of trials in the Districts of Vaishali and Muzaffarpur in Bihar. The first set had 8 varieties trialled among 125 farmers across 2 villages in Vaishali and 8 villages in Muzaffarpur. The varieties were:

Akshaydhan
IR 36
MTU 1001
MTU 1010
Samba Masuri
Sampada
Sugandh Samba
Varadhan

In the second set, we had 11 varieties trialled among 200 farmers across 5 villages in Muzaffarpur district in Bihar. The varieties were:

HKR 47
IR 64
PNR 381
PR 113
Prabhat
Pusa 1176
Pusa 44
Pusa Basmati 1121
Rajendra Bhagwati
Rajendra Suwasini
Sugandh 5

In the crowdsourcing trials, there were 9 questions that the farmers were asked to answer about the 3 varieties that they have grown in their farm. The questions were

1. Which variety had the best germination and emergence?
2. Which variety had the best initial vigour?
3. Which variety had the maximum tillering capacity?
4. Which variety was best in terms of maturity?
5. Which variety had the best seed quality (color, aroma, taste)?
6. Which variety was most resistant to pests and diseases?
7. Which variety had the maximum grain yield?
8. Which variety will you rank overall best plant quality?
9. Which variety you would like to plant again in the next season?

So based on these, the following is the result of the trials depicted as graphs. The values are number of farmers considered that particular variety as the best.

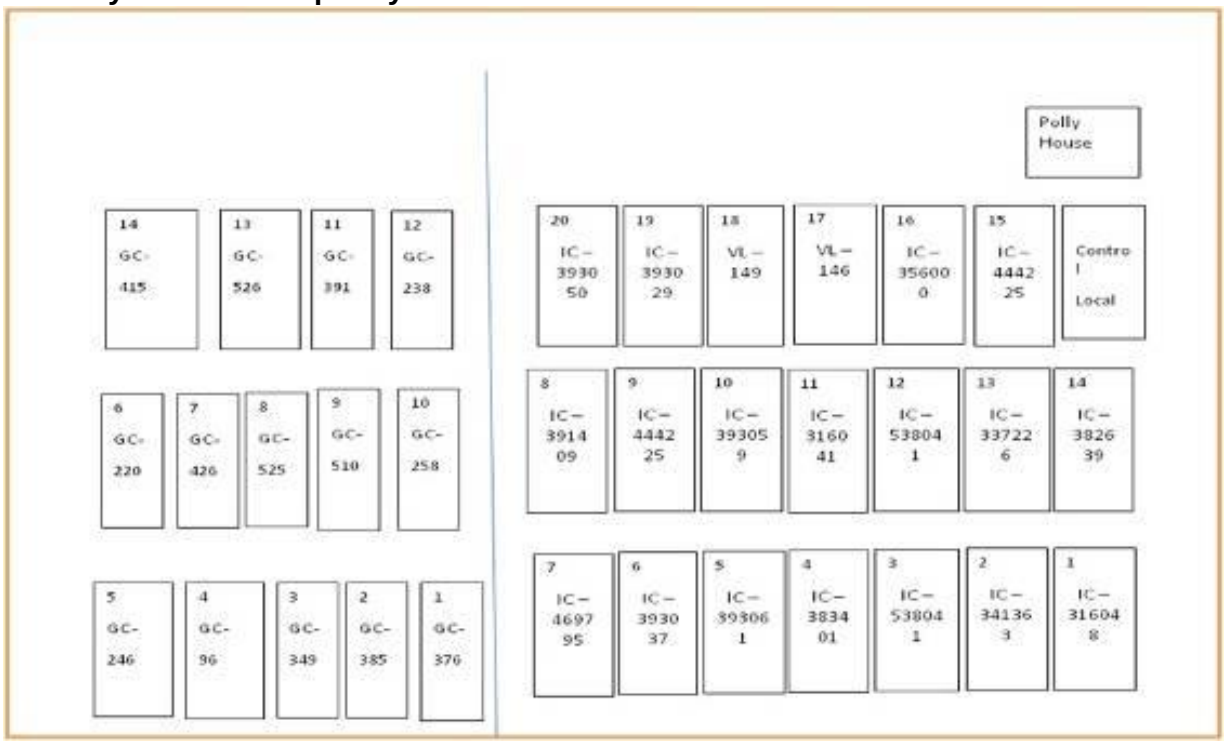
See Annexure 6 for full report on crowdsourcing trials of Bihar.

Participatory Varietal Selection of Finger Millet
UTTARAKHAND

Fourteen varieties of finger millet were collected from 3 districts and 2 improved varieties developed by Vivekananda Parvatiya Krishi Anusandhan Sansthan (VPKAS), Almora were cultivated in 2 locations.

Participatory varietal selection (PVS) was conducted with 30 farmers from 6 villages in location 1 (Okhalkanda) and 35 farmers from 6 villages in location 2 (Dhari). Name of the improved varieties were selected by the farmers. They found four varieties of finger millet most suited for their requirements under current cultivation conditions.

Trial Layout for Participatory Varietal Selection with Millets



Of the 14 varieties tested in participation mode with farmers, they selected four varieties as well-adapted to the current conditions. ‘Muthiya’, ‘Jhaparua’, ‘Dotiyali’ and ‘Jhapri’ were selected as the best suited by all farmers because of the following reasons:

Varieties selected by farmers	
Muthiya	Pleasant sweet taste, cooks easily. Grains are bold. The straw is also sweet and animals like it.
Jhaparua	High yielding but the straw is hard and the grains have an ordinary taste.
Dotiyali	Good yield, straw is soft and sweet, easy to thresh.
Jhapri	Long panicles, easy to thresh, tall plants so more straw for fodder.

PVS trials with Millets in Uttarakhand




c) Developed user-friendly communication tools for researchers and farmers

Kisan Call Centres

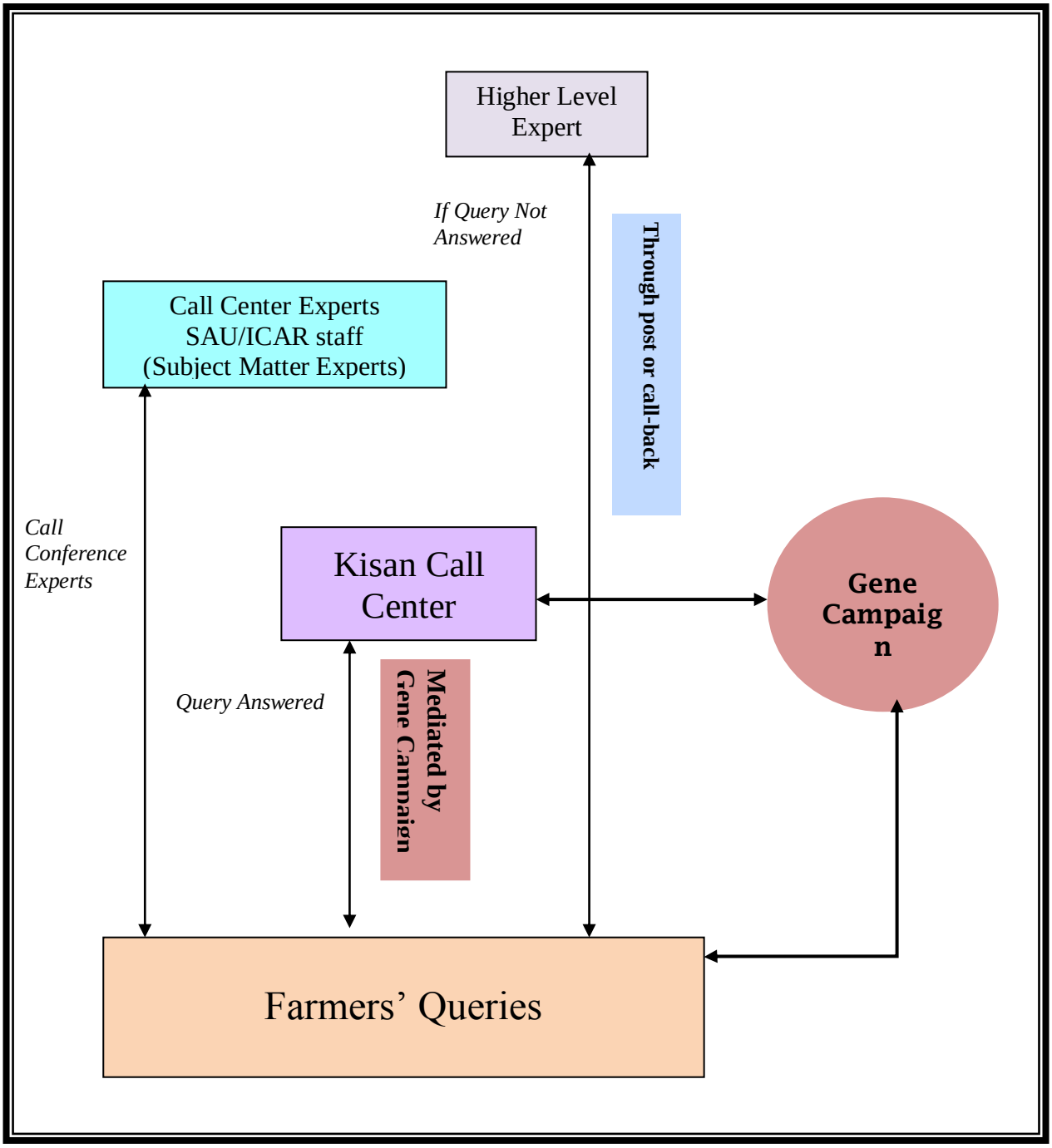
In order to overcome the information asymmetry between farmers and between villages and regions, training was provided to use communication tools based on information communication technology. Gene Campaign has connected farmers in the study areas to the Kisan Call Centre service (Farmer Support Service) and provided training in the use of this service. The Kisan Call Centre service provides farmers a quick to their problems and queries by subject matter specialists. Due to the penetration of mobile phones and the impressive telecom network, it is possible to use communication technology effectively in rural areas.

The Department of Agriculture and Cooperation has been working on schemes to use both Mass-Media and telecom network for the delivery of extension services. Linking farmers to this network and teaching them to use the service has provided a useful and effective means to access and exchange relevant information related to agriculture, climate and weather, pests and diseases, etc. This communication tool helps to keep a record of what is being delivered to the farmers in terms of knowledge and information.The objective of the scheme has been to make agriculture knowledge available at free of cost to the farmers as and when desired.

This scheme has an in-built system of monitoring and continuous evaluation for modifications and improvements. The services are presently of a foundational nature but it is expected that more exciting tiers will be built on this infrastructure. The Kisan Call Centre scheme is available throughout the country. At present the Call Centre services are available at a common toll free telephone number which can be dialled from anywhere in the country. The location is immaterial as the calls can originate from any village to land at a specific call centre and a specific seat which would be answered by an agriculture graduate knowing the local language and having an understanding of the local agricultural issues.

Kisan Call Centre (KCC) provides guidance to farmers in local dialects on all aspects of agriculture and allied subjects. KCC Services are accessible through all telephone networks from 6 A.M. To 10 P.M. on all seven days of the week. The calls are received at 13 Call Centres wherein 116 Agriculture Graduates attend to answer the query of the farmer in the local language. 123 experts located in different parts of the country at State Agriculture Universities, ICAR institutes, State Department of Agriculture, Horticulture and other developments are answering the calls at Level –II.

Farmers', project staff, local organizations and NGOs have been trained in knowledge management using the Knowledge Management System, a software tool which has been developed by the Telecommunications Consultants India Ltd. (TCIL) a Government of India enterprise. The Kisan Call Centre have been linked to this trough identified telephone numbers and will provide all technical assistance to the caller and will record the queries along with the personal details.



Knowledge Management System

The Knowledge Management System is supported by the data base built up using the responses to farmers' questions. The Kisan Call Centre report generation software provides the user interface forms in which the call Centre Agent has to put the parameters according to which he wants the report to be generated. The report generated is based on data which includes date, location (district, state), crop, problem faced, extent of problem, type of caller, etc. All India data is being compiled and will be available on the internet after hosting.

CiImMob

ClimMob is a software programme developed by the CGIAR system for *crowdsourcing climate-smart agriculture*. Crowdsourcing makes it possible to engage many people at a low cost and realize large amounts of work in a short time. Crowdsourcing climate-smart agriculture implies that farmers contribute observations in order to produce information about technological options under different field conditions. These observations are then combined and patterns extracted, providing new insights about the suitability of the evaluated options.

Training was provided to farmers, researchers, GC staff and project staff as well as selected NGOs on using ClimMob to communicate their preferences of crop varieties under their specific agro climatic conditions. Full use of ClimMob enables farmers to communicate their preferences to researchers and researchers to communicate with other researchers.

The manual (Attached as **Annexure 7**) explains step by step how to install and use ClimMob.

OUTCOME 3: SMALL AND MARGINAL FARMERS ARE BETTER ABLE TO USE ADAPTED GENETIC MATERIALS THROUGH AN IMPROVED LOCAL SEED SYSTEM NETWORK

Activities carried out:

a) Collected local rice germplasm and established community seed banks

COMMUNITY SEED BANKS

Four community seed banks have been set up as part of the project activities, one each in UP, Bihar, Himachal Pradesh and Uttarakhand. The latter is established as a master seed bank. It is a large bank in which Gene Campaign will continue to add varieties as part of its ongoing work on collecting and conserving the genetic diversity of crop plants, chiefly rice but also millets and other pseudo cereals like buckwheat and amaranth which are known to be climate resilient (finger millet being a C4 plant) as well as highly nutritious. The master seed bank in Uttarakhand will in addition to the ongoing seed collection, also maintain a back up collection of the material in the other seed banks set up under the project.

Recognizing the importance of agro biodiversity to ensuring viable agriculture under difficult situations like that predicted by global warming and climate change, Gene Campaign began a few years ago to collect, characterize and conserve the agro biodiversity of local crops particularly rice but also millets, legumes, vegetables and oilseeds, chiefly in Jharkhand and Uttaranchal.

The focus of Gene Campaign's conservation exercise is rice because it is an important staple food and because India is a Center of Origin and the greatest genetic diversity of rice is found here. The Eastern Indian region consisting of Orissa, Jharkhand and Chhattisgarh are considered important centers of rice diversity, as are the states of West Bengal and the states of the North East.

Gene Campaign decided that in order to prepare for the challenges that will confront rice cultivation, conservation efforts must be focused in areas where the largest number of genes can be identified and saved for future use.

Our approach to conservation is to set up community managed, field level Seed Banks. These Banks are simple rooms, which are moisture and light proof and well aired. The seeds of traditional varieties of rice, and other crops like legumes, oilseeds and vegetables are collected from the fields of farmers who are still cultivating them, usually in remote areas.

At the time of collection information is recorded about the properties of each variety. This knowledge held by the farming community is extensive and detailed and documenting it faithfully provides a wealth of information about the genetic properties of crop varieties. It is farmers who reveal whether the variety is resistant to disease or has a short or long duration to maturity. This valuable information tells the scientists which traits to look for in which varieties.

The seed samples collected from the field are scientifically processed to reduce moisture level and stored in glass jars for medium term storage and in baskets for short-term storage.

The properties of the traditional varieties are characterized, and their genetic features are documented for use by scientists in research institutions.

The Community Seed Banks are located in the village and they are owned by the community. Village youth committees supervised by village elders are being trained to administer the seed banks. The seed in the banks is for farmers to access in a barter system. Farmers must return three times the seed they take when their harvest comes in. The core collection is multiplied in carefully designed plots in farmers' fields, monitored by trained village youth and Gene Campaign staff. The material that is returned to the Bank after renewal is taken from the center of the plot to avoid mixing.

Uttarakhand Seed Bank

Bihar Seed Bank

Uttar Pradesh Seed Bank

Himachal Pradesh Seed Bank

OVERVIEW OF THE SEED BANK COLLECTION

UTTARAKHAND

Crop	No. of Samples
Rice	403
Finger millets	212
Barnyard millet	23
Foxtail millet	7
Vegetable	8
Maize	14
Legume	6
Pearl millet	1
Barley	8
Wheat	29
Buckwheat	2
Oilseed	29
Pulses	68
Total	814

BIHAR

Crop	No. of Samples
Rice	51
Barley	4
Maize	5

Millets	2
Sesame	5
Flax seed	2
Mustard	4
Vegetable	5
Wheat	33
Total	111

UTTAR PRADESH

Crop	No. of Samples
Rice	26
Legumes	8
Spices	3
Mustard	2
Wheat	4
Maize	1
Barley	1
Total	45

HIMACHAL PRADESH

Crop	No. of Samples
Wheat	25
Rice	7
Vegetables	17
Mustard	4
Flax seed	3
Barley	2
Maize	3
Legumes	13
Finger millet, proso millet and barnyard millet	3
Total	77

For the whole catalogue see **Annexure 8**

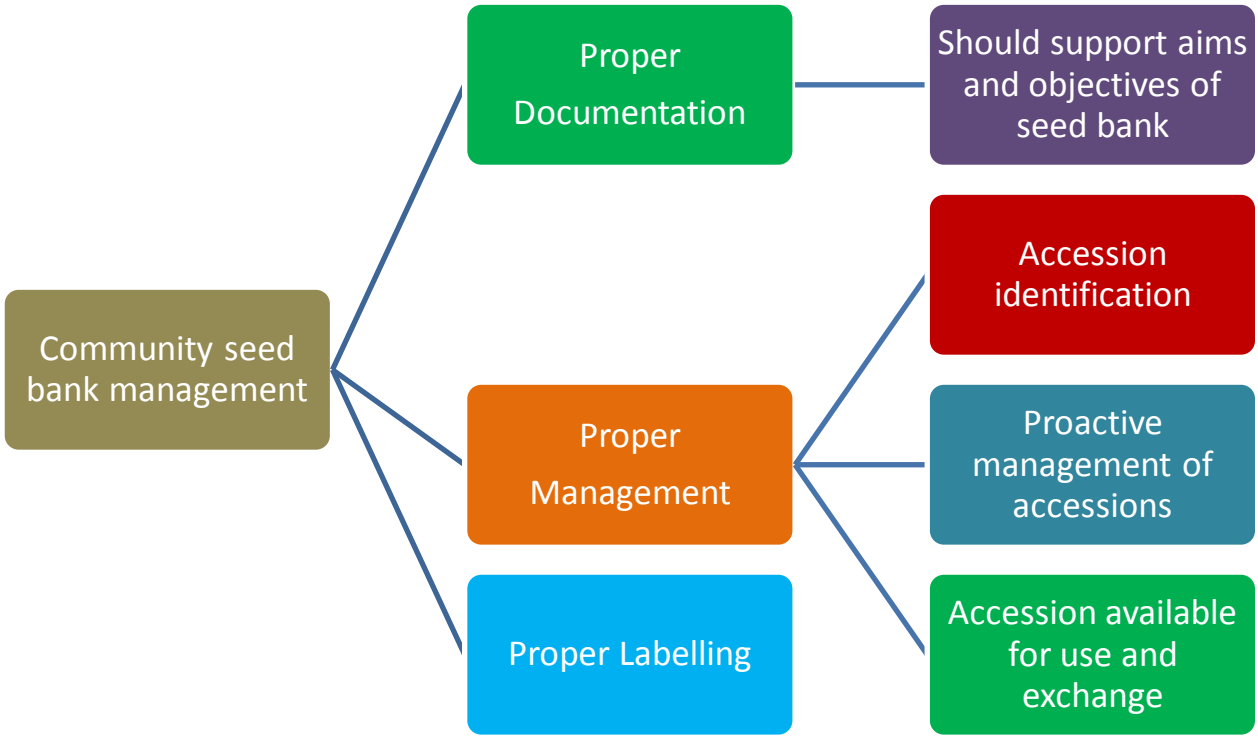
b) Established database at each project site and training was provided in database management

Gene Campaign has documented all data from all the interventions in hard copy at each project site and in soft copy at GC head office. All the data is also freely available on the Gene Campaign website: www.genecampaign.com

Training on Database Management

Training on database management was organized by Gene Campaign in collaboration with Bioversity International at Bihar, Uttarakhand and Ranchi. More than 50 farmers at each project site attended this training. Field staff from different project locations also attended this training. Dr. Paul Queck from Bioversity explained the importance of properly maintaining the database of the seed bank.

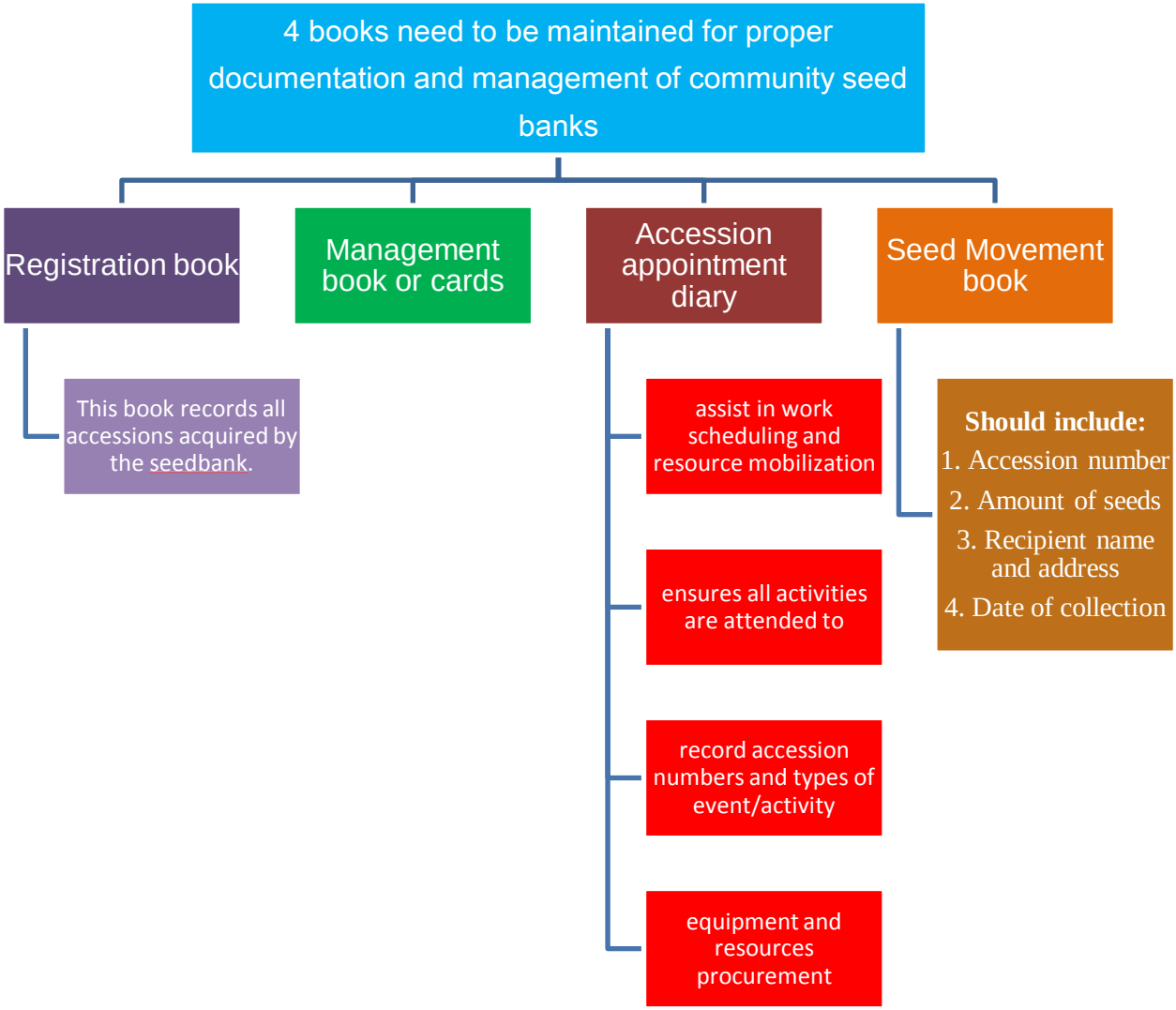
The following topics were covered in the training session:



Community Seed bank Documentation

Community Seed banks located in remote areas generally will not have easy access to computers and electricity. These seed banks assist the communities to store and make seeds available.

In a community seed bank a manual documentation system is proposed to records all activities related to maintaining viable seeds and making them available throughout their storage life. The documentation system will ensure the identity of the accessions, proactive management activities (viability and health monitoring etc) are scheduled, and tracked exchange and use of the accessions



1. Registration book

This book records all accessions that come into the seed bank. A unique accession number is assigned and passport data recorded. Passport data are information collected during the seeds collection activity and can be in a field form submitted with the seeds.

Table of examples of Passport descriptors

Accession number	A unique sequential number. Usually with a genebank prefix to differentiate between genebanks. Accession number is not reused .
Date of entry	
Type of material	Seeds, suckers, buds, etc
Crop	
Variety	Local name
Source/farmer/genebank	From whom was the accession from
Locality/Village	
Latitude	Geo-reference coordinates in degree decimal
Longitude	Geo-reference coordinates in degree decimal
Collector's name	
Collecting source	
Known attributes	
Remarks	
Location of safety duplicate	If any.

2. Management Book

This book has 4 columns and referring to one accession on each card.

Table of activities monitoring descriptors

Accession number	One accession number per card
Appointment date / Actual date	This is the next management event appointment date and the actual date of the event.
Event, Management activity	The activity in seed management guide. E.g. Seed treatment is followed by seed drying and then moisture monitoring every month. The next event is recorded in the next line with an appointment date
Description of outcome of management activity	Give details of the activity e.g seed treatment provide chemical name, amount and method used to apply.
In hand	Amount of the seeds in storage container at end of event/activity

3. Accession appointment diary (AAD)

The AAD is the daily management planner for the seed bank. The AAD assists in work scheduling and resource mobilization for the seed bank. It ensures that all events and activities related to all accessions in the seed bank are attended to promptly.

A normal desktop diary with one page per day or per week or desktop planner (depending on number of accessions) can be used for booking an activity or event, accession number

and type of event/activity. Where activity needs some equipment and resources the date for procurement need to be determined and added to an earlier date concern. Any activity not completed will need a new appointment date and indicated on management book as well. In the management book, the next event or treatment will need a date to be set by referring the AAD. Once the date is selected, it is also placed in the appointment diary.

Mon	Tue	Wed	Thu	Fri	Sat	Sun
	1 GC 018 for treatment	2	3	4	5	6
7	8	9	10 GC023	11	12	13
14 GC168 dry n storage	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

4. Seed movement book

This book tracks the movement of seeds from the seedbank. A a duplicate or triplicate book allows the seed bank to maintain a copy of seed movement outside the seedbank. The original copy goes along with the seeds. The information to be captured should be basic.

1. Accession number
2. Amount of seeds
3. Recipient name and address
4. Date of collection
5. Amount of seeds to return
6. Estimated date of return

In a duplicate book where pages are numbered, every 2 pages will have the same number printed on pages.

Labelling

When labelling a container on the external surface, bear in mind that labels can drop off depending on the glue/adhesive tape used. Good practice is to include another accession label in the container itself. Use a 2B pencil to write on the label to ensure the label legibility will last. Besides Accession number, other information can be included if space permits

Monitoring Graphs

It is good to have a monitoring graph to show basic information of the seed bank. Indexes such as number of accession added, number of accessions attended to management activities and number/amount of seeds exchanged or multiplied are useful to plot on a graph paper. It will provided staff to see the progress in the seed bank.

Trainings on database management at different project sites

c) Established database at each project site and training was provided in database management

SEED DIVERSITY FAIRS

10 Seed Fairs were organized by Gene Campaign in collaboration with local NGOs to showcase the diversity of seeds in different study regions. There was great interest in the seed fair since farmers were able to meet and exchange notes about seed varieties and cultivation practices with other farmers from far away villages. Many farmers established connections with those farmers whose seeds they liked and wanted to try out in the next season. The seed fairs were a very successful platform for increasing awareness and interest in seed diversity and increasing access to seeds that were locally adapted and successful. Farmers made plans to visit other farmers during the next cropping season to see the performance of the varieties they liked in the field.

Around 2000 farmers participated in the Seed Diversity fairs organized in the four study locations Uttarakhand, Bihar, Uttar Pradesh and Himachal Pradesh.
Traditional (and some HY) seeds of Rice, Millets, Paddy, Wheat, Maize, Pulses; vegetables were brought by farmers for display. Gene Campaign displayed the collections from the community seed banks that were established under the ITPGR project.
Many farmers exchanged seeds with each other during the fair. Farmers also shared their views on traditional varieties, HYV and hybrid seeds. Farmers were greatly appreciation of the community seed banks set up by Gene Campaign since they provide easy access to traditional seeds of various crops.

Farmers, mahila samoohs (womens' groups), farmer clubs, local NGOs, community based organizations, college students, scientists and researchers as well as members of the local Agriculture Science Centres participated in the seed fairs.
Scientists interacted with the farmers giving their tips and answering their questions.
For the whole photo file, see **Annexure 9**

Seed diversity fair in Uttar Pradesh

Seed Diversity Fair in Himachal Pradesh

Seed Diversity Fair in Bihar

Seed Diversity Fair, Uttarakhand

d) Strengthening Local Seed Distribution Systems

As result of the farm trials with varieties, Participatory Varietal Selections conducted with farmers and trials with System of Millet Intensification, certain varieties have been selected which are locally suited to cope with climate change. Farmers are keen to have seeds of these climate adapted varieties. Gene Campaign therefore began a local community based seed multiplication and seed production exercise in order to make available seeds of the preferred varieties.

Local seed production has enabled better access to seed of both traditional and improved varieties and has strengthened the seed network. Farmers are able to sell and exchange seeds and a viable system of farmer to farmer seed sale and seed exchange can grow out of this in time.

Collecting and conserving traditional varieties and making them available for seed production through community seed banks has also laid the foundation for diversifying crop varieties on the farm.

Both the seed diversity fairs and the seed banks provided the farmers a platform to see new varieties. Linked to local seed production, this can reduce dependence on the market for seed, encourage diversification of varieties cultivated, strengthen farmer knowledge about available seeds and provide resilience in the seed availability and distribution to and among farmers.

Seed production trainings were provided to more than 400 farmers in Uttarakhand and Bihar. In Bihar, farmers were provided foundation seeds of HYV rice varieties in the Kharif 2014. They harvested 6.2 Tonnes of quality rice seeds for their own use as well as community exchange. This has reduced their dependence on hybrids since now they have good quality rice seeds of 9 varieties available with them.

In Uttarakhand, farmers have been provided training in the basic principles of seed production and community seed production of climate resilient varieties of both rice and finger millet has been initiated. Till now, farmers have produced 76 quintal of finger millets.

e) Plan for multiplication of adapted crop diversity for distribution in future

Gene Campaign has started a local community based seed multiplication and seed production exercise in order to make available seeds of most climate resilient varieties to the farmers. Seed production trainings include trainings on seed production technologies, seed storage techniques (traditional and scientific), simple seed quality tests and managing and multiplication of the collection in the community seed banks.

Once the farmers' preferences for adapted crop diversity will be identified, we will initiate large-scale seed production with the farmers for distribution of those selected varieties which are best adapted to the changing climate. Currently, seed production of Rice and Finger Millets has been initiated by Gene Campaign in Uttarakhand.

OUTCOME 4: STAKEHOLDERS' CAPACITIES AND SKILLS STRENGTHENED FOR IDENTIFYING AND UTILIZING SUITABLE GENETIC MATERIAL FOR CHANGING CLIMATIC CONDITIONS

a) Organized training programs for researchers in the use of germplasm characterization & trait specific evaluation, GIS tools and Climate Stimulation Modelling

Geographic Information System Trainings and their Impacts

Introduction

Two trainings on GIS were conducted. The workshops were facilitated by Dr. Prem Mathur, Dr.Paul Quek and Sarika Mittra from Bioversity International.

One GIS workshop, entitled "Application of GIS and Climate Analogue Tools for Agricultural Plant Genetic Resources (APGR) Management," was held on the Bioversity premises in New Delhi on 3-4 June 2013. The two-day training workshop was attended by researchers, project staff and invited NGOs. The purpose of the training was to introduce the participants to the applications of GIS tools for APGR analysis, including methods of assigning geo-reference to germplasm, software and tools (both commercial and open source) available, the use of the Global Positioning System (GPS), the availability of climate databases and the application of GPS in the identification of climate analogue sites.

Another three-day training workshop on the "Application of Geographic Information System (GIS) and Climate Analogue Tools (CAT) for Agricultural Plant Genetic Resources (APGR) Management and Increased Varietal Adaptation" was held at New Delhi from 9 to 11 June, 2014. The workshop was attended by 22 participants which included project staff, researchers, scientific officers from other organizations, Gene Campaign staff from Jharkhand, Uttarakhand and Delhi as well as invited NGOs.

Objectives of the workshop:

- Educate researchers and extension workers in PGR documentation and data analysis in excel and DIVA-GIS
- Create a group of researchers and extension workers trained in the use of tools for rapid screening of Germplasm for climate change using Geographic Information System.

Topics covered:

- Methods of assigning geo-reference data to germplasm
- Software and tools (both commercial and open source) available
- Use of the Global Positioning System (GPS)
- Availability of climate databases and its use in the application for identification of climate analogue sites.

Participants were introduced to DIVA-GIS (http://www.diva-gis.org/download), Maxent (http://www.cs.princeton.edu/~schapire/maxent/), and the Climate Analogues tool (http://gismap.ciat.cgiar.org/analogues/) that is freely available online. Spatial data and

climate data, required for GIS analysis, is also freely available online and participants were shown the relevant web links from where these can be downloaded (http://www.diva-gis.org/Data). Participants performed practical exercises using the coordinates of their own field sites to visualize the results of such analyses and readily understand the interpretation of these results.

Relevance and Contents

The importance of proper PGR documentations was highlighted. Plant genetic resources provide base material to plant breeders for the development of new and superior crop varieties. During the last three decades, a growing awareness has been witnessed to collect and conserve these fast depleting, irreplaceable resources for the good of the present and future generations. At the same time, it has been accepted that the success of the entire genetic resources activities is dependent upon the descriptive information of the conserved material which enables plant breeders to make decisions regarding the material to be used in breeding programmes. This dependence on information grows exponentially with the size of the collections". He emphasised on the proper documentation and creating a neat and clean database for collected germplasm. Without geo-coordinates of the location of sample collection; it's difficult to locate the origin of the sample.

After describing the importance of PGR documentation a demonstration was given of Microsoft Excel and how proper data entry format needs to be done. During this session he also taught us conversions of Lat/long from degrees to decimal points using excel.

Documentation of Traditional Knowledge and its importance

Documentation of traditional knowledge is important to create scientific knowledge. He explained ways by which traditional knowledge can be documented. One way to document traditional knowledge is to interview individuals. Many times people may not be always willing to share their knowledge., so researchers often use the tool of motivation, so if one village is not ready to take part in documentation then we can motivate them by giving example of another village.

DIVA-GIS and its use

DIVA-GIS is a free software and can be downloaded from www.diva-gis.org. From this website we can also download other data files for free such as climate data, location data, etc.

DBF (version IV) is a commonly used database format. DIVA-GIS uses it to import and export tabular data. You can create a DBF file by exporting it from a database program such as Access. But today most of us use excel for data entry. To use data in DIVA-GIS excel file must be converted into shape file which we will discuss later. One important thing that needs to be in mind while doing the data entry is that the field names (variable names) should be in the first row, and do not have spaces. Each column with data should have a field name. The names of fields may not be repeated, may not start with a number, and should only consist of letters and numbers. Field names should NOT contain characters such as * ^ % ? / - and >.

After basic introduction with Diva- GIS next step is to learn creating maps in Diva. DIVA-GIS have two view tabs one is data and other is design as shown in Fig (4) in red circle. Map can

only be created in design tab however editing feature is not available if you want to change map then you need to go to data tab change the desired value and again go to Design tab. To create map click on the globe icon on top left side of the screen then click ok your map will be ready to paste in report. Tabs for creating legend, meter scale, north arrow, delete, copy and save are all available on left side of screen moving left to right

Use and impacts of GPS (Global Positioning system)

The development and implementation of precision agriculture or site-specific farming has been made possible by combining the Global Positioning System (GPS) and geographic information systems (GIS). These technologies enable the coupling of real-time data collection with accurate position information, leading to the efficient manipulation and analysis of large amounts of geospatial data. GPS-based applications in precision farming are being used for farm planning, field mapping, soil sampling, tractor guidance, crop scouting, variable rate applications, and yield mapping. GPS allows farmers to work during low visibility field conditions such as rain, dust, fog, and darkness.

In the past, it was difficult for farmers to correlate production techniques and crop yields with land variability. This limited their ability to develop the most effective soil/plant treatment strategies that could have enhanced their production. Today, more precise application of pesticides, herbicides, and fertilizers, and better control of the dispersion of those chemicals are possible through precision agriculture, thus reducing expenses, producing a higher yield, and creating a more environmentally friendly farm.

Shannon Diversity Index

The Shannon Diversity Index quantifies the diversity of the countryside based on two components: the number of different patch types and the proportional area distribution among patch types. Commonly the two components are named richness and evenness. Richness refers to the number of patch types (compositional component) and evenness to the area distribution of classes (structural component).

The Shannon Index is calculated by adding for each patch type present the proportion of area covered, multiplied by that proportion expressed in natural logarithm, according to the formula:

$$SHDI = -\sum_{i=1}^{m}(Pi * \ln Pi)$$

m = number of patch types P_i = proportion of area covered by patch type (land cover class)

Shannon Diversity Index increases as the number of different patch types (=classes) increases and/or the proportional distribution of the area among patch types becomes more equitable. For a given number of classes, the maximum value of the Shannon Index is reached when all classes have the same area. The following examples try to illustrate the influence of richness and evenness on the index. Since geographic areas are not equal in size it is better to use grid with cells of equal areas. So first go to analysis tab select point to

grid then click on diversity a new window will open select input file (your data shape file), then define grid as “create new grid” select output variable as “diversity” . Keep point to grid position simple select output file and click on apply. Areas with different diversity index will show in different color. Similar procedure can be followed to create maps for species richness and other analysis. One can also view details of analysis by clicking on table tools.

“It was a great learning and enriching experience during the Workshop on Applications of GIS and Climate Analogue Tools for Agricultural Plant Genetic Resources (APGR) Management and Increased Varietal Adaptation from 9-11 June, 2014. We are thankful to Gene Campaign and Bioversity International for wonderful demonstration and knowledge sharing with us. We'll certainly utilize these tools in our research work in future. If given opportunity, we'll be interested to join the next refresher course for this training”

— Feedbacks about the workshop by Researchers, Ms. Monika Sah and Md. Sajid

Participants of GIS training workshop

b) Trained farmers, extension workers and communities for participatory variety selections

Trainings on Participatory Varietal Selection (PVS)

1. Workshops

Workshops on PVS were organized in study locations.

The discussions included methods of rice cultivation, germplasm and varietal trials, problem faced by farmers due to climate variations, difficulty in getting seeds of released varieties, seed system, seed storage, and establishment of community seed bank.

Other topics covered were participatory varietal selection (PPV) and participatory plant breeding (PPB) and their importance and usefulness to farmers particularly under climate change conditions. Farmers were informed about their rights under the Protection of Plant Varieties and Farmers rights (PPVFR) Act, 2001 and the rights of communities as provided in the Biodiversity Act, 2002 for plant genetic resources, as well as the importance of characterization of farmer varieties and registering them with the National Plant Variety Authority which will establish the ownership of the community over the germplasm and their claim to a fair share in the benefits accruing from their use.

Farmers were given practical training with a survey form (see **Annexure 10**) to record their observations on both germplasm and varieties on traits such as plant height, tillering habit, incidence of pest and diseases, panicle appearance, grain size, aroma and their liking to germplasm line and variety.

2. Hands on training for rice descriptors: Training to project staff and key farmers from all locations was provided on recording of rice descriptors for germplasm and rice variety evaluation trials. Every plant trait was explained in detail with its contribution to the plant's yielding ability. Farmers were educated about single plant selection, the selection stage of plants and selection of germplasm line based on different traits such as plant height, effective tillers, panicle size and maturity, grain size and aroma, disease if any, among others. Farmers were also told about harvesting and threshing procedures of selected materials in order to maintain purity of individual germplasm lines without damaging the seed, through proper separation and tagging.

Training on rice descriptors to farmers and field staff

3. Training on conducting trials

In order to develop resilient system that can buffer crops against climate variability and extreme climate events. There can be variety of ways that diversified agricultural systems are able to mitigate the effects of climate change on crop production. Crop diversification can be at inter and intra-species level and this project is promoting crop diversification approach both at inter and intra-species level for climate change adaptation. The PVS (Participatory Varietal Selection Trials) are more technical and scientific in nature where there are 20-30 varieties trialled at different villages in a region. All these data are analyzed and feedback is taken for the farmers and they are asked about the entries they find much promising and are outperforming their original lines.

Although the importance of seed has always been recognized, the need for quality seed production is more recent.

Trainings focussed on:

1. Techniques of quality seed production in wheat and rice
2. Seed storage
3. Seed conservation and Seed Bank operations
4. On farm demonstration of rouging operation: **Rouging** refers to the act of identifying and removing plants with undesirable characteristics from agricultural fields. Rogues are removed from the fields to preserve the quality of the crop being grown. That is, the plants being removed may be diseased, be of an unwanted variety, or undesirable for other reasons. For example, to ensure that the crop retains its integrity with regards to certain physical attributes, such as color and shape, individual plants that exhibit differing traits are removed. Roguing is particularly important when growing seed crops to prevent plants with undesirable characteristics from propagating into subsequent generations.
5. Isolation distances: How to ascertain isolation distance in rice and other crops
6. Trial layouts for paddy and millet varieties

Trainings on PVS, Bihar


Trainings on PVS, Himachal Pradesh


Trainings on PVS, Uttar Pradesh


Trainings on PVS of rice, Uttarakhand

Trainings on PVS of millets, Uttarakhand

c) Farmer exchange visits of farmers were conducted across project sites

Farmer Exchange Visits

Farmers exchange visits were organized across project sites to enable farmers and project staff to interact with people in different areas and exchange views on suitable rice varieties, cultivation practices, and other crop production and protection related information. Farmers found these exchange visits very useful since it gave them a chance to see different varieties and cultivation practices. These visits established contacts between farmers. They exchanged seeds and tips on overcoming problems in rice cultivation. This kind of exposure is very important to give farmers a perspective on problems they face, for example the changing climate. It also enables farmer to farmer learning.

d) Established Farmer Field Schools for training local communities on conservation and use of crop diversity

FARMER FIELD SCHOOLS

Farmer Field Schools were conducted in all project sites in Uttarakhand, HP, UP and in Bihar. In Bihar, with the collaboration of Bioversity, we tried out crowd sourcing using HYV since there is next to no interest in traditional varieties.

In UP trials are being conducted in Shohratgarh, under SiddarthNagar district, which spreads across 2,752 km². In UK rice trials are being done in Ramgarh/ Nainital district. The Ramgarh district spreads across 1360.08 km^2.

In HP rice, trials have been started in collaboration with Himachal Pradesh Krishi Vidyalaya, Palampur, at Malan Rice & Wheat Research Station in Kangra District, which spreads across 55,673 km^2.

On-farm training to the farmers of all project locations was given on rice characterization, single plant selection, stage of selecting plants and selection of germplasm lines based on different traits like plant height, effective tillers, panicle size and maturity, grain size and aroma. More than 300 farmers from each site participated in these on-farm trainings including women farmers.

Manual used for farmer field school is attached as **Annexure 11.**

Farmer Field School, Bihar

Farmer Field School, Himachal Pradesh

Farmer field school, Uttar Pradesh

Farmer field school, Uttarakhand

e) Workshop and training programs were organized for policy makers at national and local level

Gene Campaign conducted two training workshops for policy makers at national level which were held at Bioversity International in December, 2014. Policy makers, project staff, researchers and students attended the training workshops. Similar training programs were conducted at local level in Uttarakhand and Bihar in association with community organizations and local NGOs. The objective of the workshops was to generate awareness among the masses about the outcomes and issues that were realized during the project with International Treaty on Plant Genetic Resources and recommend changes in the policies at both national and local levels.
Workshop presentation is attached as **Annexure 12.**

f) Policy Dialogues were organized for climate adaptation

Two policy dialogues were organized by Gene Campaign.

(i) Using rice genetic diversity to support farmers' adaptation to climate change for sustainable production and improved livelihood in India

Policy Dialogue
1 October 2012

A policy dialogue for policy makers that included scientists, researchers, civil society organizations, NGOs, graduate and postgraduate students etc. was organized at the National Academy of Agricultural Sciences, New Delhi on October 1, 2012 to launch the Gene Campaign project on: "Using rice genetic diversity to support farmers' adaptation to climate change for sustainable production and improved livelihoods in India".

The meeting was chaired by Dr. Suman Sahai, Chairperson, Gene Campaign and Dr. P. Mathur, Bioversity International. Dr. R.S. Paroda, Chairman TAAS and Dr. Gurbachan Singh, Chairman, Agricultural Scientists Recruitment Board were invited as special guests. Twentysixscientists who participated, including Dr. Arvind Kumar, DDG (Education, ICAR), Dr. J.S. Sandhu, ADG (Seeds), ICAR; Dr. S. Mauria, ADG (IP & TM) ICAR, Dr. N.N. Singh, Consultant APAARI, Dr. Bhag Mal, Consultant APAARI. The meeting was also attended by scientific experts from the Plant Variety Authority, Civil Society Organisation representatives and graduate and postgraduate students of agriculture

Dr. Sahai, discussed the goals and objectives of the project and how Gene Campaign's long standing work on collection and characterization of rice agrobiodiversity ties in with the objectives of the current project. Dr Sahai informed the participants about the state of agriculture productivity in the Indo-Gangetic Plains, which is one of the prime food producing regions of our country and emphasized the challenges that farmers in this area face. She discussed that the project aims to contribute to the adaptation strategies farmers of this region will need to focus on, in adapting to future climate change adversities. The project activities will be implemented in ways to strengthen the farmer's adaptation strategies including conserving and multiplying traditional rice genetic diversity, combined with introduction of new varieties/landraces. This will help strengthen local seed systems due to increased availability of rice diversity and will also enhance environmental resilience and improve security of food systems in the face of climate change. Dr Sahai pointed out the importance of studying the role of social and cultural barriers in farmers adapting to new varieties and ways to strengthen links between national and community seed banks, which contribute significantly to climate adaptation and conservation of crop diversity.

Given the central role played by Gene Campaign in developing national legislation like the Protection of Plant Varieties and Farmers Rights (PPV-FR) Act and the Biological Diversity Act, Dr. Sahai stated the commitment of the project towards farmer and community rights, biodiversity conservation and access and benefit sharing made in national legislation like the Protection of Plant Varieties and Farmers Rights (PPV-FR) Act, the Biological Diversity Act, the Forest Act and the Forest (Conservation) Act.

Participants were made aware that the project activities will advance the goals of the four relevant missions enunciated in India's National Action Plan on Climate Change (NAPCC), the National Mission for Sustaining the Himalayan Ecosystem, National Mission for a "Green India", National Mission for Sustainable Agriculture, and National Mission on Strategic Knowledge for Climate Change, all of which focus on the conservation and sustainable use of biodiversity. There would be other beneficial outcomes of the project that would support national policies and plans. Dr Sahai said Gene Campaign's collection of rice diversity was being put to use to help famers from all regions take advantage of it, if the material was adapted to their area.

The project is in harmony with the International Treaty & addresses the goals of the Global Plan of Action for the Conservation and Sustainable Utilization of PGRFA, and the Global Strategy for Plant Conservation of the Convention on Biological Diversity (CBD). The rights of farmers and rural communities over PGR will be strengthened. This work will strengthen support to the CG system and to International Agricultural Research Centres by demonstrating the value of genetic diversity to food security. The model of the Zero Energy Gene-Seed Bank developed by Gene Campaign which is labour intensive rather than energy intensive is an approach that can be followed in different centres of genetic diversity.

During the discussions experts welcomed the urgent need to evaluate rice germplasm present in gene banks for assessing their multi-stress characters, which can benefit farmers in mitigating climatic fluctuations and adversities like drought, flooding, water logging, salt stress, etc. An example of Eastern India was also cited, to highlight the importance of sharing more diversity with farmers, where farmers can cultivate short duration varieties to accommodate wheat in the cropping rice-wheat pattern, which would allow them to harvest two crops in a year than just long duration rice which they are presently practicing.

The event was covered and broadcast by the national television channel 'Doordarshan'.

URL: https://www.youtube.com/watch?v=jVGIjlQ5oXs

(ii) Policy Dialogue for Climate Adaptation

A Policy Dialogue for Climate Adaptation was organized by Gene Campaign in November, 2014 for policy makers at local and national level. Dr. Suman Sahai addressed the meeting with how Gene Campaign competed successfully to get the award of a grant from the FAO-International Treaty on Plant Genetic Resources Fund to work on the 'Use of Genetic Diversity for Climate Change Adaptation'.

OBJECTIVES OF THE PROJECT:

This project was designed with the following specific objectives

- Exploring means for strengthening link between national and community gene banks and local farmers in the context of adaptation to climate risks
- Understanding social and cultural barriers to adoption of adapted varieties and explore effective means of introducing new adapted plant genetic resources
- Understand the role of national and local seed systems in enabling adaptation under changing production constraints
- Strengthening capacity of local institutions and farmers for climate variation adaptation and conservation of crop diversity
- Setting up community based gene banks and information dissemination systems

RECOMMENDATIONS FOR POLICY MAKERS:

- Placing agrobiodiversity management and conservation as a key policy objective.
- Increasing investment in research for the neglected mountain areas and focus on developing suitable varieties for the region.
- Investing in training programs on seed selection and storage and a program of knowledge and experiences exchange between sites. Women farmers should be supported with a parallel process of empowerment to be able to intervene in agricultural activities and decision-making within the households and the village.
- Increasing the genetic base of agriculture by introducing a greater number of crops and varieties. Richer crop diversity in the field builds resilience and provides better protection against pest and disease.
- A diversified crop basket including suitable landraces and improved varieties with a mix of important properties like different maturity periods, a variety of plant architecture etc.
- Conserving established cultivars the properties of which are known to farmers will help to buffer against climate/weather shocks. Local varieties of legumes, finger millet, (Eleusine coracana) barnyard millet (Echinochloa crus-galli), foxtail millet (Setaria italica), or pearl millet (Pennisetum glaucum), amaranth (Amaranthus sp.) will be useful to cope with critical situations. These crops are also highly nutritious and also have medicinal value.
- Conservation of traditional knowledge about crops, biodiversity and agriculture practices will provide leads for adaptation.
- Maintaining cultural practices will help to deal with future climate changes. For instance, cooking of traditional food during festivals like Harela helps conserve agro-biodiversity because a variety of crops are offered to God. Such practices reinforce the socio-cultural system.
- Maintaining cultural practices is integral to maintaining crop genetic diversity. In festivals like Harda, five, seven or nine varieties of crop seedlings form part of the ritual and are offered in worship.

Policy Dialogue for climate adaptation

3.2. Outputs and methodology of implemented activities

Project Activity	Number	Number of farmers involved	No. of project staff involved
Group discussions & interviews with farmers to introduce and discuss project activities	220 FGDs and 50 personal interviews with elders and key persons	3100 farmers including - 20 Women Farmers Association (WFA) 55 Self Help Groups (SHGs) -80 farmer clubs -27 community organizations & NGOs	12 GC staff and chairperson GC
Compiled and synthesized information for characterization and evaluation of existing diversity to adapt to climatic variations.	-112 traditional varieties were characterized		12 GC staff with support from scientists
Characterized farmer varieties with climate resilient trait(s) for registration with PVA	20 traditional varieties of rice and 13 traditional varieties of millets (1 kodo millet, 1 foxtail millet, 2 barnyard millets and 9 finger millet varieties)		6 GC staff
Documented information on the identified accessions	-48 rice varieties from all 4 project sites have been identified as adapted to current climate conditions -5 varieties of finger millets have have been identified as adapted to current climate conditions	-800 farmers -57 Women Farmers Groups - 37 farmer clubs	14 GC staff 2 BI staff
farm trials to identify paddy varieties/landraces suitable for climatic variation through crowdsourcing approach	- 31 varieties evaluated	325 farmers	- 8 GC staff 3 BI staff - 5 members from local NGOs - 6 scientists
farm trials to identify paddy varieties/landraces	- 59 varieties evaluated	122 farmers	- 12 GC staff -2 BI staff - 4 staff from NGOs

suitable for climatic variation through PVS approach			- 2 scientists
Testing finger millets in a System of Rice Intensification (SRI) design - System of Millet Intensification (SMI)	4 traditional +2 improved varieties of finger millet were evaluated in 2 locations each over 2 crop seasons.	360 farmers including 20 Women Farmer associations (WFA)	6 GC staff
Finger millet trials using PVS approach to identify varieties/ landraces suitable for climatic variation	- 14 traditional & 2 improved varieties tested in 4 locations over 2 crop seasons	285 farmers including: - 20 Women Farmers Association (WFA) and 18 farmer clubs	- 6 GC staff - 4 scientists from research organizations
Developed user friendly communication tools for researchers and farmers	- 10 trainings provided at 4 project sites on the farmer communication tool developed by the Government of India called the Kisan Call Centre 8 trainings provided to researchers on using the ClimMob application	- 500 farmers trained and connected to Kisan Call Centres 20 researchers and members of local NGOs	-2 staff from BI 8 GC staff -
House hold surveys to document local seed system and indigenous knowledge	- 142 FGDs conducted in 4 states - 52 personal interviews	- 1516 farmers surveyed	-10 GC staff supported by 6 members of local NGOs
House hold surveys to document farmers' perception of climate change	- 865 households surveyed in 4 states	-2595 members of farm families	- 12 GC staff, 12 members of community organisations
Collected germplasm of rice, millets and other crops	Approx 1033 varieties of local germplasm collected including: -484 rice varieties	- 2800 members of rural communities	- 20 GC staff, supported by members of WFA, local organisations and NGOs
Established community seed banks	4 seed banks established with a master seed bank in Uttarakhand		-12 GC staff

Trainings on seed bank maintenance	4 trainings held, 1 at each site	1300 farmers trained on seed bank management (seed drying and seed storage) including: - 20 Women Farmers Associations, -33 Self Help Groups	- 2 BI staff 6 GC staff - 8 staff from collaborating institutions
Trainings on Farmers' Rights	6 trainings	2450 farmers -38 NGOs -170 womens' groups	- 6 GC staff -6 NGO staff
Established database at each project site	4 catalogues of the entire seed collection established (1 at each project site) - 4 books being maintained for managing the collection keeping record of incoming and outgoing collection as well for seed multiplication -All data generated from project activities is being maintained in hard copy at each project site - The entire database of the four sites is also maintained in MS Excel in the GC head office, Delhi	- 130 farmers trained in database management	- 8 GC staff 2 BI staff
Organized seed diversity fairs	- 10 seed diversity fairs organized	More than 4800 farmers attended the diversity fairs including: - 170 women's groups - 100 farmers' clubs - 70 panchayat members About 25 members	20 GC staff 2 BI staff - 6 staff from collaborating NGOs, -members of community organisations, SHGs and farmers clubs

		of local NGOs and organisations, approx 18 scientists, 10 Agriculture Science Centers , some 500 students from local schools and colleges as well as tourists in the area attended the seed diversity fairs	
Organized training programmes for researchers in the use of germplasm characterization, trait specific evaluation; GIS tools, climate simulation modelling	2 trainings conducted	- 10 project staff - 10 GC staff 5 staff from collaborating institutions 14 researchers	-3 BI staff -6 GC staff
Trained farmers, extension workers and communities for participatory plant variety selections	27 trainings conducted	- 1600 farmers including 20 WFA, 28 SHGs 8 members of local organisations and NGOs	- 4 scientists 10 GC staff 2 BI staff - 4 staff from other institutions
Conducted exchange visits of progressive farmers across project sites	- 5 exchange visits	- 350 farmers	-10 GC staff
Conducted exchange visits of progressive farmers across country	3 exchange visits conducted of custodian farmers 1 exchange visit to Nepal Seed Bank	55 farmers 8 farmers	4 GC staff For Nepal visit: 6 GC staff 4 Bioversity staff
Conducted Farmer Field Schools for training of local communities on conservation and use of crop diversity	11 FFS were conducted	More than 1650 farmers participated including: - 16 Women Farmers Association -30 farmer clubs	- 6 scientists including 2 from NBPGR 10 GC staff
Conducted workshops/training programmes for policy makers at national and local levels	-2 workshops conducted at national level.	- 48 scientists from the ICAR system, academics from Delhi University and affiliate colleges ,graduate	-4 GC staff -2 BI staff

	- 3 training workshops were conducted at local level	& post graduate students - More than 300 farmers attended the workshops in Uttarakhand, Bihar and Haryana	6 GC staff 2 BI staff
Organized policy dialogues for climate adaptation	2 policy dialogues on climate adaptation were conducted at national level	68 people from various government departments, national & international NGOs, scientists from the ICAR system, academics from policy institutions and Think Tanks like the Centre for Developing Societies, Centre for Policy Research, NISTADS etc) , students	6 GC staff and chairperson GC 2 BI staff

Farmers Right's: In addition to the execution of the activities to achieve the project outcomes, Gene Campaign also engaged in large scale awareness programs about Farmers Rights during the project period. Given Gene Campaign's leading role in the research and advocacy related directly to the development and passage of the ' Protection of Plant Varieties and Farmer's Rights Act, 2001' and GC's familiarity with its content, the organisation took the opportunity to train diverse stakeholders on the legal rights given to farmers over seeds, as enshrined in the Indian law.

At least 2450 farmers (1500 in Uttarakhand, 200 in Himachal, 200 in Bihar and 250 in UP) have been made aware of the rights that have been granted to farmers over seeds.

In addition to this, approximately 38 NGOs and community organizations across the four project sites as well as over 120 women's groups in Uttarakhand and Himachal and 50 in UP have become champions to spread the message about Farmers Rights.

The project interventions have been consistently of high quality, designed, planned and executed with scientific rigour. The scientific nature of the research study, using appropriate methodologies from the biological and social sciences was upheld at all project sites, for all investigations. Data recording was regular, double checked and maintained in two copies throughout the project period.

The participation of stakeholders was enthusiastic and technical support from universities and research institutions was forthcoming, so this enabled a high quality in the work.

The seed bank in Uttarakhand is an impressive and sophisticated master seed bank with a large collection. It is also designed to serve as a backup repository of the collections from

other seed banks. In addition, it showcases some special collections of rice from Eastern India from the collections that Gene Campaign maintains in its 7 seed banks in Jharkhand.

The UK bank carries some special crop cultivars from the Himalayan region and already has gained the interest and admiration of local farmers who have begun taking seeds from the seed bank.

The relevance and utility of project activities is ensured largely because the project proposal was structured keeping in mind the problems of the project locations. South Asia and India are predicted by climate models to be amongst the regions that will be hardest hit by climate change. Mountain regions are especially vulnerable, as is the IGP.

India still has a reasonable diversity in rice. The Gene Campaign collection of rice diversity is large and diverse and is available for adaptation. The GIS mapping done in this study and the predictions for adaptability to sites other than current locations, has thrown up interesting information which will be very useful for the future.

Outputs	**What was done**	**Executors (Who)**	**When (Time frame)**	**Where**
Challenges presented by climate change for rice cultivation in Indo-Gangetic Plains assessed.	Literature review of the impact of climate change. Baseline surveys done in 4 sites on: 1.Farmers' Perception of Climate Change & Adaptive Responses 2.Seed systems and Indigenous knowledge 3.Farmer perception of agrobiodiversity/ traditional varieties	Gene Campaign Gene Campaign	June – September 2012 August-December, 2012 Jan 2013-May 2013 August – December 2013	Nainital & Bagheshwar, Uttarakhand; Muzaffarpur & Vaishali, Bihar; Siddharthnagar, Uttar Pradesh & Palampur, Himachal Pradesh
Rice diversity for climate change adaptation through	872 varieties of Indian rice	Bioversity		Gene Campaign

use of GIS technologies, climate change prediction models and farmers' participation identified for project sites	germplasm from Gene Campaign collection characterised for climate adaptation		September-October 2014	collections from Eastern India Analysis in Delhi
Genebank accession-level climate suitability and evaluation database established at community level.	Catalogues of the collections were made highlighting the most adapted varieties.	Gene Campaign	Catalogues of the collections were prepared from October-December 2013 and October - November 2014	Uttarakhand, Himachal Pradesh, Bihar & Uttar Pradesh
Farmers varieties identified for climate resilience prepared given for registration with Plant Variety Authority (PVA) of India.	Twenty traditional rice varieties and 13 varieties of millets (1 kodo millet, 1 foxtail millet, 2 barnyard millets and 9 finger millet varieties) given for registration with PVA	Gene Campaign	November 2014	Varieties collected from Uttarakhand, Himachal Pradesh, Bihar & Uttar Pradesh
Adaptive crop diversity validated and used by farmers for climate risks adaptation.	112 varieties of paddy were characterized and 25 varieties selected by farmers for climate risk adaptation	Gene Campaign in Uttarakhand, Himachal Pradesh & Uttar Pradesh and Bioversity in Bihar	Varieties were evaluated in 2013 after trials conducted during Kharif, 2013	Bagheshwar, Uttarakhand; Malan, Himachal Pradesh; Siddharthnagar, Uttar Pradesh and Muzaffarpur, Bihar
Participatory plant variety selection programmes in place that use climate adaptive diversity superior in marginal environments.	Training on PVS Farmers Field Day & training on Rice Descriptors Twenty five varieties of rice	Gene Campaign	September – October 2012 September – October 2012 -PVS and crowdsourcing trials of paddy	Uttarakhand, Haryana, UP and Bihar Uttarakhand, Haryana, UP and Bihar PVS trials and trainings were held at Killore,

	identified through participatory approach for climate adaptation and 1600 farmers trained in participatory plant variety selection Four varieties of millets were also identified through participatory approach in Uttarakhand		were conducted in Uttarakhand, Uttar Pradesh and Bihar in kharif season of 2013 (June-July, 2013) and best adapted varieties were identified by farmers in September-October 2013 PVS Trials of millets were conducted in June, 2013 and best adapted varieties were identified by farmers in October 2013	Buribana, Uttarakhand; Muzaffarpur, Bihar & Siddharthnagar, Uttar Pradesh PVS trials of millets were held at Buribana, Uttarakhand
Easy communication tools developed and deployed which allow researchers and farmers to access information about crop genetic diversity and associated climatic information.	10 Trainings were provided to more than 500 farmers in using communication tools based on information communication technology and 8 trainings were provided to 20 researchers and members of local NGOs researchers on using the ClimMob application	Gene Campaign and Bioversity	Trainings were provided to farmers during June-July 2013 and May June 2014	Trainings given in Nainital, Pithorgarh, , Bagheshwar & Almora districts in Uttarakhand; Samastipur, Muzaffarpur & Vaishali districts in Bihar; Shorathgarh & Unnao districts in Uttar Pradesh & Kangra & Chamba districts in Himachal Pradesh

Developing and mainstreaming database to improve access to information on local genetic diversity along with associated climate information.	Four community based database established and 3 trainings provided to more than 100 farmers in database management	Gene Campaign	Database was established in October-November 2014. Trainings on database management was conducted in October-November 2014	Trainings on database management was provided by Bioversity staff at: Orakhan, Uttarakhand; Itha, Bihar and Ranchi, Jharkhand
Community seed banks established at each project site to facilitate local access to PGR.	. 4 community seed banks established and more than 1000 village youth (men & women) trained in managing community seed banks and local seed system networks in all four sites Trainings on seed bank management at all four sites Training on	Gene Campaign Bioversity Gene Campaign	Seed collection was done in October – November 2012, October – November 2013, October – November, 2014 Seed banks were established at 4 sites during February-November 2014 Collections for Uttarakhand seed bank is still being done by the GC field staff. August 2014-September 2014 July- Aug	CSBs were set up in Orakhan, Uttarakhand; Palampur, Himachal Pradesh; Muzaffarpur, Bihar and Siddharthnaar, Uttar Pradesh Seed bank trainings provided in Orakhan, Uttarakhand; Palampur, Himachal Pradesh; Muzaffarpur, Bihar and Siddharthnaar, Uttar Pradesh Uttarakhand, Bihar, Uttar Pradesh, Himachal Pradesh

	Farmer's Rights		2012, July- Aug 2013	
Seed Diversity Fairs	10 seed diversity fairs conducted	Gene Campaign	November-December 2012 November-December 2013	Ramgarh, Uttarakhand Muzaffarpur-Bihar, Kangra-Himachal Pradesh, Siddharthnagar-Uttar Pradesh, Reetha, Uttarakhand
Community-based seed production organized for adapted materials.	Quality seed production trainings for rice and millet varieties are being conducted actively with more than 400 farmers	Gene Campaign & Bioversity	Seed production trainings were conducted during Kharif 2014.	Uttarakhand, Bihar & Uttar Pradesh
Researchers and other users trained in the use of tools for rapid screening of germplasm, Geographic Information System (GIS), climate-based models and other areas important for ensuring project outputs.	2 trainings provided to more than 50 participants including researchers, project staff and staff of other research-based organization on rapid screening of germplasm, Geographic Information System (GIS), climate-based models and other areas.	Bioversity	3-4 June 2013 and 9-11 June 2014	Delhi
Enhanced capacities of farming communities networked across project sites, in selecting & deploying adapted rice germplasm.	More than 1300 rural men & women, 28 Self help groups and 8 members of local organisations and NGOs were trained in activities		Evaluation of rice varieties July – December 2012 Evaluation of	Haryana and Uttar Pradesh Uttar Pradesh,

	relating to collecting, characterization, evaluation and documentation of local rice diversity for climate adaptation	Gene Campaign	rice varieties with PVS, July – December 2013 Evaluation of Millet varieties, June – October 2012 Evaluation of Millet varieties, June – October 2013 Farmer Field Day held at Karnal was held on 13-14 October 2012; Training programs and Farmer field school were held in all four sites were held during Kharif seasons of 2013 and 2014	Bihar, Uttarakhand Ramgarh-Nainital, Uttarakhand Ramgarh-Nainital, Uttarakhand Trainings given in Karnal, Haryana; Nainital, Pithorgarh, , Bagheshwar & Almora districts in Uttarakhand; Samastipur, Muzaffarpur & Vaishali districts in Bihar; Shorathgarh district in Uttar Pradesh & Kangra districts in Himachal Pradesh
	A total of 5 farmers' exchange visits were organized: 1 farmers exchange visits organised within site and 3 farmer exchange	Gene Campaign	-From different project sites to Karnal: October, 2012 -From Bihar to Delhi: 26-	Across borders to Nepal; within sites in Uttarakhand; Across project sites to Karnal, Haryana; Delhi and

	visits organized across project sites and 1 farmer visit organized to Nepal		28 February, 2014 -From different project sites to Uttarakhand: 23 October 2012 - Within Uttarakhand: 2 December 2013 - From different project sites to Nepal: 9 July-11 July, 2013	Uttarakhand. Bioversity conducted a farmer exchange visit of farmers from Bihar to Delhi
Recommendations to put policies and laws in place that ensure access to local crop biodiversity is compatible with national laws promulgated to comply with international treaties suggested.	Two policy training workshops were organized on national level and 3 training workshops were conducted at local level. Also 2 policy dialogues for climate adaptation were conducted at national level	Gene Campaign	At National level: - One in October, 2012 -Three from September to November 2014 At local level: - September 2013 - April 2014 - July 2014	At national level in Delhi. At local levels in Uttarakhand & Bihar

The project activities have been by and large completed but required an extension of 6 months for completion. The project has managed to make a substantial contribution to the understanding of the adoption of genetic diversity for climate change adaptation. In future however, such projects must be structured to include three complete crop cycles.

3.3. Activities not completed

All activities have been completed

3.4. Contribution to the Benefit-sharing Fund priorities

1. **Managing and conserving plant genetic resources on farm**

Awareness was generated, particularly among younger farmers and members of the rural

community about the importance of crop genetic diversity to stable and sustainable agriculture and food security. In the context of climate change, the value of crop choices to build resilience into food production systems was underscored. Community organisations and local NGOs, women's groups, farmer clubs, members of panchayats (Local Self Government bodies) and district level government officials are now better educated about the importance of maintaining genetic diversity on the farm and this should refelect in policy decisions.
On farm conservation of crop genetic resources has been promoted by encouraging people to continue to cultivate traditional varieties.
Farmers were given increased choice of varieties to broaden the genetic base of their cultivation. The effort to broaden the genetic base included the introduction of both traditional and improved varieties to give farmers options.

Participatory Varietal Selection (PVS) trials were conducted where farmers were presented with diverse varieties in cultivation and got the opportunity to select and adopt varieties according to their specific needs.

In Uttarakhand, PVS trials were done both with rice and finger millets. Traditional varieties as well as improved varieties were presented to farmers. Four traditional varieties of millets collected from other parts of Uttarakhand have been adopted in the project villages, thus increasing the genetic diversity on farm.

The PVS program was greatly appreciated by farmers. They said they have participated in training programs offered by the government agencies and NGOs but have never participated in such a useful and relevant program.

"The opportunity to see several varieties from different places in cultivation at one place and being asked to select what we like was very empowering. We got the chance to choose according to our needs. Now we want seeds of the varieties we have selected. This kind of exercise should be done regularly."

The crowdsourcing approach was implemented over two seasons when farmers were given 20 to 30 varieties each time to select and discard according to their preference. Farmers have adopted up to six to seven new rice varieties to take forward.

Seed diversity fairs have been great platforms for exchanging seeds and information. Farmers have appreciated this and have had the opportunity to increase the varieties they cultivate.

Farmer Toofani said *"The Beej Mela (seed diversity fairs) that were conducted in our area, were very useful. We met farmers from other villages who were cultivating traditional varieties that were lost from our village. I had been looking for Kalanamak seeds for my farm but could not find it. Then I met Rajendra who had brought Kalanamak seeds to show at the Seed Fair. I have arranged to get the seeds from him."*

Seed banks have been established in all project sites, with a master seed bank in Uttarakhand which apart from the state's collections will also hold a back up of the collections

in UP, Bihar and Himachal Pradesh. Seed banks aid on farm diversity by making available seed choices to farmers, often of varieties that are lost from their area but were locally adapted and suitable.

Farmers' views on the seed bank can be viewed in the video:
https://www.youtube.com/watch?v=Dwip5V8uFMA

The work of collecting, characterising and conserving genetic diversity will continue beyond the life of the current project.

2. Sustainable use of plant genetic resources

All the activities mentioned above enable and encourage the sustainable use of plant genetic resources to strengthen and support sustainable and resilient agricultural systems and food production.
Instead of the two to three varieties they have been cultivating farmers in Bihar and UP are now cultivating eight to ten varieties after being exposed to new varieties through crowdsourcing and PVS trials.

In Uttarakhand, four 'new' varieties of traditional finger millets have been liked and adopted by farmers in Nainital district and farmers in Bageshwar district have taken seeds of five rice varieties to try out.

As we saw repeatedly in our study of the seed systems, farmers are keen to experiment with new varieties if they get an opportunity. Whereas Himachal farmers seem to have lost interest in traditional varieties, farmers in Bihar, UP and Uttarakhand are receptive to new choices.
Rapid genetic erosion and market forces, along with the penetration of commercial agriculture have reduced the seed choice available to farmers. The interventions of this project have made available increased seed choice and farmers have taken advantage of that. This has contributed significantly to reviving interest in crop genetic diversity, its adoption and its sustainable use.

For evaluating the response of finger millet varieties to the principles of SRI (System of Rice Intensification) which is known to increase rice yields, trials were done with traditional and improved varieties of finger millet in a System of Millet Intensification (SMI). This was done with the expectation of promoting those varieties that demonstrate yield increase under SMI. The importance of the strongly climate resilient finger millet to the food security of rural communities in mountain areas cannot be underestimated; hence Gene Campaign elected to include this crop in the research. 20 different varieties of finger millet from National Bureau of Plant Genetic Resources (NBPGR) were taken for the trials in 3 different locations in Uttarakhand (Orakhan, Majhera & Hawalbagh) out of which 8 millet varieties were also evaluated through SMI. The qualitative and quantitative characterization was then done.

3. Information exchange, technology transfer and capacity building

All the information, data and reports generated during the project period are available on the Gene Campaign website and can be downloaded easily. The link to the project data has been provided to GC's network of approx. 8000 people and information is available to them. FAO may provide a link to the GC website so that the information is available to a wider audience.

The project invested significantly in training and capacity building at various levels. Farmers, members of the rural community, SHGs, Women Farmer Associations, Farmer Clubs, women's groups, Panchayat members, community organisations , local NGOs, district level government officials, Gene Campaign staff from all its field stations and staff hired to implement the project activities have all been beneficiaries of the capacity building done through trainings as listed below:

- Trainings for farmers and researchers on the use of the services of Kisan Call Center
- Trainings for researchers on agrobiodiversity, germplasm characterization and trait specific evaluation
- Trainings for researchers on GIS tools and climate stimulation modeling
- Trainings for farmers, extension workers and communities on participatory varietal selections
- Trainings for local communities on conservation and use of crop diversity through farmer field schools
- Trainings for farmers and local communities on maintaining the seed collection and the seed bank
- Trainings for farmers and researchers on ICT and Database management
- Trainings for farmers in seed production and multiplication
- Training programmes for policy makers at national and local levels
- Trainings on Farmers' Rights

In addition to the training programs, the inception meeting conducted on a large scale, subsequent workshops with 48 scientists from the ICAR system, academics from Delhi University and affiliate colleges, graduate & post graduate students. More than 300 farmers attended the workshops in Uttarakhand, Bihar and Haryana. The policy dialogues were all occasions to increase awareness in diverse participants and stakeholders about the issues that the project worked on, the methodologies it used and broadly the importance of agro biodiversity as a climate adaptation tool.

3.5. Project partnerships and stakeholders' involvement

Gene Campaign engaged with three levels of partners to collaborate with for the execution and implementation of project activities.

International level partners: Bioversity International as project partner.

National level partners: Institutions of the ICAR system, Agriculture Universities and research stations, colleges and educational institutions on location.

Local level partners: village elders, farmers organizations, Women Farmer Associations (WFA), Farmer Clubs, women's groups, Panchayat members, Self Help Groups, community organisations , local NGOs, government officials at tehsil and district level.

Bioversity International (BI) was a project partner that was involved in designing the proposal, the project activities and selecting institutional partners. It was also involved in field level implementation, monitoring activities, training programs and in preparing the final technical report. National level and local level partners made different kinds of contribution depending on the location

Contribution of the project partners to implementation has been explained in **Section 2.1**

Mechanisms for identification and engagement of relevant stakeholders

Stakeholders were identified at each project site based on the crop (rice) and the nature of activities to be implemented. For technical support, seeds of varieties, the local NBPGR station, the relevant research institutions and agricultural universities were approached.

For training programs scientists, biology teachers from local colleges and NGOs with good experience were identified. Establishing a rapport with the rural and farming communities in project sites and identifying stakeholders began with discussions with village elders. GC staff and project staff maintained regular contact through frequent discussions to seek the advice of the community in identifying groups, individuals and organisations with whom we could partner in project activities. Elder women and men of the community were regularly consulted about traditional crop varieties, their locations and farmers who were cultivating them.

District level government officials and panchayat members were requested for support and for local level information. Women Farmer associations set up by GC in Uttarakhand were a strong stakeholder being involved in designing, planning, implementing activities as well as monitoring of activities. Women's SHGs and farmer clubs were contacted in all sites and the enthusiastic ones selected as partners.

Degree and effectiveness of collaboration between implementing institution, partners and relevant stakeholders

The collaboration between Gene Campaign and its partners at all levels , has been excellent. GC staff and project staff worked closely with partners and stakeholders and succeeded in building an excellent rapport with them. Stakeholders therefore offered their support and cooperation which was a very important reason for the successful implementation of all project activities.

Dr Suman Sahai Indian Agricultural Research Institute, New Delhi and Dr Prem Mathur (University of Udaipur, Rajasthan are both scientists trained in genetics and plant breeding Delhi and hence are familiar with the network of scientists in the ICAR research institutes and various agriculture universities across the country. This has helped to build good partnerships with scientists and seek their support. GC has a long history of working in rural areas and has built good collaborations with local NGOs and community based organizations in different areas. GC in addition brings 20 years of experience in working together with rural and tribal communities. All these factors have helped to facilitate the conduct of project activities and ensured good outcomes.

4. RELEVANCE

4.1. Consistency of project objectives with local needs

The project was formulated in the way that it was because of a broad understanding of the problems the rural community is facing with agriculture and food production, the manner in which climate change is beginning to impact agriculture in different agro ecological zones and the growing genetic erosion reducing farm choices.
Having worked with farming communities, GC is familiar with the problems of small and marginal farmers, their lack of access to quality seed and inputs, as well as their inability to restore lost crop varieties.
Farmers aspire to better access to information, technical training to overcome problems in the field and more secure access to seeds of varieties that are adapted to the changing climatic conditions that they face.
Before starting project activities, our interactions with village elders , group discussions with the communities and some interviews with key persons reinforced our impressions and gave us an insight into the current thinking , needs and aspirations of the farming communities in each of the regions.

Baseline surveys using structured survey forms, FGDs and personal interviews gave valuable insights into the perceptions of the community and their needs about climate change , genetic diversity and their need/ preference for specific varieties.
The project actives are very well matched to the needs and aspirations of the local people of the study area.

Most of these needs center around access to quality inputs in a timely fashion. Of these, the most urgently felt need is that of quality seed. With growing climate turbulence, delayed and reduced monsoon rains, farmers feel the need more than ever, for locally adapted seeds and varieties suited to different conditions like late or early rainfall, drought or flood situations etc.

4.2. Beneficiaries

The project has been conducted in an inclusive manner, involving all stakeholders and in participatory mode where there was regular interaction with stakeholders and the target population. Channels were created through project staff to receive inputs and suggestions, including for trouble shooting.
The project activities were conducted in collaboration with research scientists, field researchers, educational institutions, local NGOs and community based organisations, panchayats (local self government bodies), mahila samuhs (women's groups), women's and men's self-help groups (SHGs), farmer clubs and individual farmers. These agencies were also involved in monitoring some field activities and their inputs were sought for preparing the final report.

Uttarakhand (UK) - Mahila Kisan Samitis (Women farmers Associations), farmers clubs , Self Help Groups (SHGs) -participation in project activities, engaged in monitoring activities, collecting genetic diversity and disseminating information about the value of genetic diversity

to climate resilience, sustainable agriculture and food security. Involvement in setting up seed bank
-Women's groups: providing information on local varieties, villages cultivating traditional varieties, generating awareness about the importance of genetic diversity to food security, participation in collecting genetic diversity, engaged in monitoring
-Local NGOs, Panchayat members and community organisations- implementing and monitoring activities, participation in collecting genetic diversity, awareness generation about genetic diversity and the need to conserve it; awareness generation about project activities, disseminating information about the value of genetic diversity and farmers rights

Bihar- Local NGOs: monitoring field trials, conducting surveys, participation in collecting genetic diversity
-Women's groups: generating awareness about the importance of genetic diversity to food security, engaged in monitoring

Men and women farmers: support in collecting seeds of traditional varieties of crops

Himachal Pradesh -Farmer clubs – Participating in implementing and monitoring activities , generating awareness about the importance of genetic diversity to food security, participation in collecting genetic diversity
- Community organizations: support for collecting crop genetic diversity and community knowledge, participation in collecting traditional crops and setting up seed bank
-Women's groups: providing information on local varieties, villages cultivating traditional varieties, engaged in monitoring

Uttar Pradesh -Women's groups, local NGOs -collaborating in conducting trials, and evaluating performance of varieties, awareness generation about genetic diversity
Panchayat members and community organizations -participation in project activities, engaged in monitoring activities, and disseminating information about the value of genetic diversity. Women and men farmers-participation in collecting genetic diversity

Stakeholders and target populations were involved in differing degrees in the monitoring process & preparing Final Technical Report.

Individuals, groups and organizations that benefited the most

Individual farmers, farmer organisations and farmers clubs, Women Farmers Associations (Mahila Kisan Samiti), Self Help Groups (SHGs) of both women and men, community based organisations, members of Panchayats, district level officials, KVKS or Agriculture Science Centers, local NGOs and select members of the science and research establishment, staff from local colleges, graduate and post graduate students as well as policy makers at national and local level.

Women were always included in project activities from designing, implementing and monitoring to discussing the results obtained. The extent of involvement of women was sometimes determined by the local cultural conditions. In Uttarakhand, where women are

active in agricultural activities and are decision makers, women were enthusiastic partners in the project and took advantage to learn new things and build up their skills and capacities. This was to a similar if somewhat reduced extent in Himachal Pradesh. In UP and Bihar on the other hand, where culturally women are less dominant and somewhat more confined to their responsibilities within the home, they had to be persuaded to participate in certain activities, in others they were more forthcoming**.**

Direct Beneficiaries:

Farmers: 25046
Womens' Groups: 513
SHGs: 116
Farmers' clubs: 265
Panchayats: 70
Community organizations & Local NGOs: 121
Policy makers, researchers/ scientists: 664
Project Staff: 63

Total number of people reached: 26858

Indirect Beneficiaries

An average of a 1000 individuals per village X 202 villages = 202000 indirect project beneficiaries

4.3. Gender considerations

Given the increasing feminization of agriculture in most parts of the developing world, as also in India, care was taken to include women's views, their needs and their areas of interest in all aspects of agriculture. The gender component of all activities like access to seeds and genetic diversity, participation in trials, position in seed networks etc was ensured. Women were included in all skill and capacity building activities and their perceptions on aspects like climate change and the value of traditional varieties and genetic diversity were noted as they were for men.

Women either collectively or individually were involved in all activities their views were sought in designing, implementing and monitoring activities, as also discussing the results

In those states where women are not able to be as forthcoming as they would like, due to the social and cultural mores and restraints, such as obtains in Bihar and Uttar Pradesh, the project teams made a special effort to include women by organising separate workshops, trainings and discussions for women farmers. The team also took the trouble to understand the needs of women and elicit their views and responses in their homes rather in open or public spaces where they were constrained. Women in the mountain states of Himachal Pradesh and Uttarakhand are able engage freely in public so it was not difficult to include them and their needs.

Level of involvement of women in project activities

Women were involved at several levels in project activities, sometimes to differing degrees, but in all project locations. Their involvement included planning activities , selecting locations for implementing activities and participating in activities like trials, collections of genetic diversity, disseminating information about the value of genetic diversity to climate resilience, sustainable agriculture and food security. They were involved in sorting seed collections and setting up seed banks.

Women were also involved in monitoring activities like field trials and in collecting data. Women's groups provided information on local varieties, villages cultivating traditional varieties and the seed networks in villages.

Women's groups, especially the Mahila Kisan Samitis (Women Farmers Associations) established by Gene Campaign participated in discussing the data obtained from the studies and were able to contribute to giving shape to the final report.

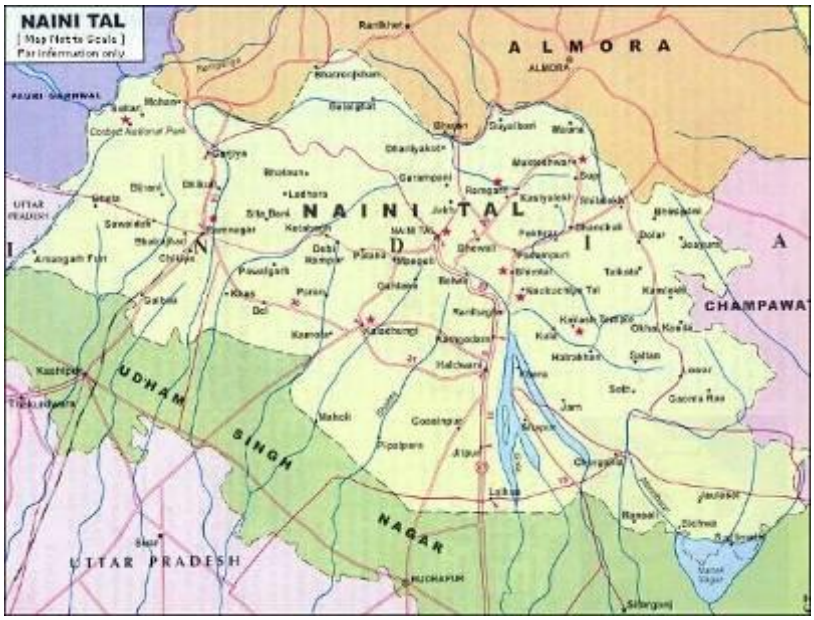
4.4. Coverage of the project

Geographic extension (km²) of the project sites with their maps are given below:

UTTARAKHAND

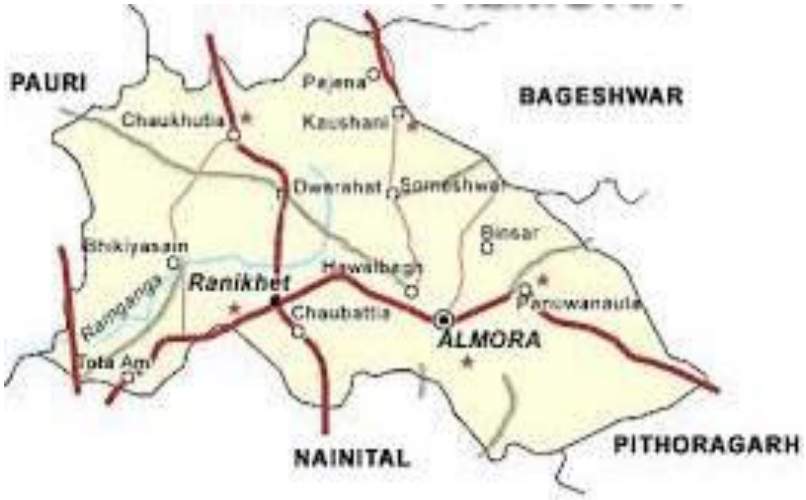
District Nainital: 3860 km^2

Villages: Buribana, Chaukhuta, Gajar, Kaul, Kokilbana, Majhera, Parbara, Pokhrar, Sunkiy, Badet, Bairoli, Bajothiya, BoharaKot, Dahra, Dadima, Gairadi, Galla, Gargaon, Harinagar, Hartola, Jhutiya, Kafuda, Kilor, Kumati, Lod, Loshgyani, Mauna, Myaura, Nathuwakhan, Naikana, Orakhan, Satkhol, Simayal, Supi, Suralgaon



District Almora: 3082 km^2

Villages: Dhyari, Daniya, Chamtola, Bhanoli ,Dungra, Jaiti, Birkham, Chaukuna, Ganau

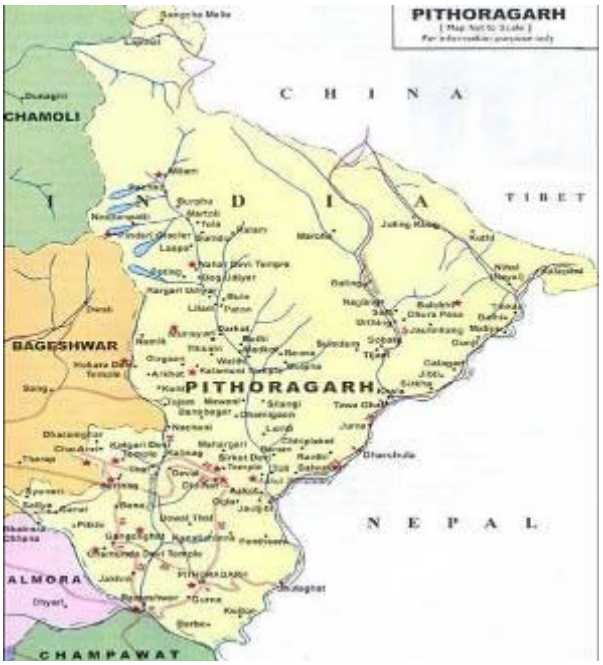


District Bageshwar: 2302 km^2

Villages: Gar-shakira, Chougaunchina, Ganotiparli, Agar, Chona, Belori, Karala, Bholnanagar, Kabhara, Bhatkhola, Jadh, Jatha, Kabhara, Okhalisirod

District Pithoragarh: 7110 km^2

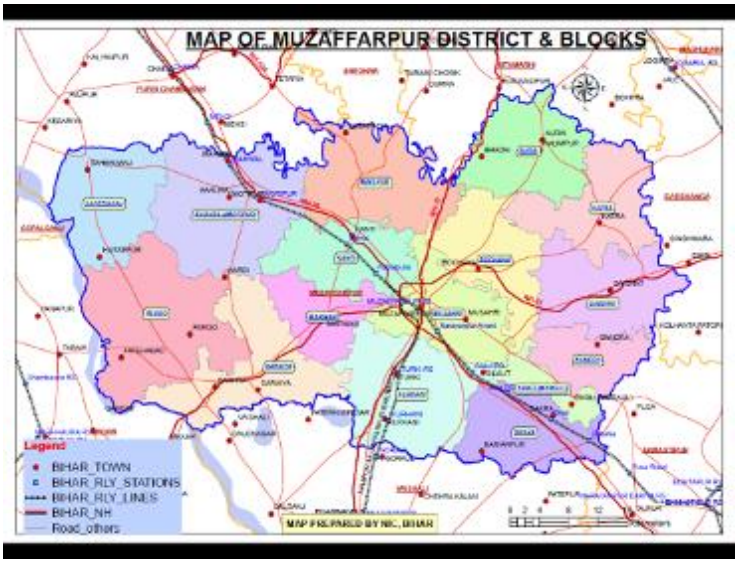
Villages: Dungari, Sann, Dwalisera, Pipli, Dhamigaon, Pankholi



BIHAR

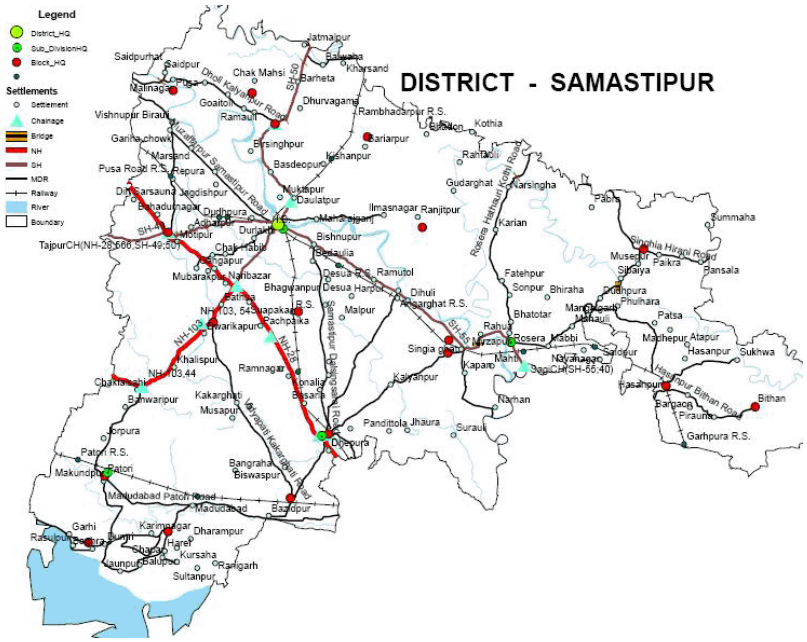
District Muzaffarpur: 3173 km^2

- Villages: Bishunpur Bakhri, Chimnapur, Dharmagatpur, Kathauli, Malpur Agrail, Balua, Markan, Kharauna, Dwarkapur, Nigopur, Mahammadpur Lalse, Pilkhi Gajpatti, Sambaha, Dholi, Itha Rasulnagar, Bakhri, Bedhipur, Chakdah, Ganiari, Keshopur, Mundiari, Saraiya, Chhapra Bahar, Donwan, Bharwari, Firozpur Asli, Katesar



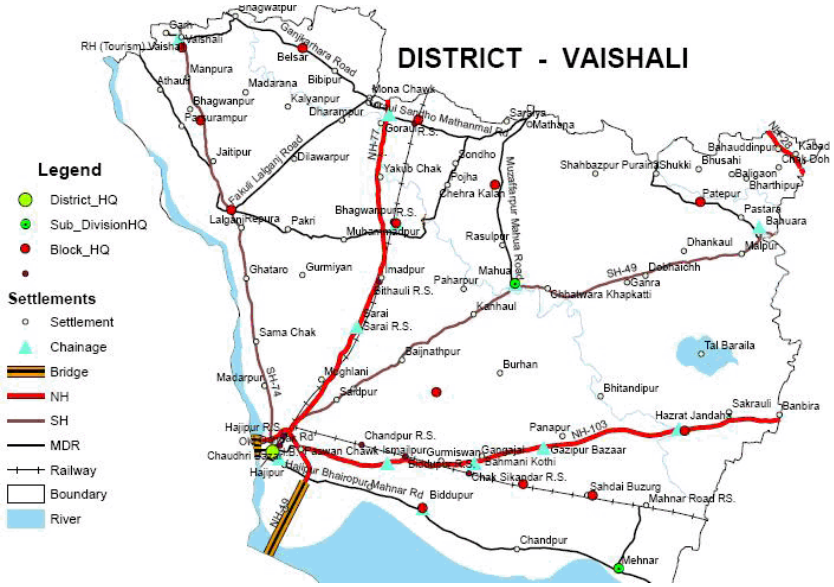
District Samastipur: 2904 km^2

Villages: Bhagwanpur, Bhairo patti, Harpur Mohamda, Sekhopur, Dighra, Gopalpur, Jagdishpur, Morsand, Nawa Chak, Pusa Deopur



District Vaishali: 2,036km^2

Villages: Mukundpur, Bhatadasi, Rajapakar, Patand, Dohanji, Simbupatti, Mahadevmath, Hajipur, Subhai, Hilalpur, Daulatpur, Daulatpur new tola, Askaranpur



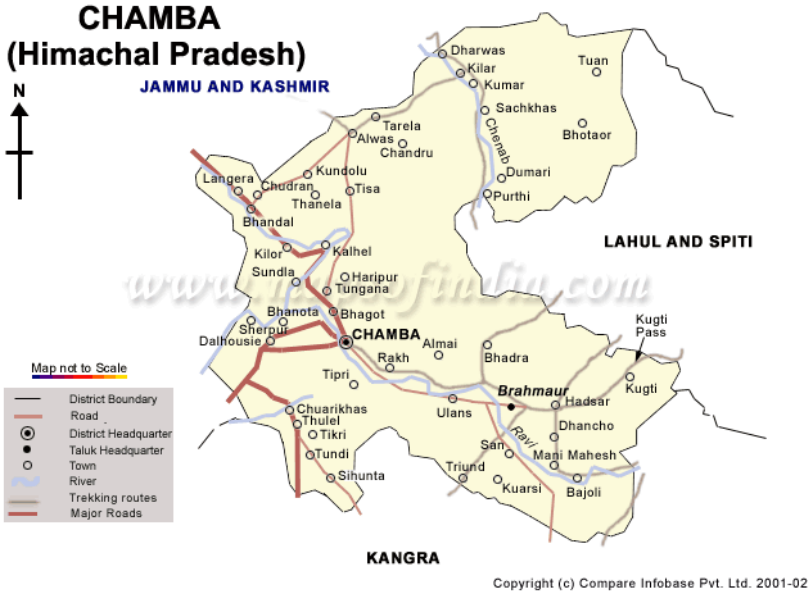
HIMACHAL PRADESH

District Kangra: 5,739 km^2

Villages: Pundar, Mudhi, Birta, Railu, Gaggal, Dhamba, Sornu, Patti, Dharmad, Gadiara, Ambotu, Badghawar, Badsar, Badera, Rajal, Palera, Bari, Behru, Dandesar, Darman, Dhati, Gujrehra, Hanglo, Jamula, Kailashpur, Kasba, Utredh, Dharoon, Gadiyada, Kanal Patt, Pudwa, Palwala, Bhedi

District Chamba: 6,528 km^2

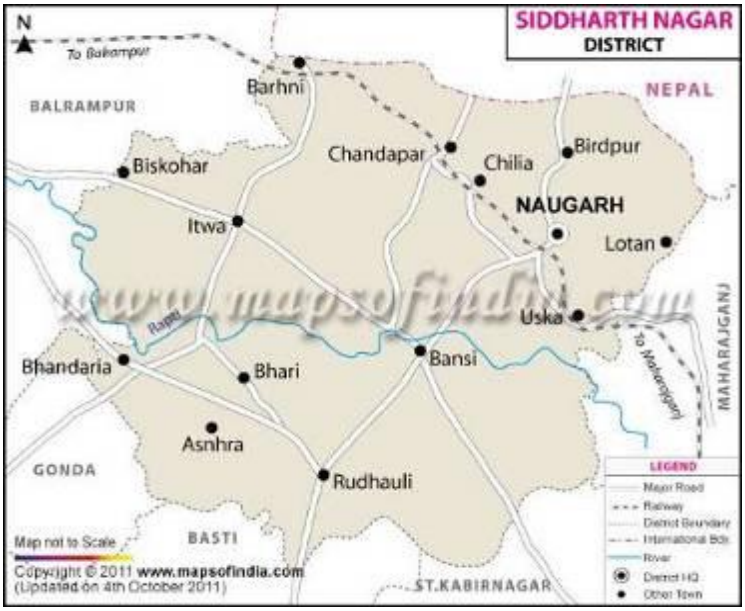
-Villages: Baror, Chamrauli, Bhowen, Biali, Diggar, Gagla, Ghagrauta, Gond, Kundi, Ladda



UTTAR PRADESH

District Siddharthanagar: 2,752 km^2

-Villages: Agaya, Alidapur, Bagulhawa, Chiliya, Dodhwa, Dohriya Khurd, Gajheri, Ganakul, Jamuni, Khunuwa, Khurahuriya, Ledawa, Madrana Khas, Manawa, Mahmudawa, Pakari, Parsohiya, Ramwapur, Sitarampur, Santora, Taniya, Jogibari, Khusmi, Naderpur, Kodertal, Koeri Diha, Narura, Mahali, Palta Devi, Bagahi, Bastiya, Bhagwanpur, Bahrami, Jogipur, Tola Dubripur, Jogiya



District Unnao: 4,561 km^2

-Villages: Dehmu, Adoli, Butaladaulat, Nanduaha, Bhawanipur

District Badaun: 5,168 km^2

- Villages: Jagatpur, Bhutiya, Bangarmau

Relevance of project sites

The project sites were selected on both parameters, those that were practising intensive agriculture like Bihar and UP and those sites like Uttarakhand and Himachal Pradesh , two Himalayan states where agriculture was still largely traditional. In the Himalayan states because of the terrain, high input Green Revolution type agriculture is not yet established. These two agricultural systems were thought to determine the extent to which crop diversity would be conserved and used.

However, there were surprises. In Himachal Pradesh (HP) where there has been commercial agriculture due to the promotion of apple cultivation, there is a strong disengagement from crop based agriculture. The influence of the agriculture university and their promotion of just a few varieties of rice has led to people losing interest in genetic diversity and the need to maintain it.

Uttarakhand remains rich in crop genetic diversity and a region where more investment is required to underscore the relevance of genetic diversity to long term food stability.
Bihar and UP as typical GR areas have moved significantly to HYV but interesting crop varieties with climate adaptive capacities are found here and need to be promoted.
According to the IPCC reports, South Asia is anticipated to be one of the areas most negatively impacted by Climate Change with agriculture and small farmers being most vulnerable.

Agriculture and food production in the Himalayan states is considered to be particularly vulnerable because of their geography, the marginal, somewhat harsh conditions, poor soil

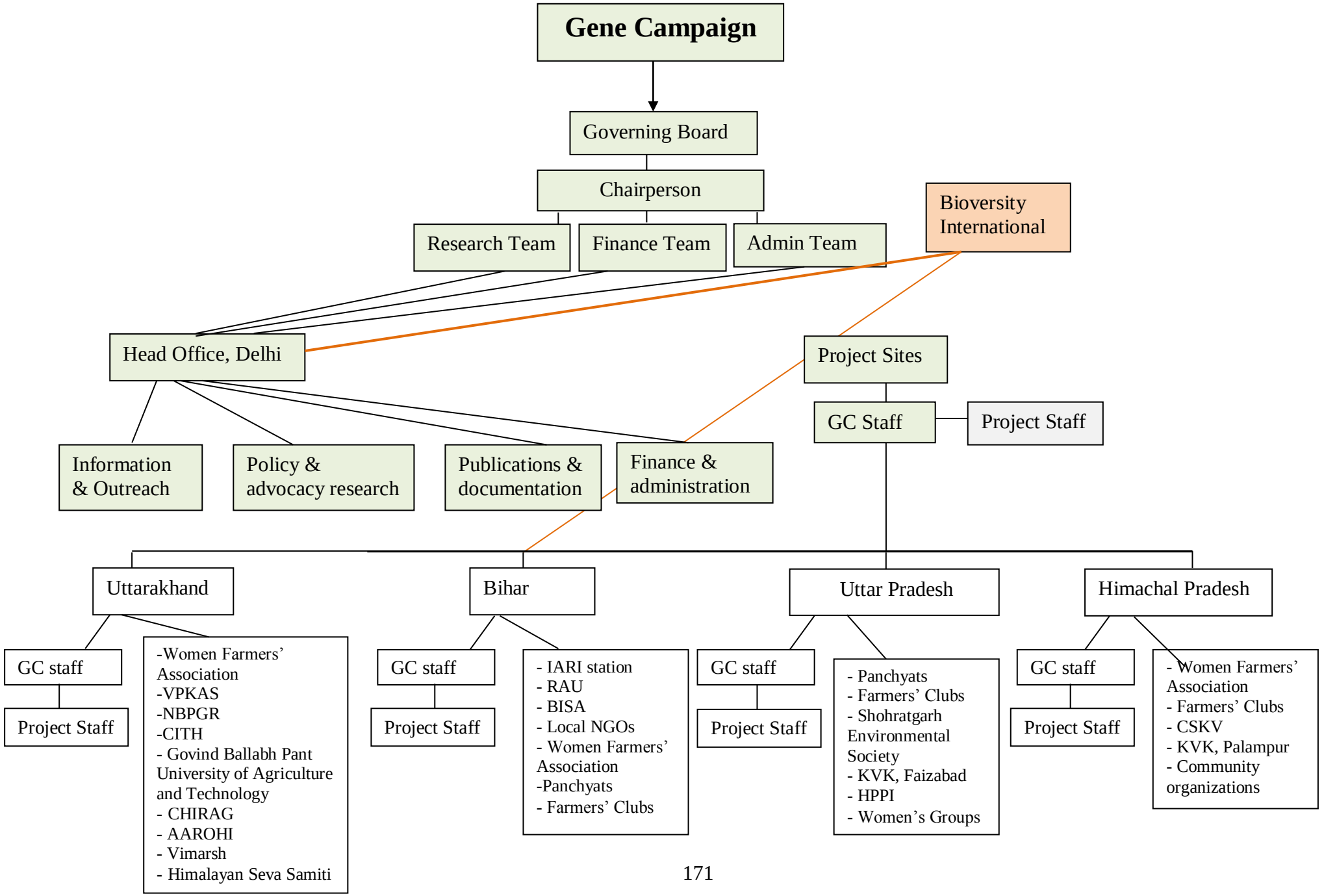
and lack of irrigation potential. Hence these states have a high degree of vulnerability to food insecurity and poverty.

The states in the IGP are also vulnerable to climate change. Climate Change which is resulting in receding glaciers will reduce the amount of water available in the major rivers of the IGP, like the Ganga and Jamuna. These rivers and their tributaries support cultivation in the region and also affect the water table and availability of ground water in areas somewhat further inland.

This has significant implications not just for the states themselves but also for India's food security since both UP and Bihar are surplus producing states that contribute both rice and wheat to the central grain pool and buffer stocks. Any reduction in food production in the IGP will impact India's ability to supply subsidized food to the poor through the Public Distribution System (PDS) and ride out climate calamities.

5. EFFICIENCY

5.1. Project management and administration


Gene Campaign
Governing Board
Chairperson
Research Team
Finance Team
Admin Team
Bioversity International
Head Office, Delhi
Project Sites
GC Staff
Project Staff
Information & Outreach
Policy & advocacy research
Publications & documentation
Finance & administration
Uttarakhand
Bihar
Uttar Pradesh
Himachal Pradesh
GC staff
Project Staff
-Women Farmers' Association
-VPKAS
-NBPGR
-CITH
- Govind Ballabh Pant University of Agriculture and Technology
- CHIRAG
- AAROHI
- Vimarsh
- Himalayan Seva Samiti
GC staff
Project Staff
- IARI station
- RAU
- BISA
- Local NGOs
- Women Farmers' Association
-Panchyats
- Farmers' Clubs
GC staff
Project Staff
- Panchyats
- Farmers' Clubs
- Shohratgarh Environmental Society
- KVK, Faizabad
- HPPI
- Women's Groups
GC staff
Project Staff
- Women Farmers' Association
- Farmers' Clubs
- CSKV
- KVK, Palampur
- Community organizations

Abbreviations:

VPKAS: Vivekananda Parvatiya Krishi Anusandhan Sansthan
NBPGR: National Bureau of Plant Genetic Resources
CITH: Central Institute of Temperate Horticulture
CHIRAG: Central Himalayan Rural Action Group
IARI: Indian Aricultural Research Institute
RAU: Rajendra Agricultural University
BISA: Borlaug Institute for South Asia
SES: Shoratgarh Environmental Society
HPPI: Humana People to People India
CSKV: Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalay
KVK: Krishi Vigyan Kendra (Agriculture Science Center)
HPPI: Humana People to People India

5.2. Co-financing

Co-financing of this project was as planned and mentioned in the proposal.

1. Gene Campaign	72,000
2. Bioversity International	48,000
3. National Bureau of Plant Genetic Resources	23,000
4. Agricultural Universities	18,000
Total	161,000

The contributions by different partners were made as planned , in kind. This was made available in the form of seeds, varieties , genetic material and germplasm, professional skills and know-how, technical expertise, scientific literature, professional time and experience, training programs, monitoring trips as also support from experienced GC staff specifically with respect to conserving seed collections and establishing community seed banks.

6. BENEFITS AND IMPACT

6.1. General perceived benefits and impact

Positive Benefits:

- Four community gene banks are established, operated & being maintained by rural community
- 25 adaptive rice varieties are available to farmers
- Local seed production has enabled better access to seed of both traditional and improved varieties and has strengthened the seed network. More than 400 farmers in Uttarakhand and Bihar have been trained on seed production.
- Increase in rice yield
- Knowledge of more than 10,000 farmers regarding climate adaptation is enhanced

- Four local seed distribution networks established through community seed banks
- 130 farmers were directly trained to maintain and operate the community based documentation system
- 872 varieties of Indian rice germplasm from Gene Campaign collection characterised for climate adaptation
- Twenty traditional rice varieties and 13 varieties of millets (1 kodo millet, 1 foxtail millet, 2 barnyard millet and 9 finger millet varieties) prepared for registration with PVA
- 25 rice and 4 finger millet varieties identified through participatory approach for climate adaptation
- More than 1000 village youth (men & women) trained in managing community seed banks and local seed system networks
- More than 1300 rural men & women and extension workers trained in activities relating to collecting, characterization, evaluation and documentation of local rice diversity for climate adaptation
- 10 seed diversity fairs organised
- Four farmers exchange visits organised
- Two policy dialogs were conducted at national level and two policy workshops were conducted at national level. 3 policy training programs were also conducted at local level.

As a result of this project, farmers have had a chance to work with diversity within crops, test the diversity through participating in trials to see what suits their local conditions. Seed banks have made a wider range of crop diversity than before, available to them. Farmers have participated in community level seed production and learnt how to maintain quality.

Scientific partners have learnt new methodologies and approaches to increasing genetic diversity. They have learnt how to do crowdsourcing with farmers with both traditional and HYV (obsolete varieties) seeds to increase farm diversity and broaden the genetic base on farms.
Scientists and researchers have also been exposed to a new approach to using current genetic diversity in future. The GIS mapping done with GC's rice collection has attempted to predict approximately in which other locations, these varieties could become suitable in future when the climate changes. This prediction was based on climate modelling data predicting the climate in the years 2020, 2040 and 2060.
Researchers have access to germplasm in seed banks, whose properties are broadly known, to use in research and future breeding programs.

The key factors affecting a good project impact have been effective planning and management with building a cohesive project team ; taking the local communities, especially women, on board right from the beginning; consulting village elders about project activities, locating interventions, trouble shooting, monitoring etc and striving to establish a good rapport with different types of stakeholders.

A key factor has been Gene Campaign's motivation to conduct project activities in a thoughtful way because this project speaks to GC's long standing interest and commitment

to conserving and adding values to agro biodiversity. Project goals were consciously linked to farmer welfare which lead to farmer's enthusiasm and participation

Another element resulting in a good impact was the availability of a large number of traditional rice varieties from Gene Campaign's collection. This was the reason we could undertake a quite futuristic analysis with GIS and climate modelling to predict in which new locations these varieties could be adapted when the climate changes in 2020, 2040 and 2060.

There was a good understanding and successful partnership with Bioversity which included regular consultations and coordination on planning and executing project activities. The national partners and collaborating institutions gave their support as did scientific and research establishments.

6.2. Scientific impact (selection, characterization, evaluation, breeding, crossing, technology used etc.)

A number of varieties of rice, finger millet and other crops have become available to the scientific community for scientific research. The characteristics of these varieties (drought tolerance, differing maturity periods etc.) have been documented so they are available for trait evaluation and plant breeding. The research community has access to climate adapted varieties from two distinct ecosystems: the IGP and the Himalayan agro ecosystem.

The successful outcome of the System of Millet Intensification (SMI) has introduced a better crop production system and increased productivity for finger millet which is one of the most climate resilient crops available in India. . The capacity building in PVS and its execution to select varieties has introduced a scientifically valid, more democratic and farmer centred approach to selecting varieties for adaptation to local conditions.

The interaction with research institutions has enabled contacts with scientists which gives the project activities a life beyond the project duration and will be useful in other types of field work. Training in technologies like SMI, PVS, crowdsourcing, GIS mapping, managing seed banks and databases etc. and seeing these in use, have enhanced the skills of the scientists and researchers in the formal and informal system. This enables the scientists to adopt these technologies in the execution of their own research and in their field work with farmers. It also enables them to share these technologies with other scientists and students.

6.3. Economic impact

The crowdsourcing strategy as well as the approach with Participatory Varietal Selection (PVS), gave farmers the opportunity to select from a range of varieties offered to them. Their selection of varieties suited to their local conditions has given them seeds that give higher and more sustainable yields.

The seed banks have given farmers a choice of locally adapted varieties so that they can choose varieties according to the changes in weather thus making their crop production less

vulnerable to failed harvests due to sudden changes in the monsoon, prolonged dry periods etc.
Broadening the genetic base of crops being cultivated in the field at the same time will decrease the incidence of pests and disease as genetic diversity is known to have this effect. This will reduce crop losses and increase the harvest, bringing economic benefit.

The successful adoption of the principles of SRI to finger millets and establishing a System of Millet Intensification (SMI) has shown yield increases anywhere from 19 to 67 percent, depending on the variety. This technology promises great benefits from increased yields in a highly climate resilient, locally adopted crop that is also very nutritious. The SMI intervention has implications for better food and nutritional security of the farm families as well as cash incomes from higher production and potential for surplus generation.

The practice in establishing community led seed production in rice and finger millet; supported by training programs to build capacity in the community has enabled local seed production. This has begun the process of reducing dependence on (sometimes unreliable) external seed sources and varieties supplied that are mismatched to the local conditions.
Farmers have developed the potential to become producers of good quality seeds adapted to local conditions. Seeds produced locally also means new seed networks like farmer to farmer sale and exchange .as well as seed sales to nearby villages.

The presence of seed banks with a range of varieties and local seed production networks also means that varieties can be quickly made available for different kinds of weather conditions. This model is well suited to maintaining contingency seed source for variable and extreme weather conditions.

6.4. Food security impact

Establishing local seed banks , making available a range of varieties with climate adaptive capacities, training and experience in seed production, new technologies like SMI etc to increase production, all contribute to better access of the farming community to seed adapted and suited to local conditions and hence more stable ,increased food production.

Having locally adapted seed translates into more stable food production since the choice of varieties available to deal with last minute changes in weather and monsoon means reduced climate shocks and yield loss. This means more assured food production and better food security.

More secure local food production has obvious implications for increased access to food, especially for small and marginal farmers who do not have the capacity to buy food in times of need. Increased and sustainable local food production is the most effective way of improving access to food for the vulnerable sections.

Establishing the capacity for climate resilient local food production based on varieties selected by farmers (PVS, farm trials, crowdsourcing etc) means farmers have selected what they like and want. As we have seen, many times they (women especially) have selected varieties for taste, aroma, cooking quality, suitability for special dishes for festivals etc. They

also select for medicinal value such as rice varieties suitable for diabetics. Regaining the choice of preferred foods because seeds of certain varieties have become available again has enabled the community to eat what they consider good food.

6.5. Capacity building and empowerment

In order to build the capacity of local farmers and to introduce self-reliance and enhanced ability to increase and secure their food production in times of climate turbulence, a number of training programs were conducted both for farmers and researchers of the area.

Working together with scientists and researchers from scientific institutions on location helped to establish the link between farmers and scientists/researchers nearby. This link can provide farmers access to new and relevant information from scientific institutions pertinent to their food and livelihood security. This link has been an important contribution of the project since under normal circumstances, farmers find it very difficult to access scientists and seek information and troubleshooting guidance from them. This broken farmer- scientist link has been the casualty of the government withdrawing extension services to villages.

Following trainings provided for capacity building:

1. Trainings for farmers and researchers on the use of the services of Kisan Call Center
2. Trainings for researchers on agrobiodiversity, germplasm characterization and trait specific evaluation
3. Trainings for researchers on GIS tools and climate stimulation modelling
4. Trainings for farmers, extension workers and communities on participatory varietal selections
5. Trainings for local communities on conservation and use of crop diversity through farmer field schools
6. Trainings for farmers and local communities on maintaining the seed collection and the seed bank
7. Trainings for farmers and researchers on Database management
8. Trainings for farmers in seed production and multiplication
9. Training programmes for policy makers at national and local levels
10. Trainings on Farmers' Rights

Number of the direct and indirect beneficiaries of the capacity building programs

Direct beneficiaries
-Farmers: 5830
-Womens' Groups: 206
-SHGs: 33
-Farmers' clubs: 30
- Local NGOs: 38
-Policy makers, researchers/ scientists: 68
-Project Staff: 25

Total number of people who directly benefitted from the capacity building programs are 6,230

Indirect beneficiaries
An average of a 1000 individual per village X 202 villages = 202000 indirect project beneficiaries

6.6. Natural resources, environment and climate change

Project interventions have contributed to enhancing the goal of conservation of genetic diversity by effectively mainstreaming the benefits from its appropriate conservation, and management into discussions with policy makers.. Recognizing the importance of agrobiodiversity to climate change adaptation, the project has developed appropriate strategies and actions based on conservation and sustainable use, to ensure that agro biodiversity is made available to communities to supports their resilience and adaptability to stabilise and support their agricultural and food production.

The project has enabled rural communities to adapt and use traditional rice genetic diversity and combined this with the introduction of new varieties/landraces for instance obsolete HYV accessed from the national *ex situ* collections, to broaden the genetic base and build resilience. In addition, the local seed systems have been strengthened thus providing farmers with increased access to diverse varieties for climate change adaptation to secure their food security and the environmental resilience of their production systems in the face of climate change.

Much better access to diverse crop varieties, a more aware and better trained farming and research community a seed system with a more diversified base have helped to strengthen to a reasonable extent the ability of the community to adapt to climate change.

7. SUSTAINABILITY

7.1. Project sustainability

Sustainability of the results achieved in this project and its application to more sites has a fair chance given that national partners have been involved in the project right from planning and execution of the project activities. National institutions have hopefully acquired a stake in ensuring the sustainability of the results since it is in line with the national goals of climate change adaptation as also enunciated in official policy the National Action Plan on Climate

Change (NAPCC). With the government's involvement, adequate financial, human and institutional resources should be available to ensure the sustainability of the results.

Dr Sahai is a member of the National Agrobiodiversity Management Committee (NAMC) and will use this platform to reiterate the need to adopt and continue with such interventions for climate change adaptation and better food security and also try to include it in the policy framework for agro biodiversity.

7.2. Country ownership/synergies

The project goals and outcomes are consistent with commitments regarding farmer and community rights, biodiversity conservation and access and benefit sharing made in national legislation. The project activities take forward the goals of the four relevant missions which are part of India's national strategy for climate change adaptation as enunciated in the National Action Plan on Climate Change (NAPCC). Specifically these are the National Mission for Sustaining the Himalayan Ecosystem, National Mission for a "Green India", National Mission for Sustainable Agriculture, and National Mission on Strategic Knowledge for Climate Change, all of which have the conservation and sustainable use of biodiversity at their core.

The project outcomes are in consonance with the goals and objectives of the International Treaty on PGRFA and also address the goals of the Global Plan of Action for the Conservation and Sustainable Utilization of PGRFA, and the Global Strategy for Plant Conservation of the Convention on Biological Diversity (CBD). The conservation of agrobiodiversity in this project contributes to several of the UN Millennium Development Goals by combining biodiversity conservation and environmental sustainability with eradication of extreme poverty and hunger.

The experience and demonstration that using agrobiodiversity makes agriculture production more sustainable, should enable a high financial value to be put on this crucial resource and give it the prominence it deserves as a critical adaptation tool for communities who have to deal with climate change and declining food availability.This will help to put realistic figures on the value of PGR and raise the component of benefit sharing accruing to rural and tribal communities.

Gene Campaign (Dr Sahai) is a member of the ABS committees of the National Biodiversity Authority and the Plant Variety Authority of the Government of India. The lessons and experiences gained from this project will be shared directly with both committees and help to guide policy with respect to PGR conservation and sustainable use as well as the rights of farmers over PGR and benefits accruing from its commercial exploitation.

This work should very much strengthen support to the CG system and to International Agricultural Research Centres by demonstrating the value of genetic diversity to securing sustainable food per se and particularly so when faced with climate turbulence. Such demonstrations should underscore the crucial need for international support to keep germplasm collections and Gene-Seed Banks as well as the Treaty that governs their use, strong and vibrant.

7.3. Innovation, scaling up and replicability

Some of the most innovative strategies and methods used in this study and that are really worthy of scaling up and replication, are the following:

-Using GIS mapping along with climate modeling data applied to 872 samples of traditional rice varieties so as to predict in which locations these varieties would become compatible when the climate changes, as predicted, in the years 2020, 2040 and 2060.
This futuristic study underlines very emphatically the value of having access to genetic diversity to cope with changing climatic conditions far into the future. This mapping exercise shows the different locations where the germplasm could become suitable for cultivation in future, based on the anticipated changes in the climate in those locations which would become similar to the climate conditions of today where the germplasm is currently found.

-Adapting the principles of SRI (transplanting older seedlings and spaced planting) to finger millets in a System of Millet Intensification (SMI) which has shown significant yield increases. For the full report, see **Annexure 13.**

-Participatory Varietal selections (PVS) which was greatly appreciated by farmers because it gave them the opportunity to select from many varieties in cultivation, what they liked for their peculiar cultivation practice.

-The crowdsourcing approach which exposes farmers to new varieties every season and allows them to choose what they like.

There is great potential for project results to be scaled up by government agencies and donor agencies because of the enthusiastic adoption of agrobiodiversity and its management by farmers who have had a chance to revive their knowhow and seen that it remains a viable and effective tool to secure their food availability.

7.4. Exit strategy and follow up work

Gene Campaign has put all project outcomes on the website to make it widely available for debate and discussion and to encourage the replication of one or the other technology or activity in other parts, especially diversity rich parts of the country. GC is prepared to provide training and capacity building in collection, characterisation and conservation of germplasm as well as establishing Gene- seed Banks.

GC is also committed to monitoring the germplasm collection in the master seed bank and increasing the collection year for year. It has plans to share the germplasm collections with the national gene bank as well as the state unit of NBPGR in Uttarakhand and is in touch with both.

Characterised germplasm and unique accessions will be made available to researchers and plant breeders.

The regular training and capacity building programs of local partners and participants as well as the participation of local institutions and organisations in one or more project activities has provided skills to groups and organisations to engage post project in conservation and sustainable use of genetic diversity of crop plants of relevance to their agriculture production systems and their food security.

Being involved in project activities has provided groups and individuals a good idea of the rationale of agro biodiversity conservation and how it gives them options to cope with climate change and to food security. This should provide an incentive to follow up on initiatives begun in the project period.
GC's linkages with several stakeholders in each of the 4 project sites has created channels for future collaboration on related work , should there be opportunity, interest and support.

GC will certainly continue with most activities related to agro biodiversity undertaken in the project period because it has a long term commitment to the collection, characterisation and conservation of germplasm for sustainable food security, with or without taking climate change into account. There are several stressors in agriculture and food production in India and having access to genetic diversity eases some of those stressors and helps communities to better stabilize their food production.

Further work will certainly continue on PVS and SMI since these interventions were very well received by farmers who saw a direct benefit to their food security, their animal husbandry and in some cases, generating market surplus for additional incomes.
Bioversity and GC will continue the crowdsourcing approach to increasing genetic diversity on farm.

Good practices and lessons learned during the project will be disseminated and scaled up to other sites.

The project period of two years is clearly insufficient for a project dealing with crops and agriculture. Two years means under normal circumstances, just 2 crop cycles which is not sufficient to make a substantial impact or introduce viable change and good practices. The duration of such projects should be at least 3.5 years.

8. BEST PRACTICES AND SUCCESS STORIES

Best Practices

The project activities culminated in several good practices and success stories that can provide leads to other researchers and can be carried forward into other projects and field interventions.

-Conducting the detailed baseline surveys on climate change perceptions was very educative for the farming communities. It raised awareness and helped the community to articulate and define more precisely what they were facing. This led to their becoming aware of the urgency of climate change impacts and their need for adaptive response

- the study on seed systems was another important intervention .It helped to bring into focus for the community the extent to which they were losing the range of varieties they had earlier and how this had increased their vulnerability and external dependence. Such studies should be done to highlight how communities will become increasingly vulnerable when crop genetic diversity is lost.

- The overall focus of the project on agro biodiversity and the repeated iteration of its importance as a survival tool for communities that are pressured by external factors like climate and other stresses, gave this resource a value and prestige that it has steadily lost over time. This has been a valuable sensitisation particularly since the formal system accords neither value nor prestige to keeping alive and using traditional crop varieties.

SUCCESS STORIES

The project activities have made some significant contributions related to understanding the community's perception about the value of genetic diversity to their food security in today's climate stressed situation. The success achieved with certain specific interventions can be replicated, transferred across regions and used by other researchers and stakeholders. Given the inclusive and participatory manner in which the project has been implemented, project outcomes are shared widely and are accessible to anyone who wants to use the data generated and methodologies used.

Some specific examples:

-The four community seed banks have been greatly appreciated by the farming community who now have access to seed of the kind they had lost and now feel the need for. The training provided to maintain the seed collection and use the bank has equipped the local community to sustainably use and maintain, perhaps add to the collection.

Farmer Rajendra Singh from Palampur, Himachal Pradesh said, *"The University only provides seeds of high yielding varieties which are developed by scientists. These varieties are good for yield but not for health. The traditional varieties were more nutritious. Farmers can cultivate hybrid and high yielding varieties to make money but for good health we need to eat our old varieties. I have been searching for seeds of traditional varieties for many years but could not find them. Now with Gene Campaigns' initiative to collect traditional varieties in the seed bank, we will be able to get seeds of the old varieties and start cultivating them again."*

-The master seed bank in Uttarakhand in particular is a valuable asset that will take forward the collection and conservation of genetic diversity, add to the national collection, help to maintain and increase on farm conservation and make available locally adapted germplasm to the community from time to time.
The seed samples conserved in the bank also make available to scientists and plant breeders well characterised varieties for trait evaluation and breeding of new plant varieties for future needs.

Farmer Devki Devi is fond of traditional millets. When she visited the seed bank, she was very happy to see traditional varieties of “Koni” (Foxtail millet), “Cheena” (Proso millet) and “Madua” (Finger millet). According to her, *“These varieties were once common but today they are hard to find. Seeds of old varieties are difficult to get and are very costly but now we are getting them free of cost from the community seed bank.”*

-One big success of the project has been to revive interest in crop genetic diversity and underscore its importance as a resource that provides options to the farmers to ride out this or the other kind of inclement weather or uncertainties in the climate. Older farmers know the value of crop diversity but the project focus on diversity not only validates their position, it educates the younger farmers.

Farmer Radha Katoch from Himachal Pradesh said*, “People are moving away from farming in this village due to frequent hailstorms. Seeds of traditional varieties which were resistant to hailstorms are no longer available. Most of the farmers are growing high yielding varieties in this village which they say are not really suited to the local climate. Thanks to Gene Campaign’s efforts, a seed bank has been established in which traditional varieties of our area are being collected and conserved. We look forward to planting those old varieties again which can withstand hail.”*

-An aspect of the collection of seeds and the indigenous knowledge associated with it, brought forth before the community how knowledgeable women were about genetic diversity and how this knowledge was an asset in selecting and sourcing seeds of appropriate varieties when faced with farm stress. This realisation has helped to improve the status of women as holders of knowledge.

-The return of varieties to the communities that have cultural and religious significance has been much appreciated

Farmer Samudra Devi from Bihar said *“Traditional rice varieties are an important part of our culture. They are used to perform rituals during religious festivals. Seeds of traditional varieties are vanishing and we are facing difficulties to continue with our cultural practices. With the help of the seed bank setup in our area, we will be able to restore lost traditional varieties and prevent our cultural heritage from disappearing. Thanks to this support, we can also conserve seed for future needs.”*

-Crowdsourcing as a strategy was used successfully in Bihar and UP to provide farmers with new varieties each season, to adopt or reject according to their preferences. This approach succeeded in broadening the genetic base of cultivation and where only two varieties were being used, now eight to ten varieties have been adopted for cultivation by farmers.

-Conducting Participatory Varietal Selection (PVS) trials with farmers was a great hit especially in Uttarakhand. Farmers were delighted they got the opportunity to see a number

of varieties growing in one place and could select according to their needs. Some chose for straw/fodder quality, others for grain. Farmers said that usually scientists did the selections and just told them this or the other variety was good for them, which may or may not have been so. PVS gave them the option to make their own choices.

- The seed diversity fairs must count as a success among project interventions. They created a platform for interaction and exchange between farmers who generally don't meet and gave them a channel to share and exchange seeds, knowledge and cultivation practices. Farmers are scientists and happy to try out new varieties. The diversity fairs showed them different types of seeds which they probably would not have had easy access to and created a network of custodian farmers who were maintaining and cultivating traditional and other varieties.

-Farmers have been trained in the use of an effective communication tool set up by the government and over 500 farmers have been linked to the Kisan Call Center (Farmers Call Center). This is a very good means by which farmers can communicate with scientists and technical experts to ask questions and seek advice. Scientists in turn can communicate with farmers in order to get feedback from the field in different regions relating to seeds, agriculture inputs, cropping cycles, etc.

All the good practices, innovative approaches used and outputs achieved are shared via the GC website and are accessible to everyone who is interested. In addition, CDs and booklets have been prepared for dissemination.

* A booklet on "Responses from the Community" is attached as **Annexure 14.**

9. LESSONS LEARNED AND CONCLUSIONS

This project by and large achieved the objectives that the proposal had set out to do.

A key lesson for all of us who work in the field is to respect and include the rural community with whom we aspire to work. Not confusing illiteracy with ignorance and acknowledging that rural and tribal communities are repositories of knowledge and have a rich fund of experience is essential.

Our taking the local communities, especially women, on board right from the beginning; consulting village elders about project activities, locating interventions, trouble shooting, and monitoring etc established good relations with the communities who felt respected and included and gave us their support in implementing project activities.

Equally important reasons contributing to a successful outcome of this project were the attention paid to effective planning and management, as well as building a cohesive project team. Good rapport with partners and stakeholders has been an important contributory factor. The collaboration between Gene Campaign and its partners at all levels has been very good. GC staff and project staff worked closely with partners and stakeholders and succeeded in building an excellent working relation with them. Stakeholders therefore offered

their support and cooperation which was a very important reason for the successful implementation of all project activities.

Dr Suman Sahai (Gene Campaign) and Dr Prem Mathur (Bioversity International) both scientists trained in genetics and plant breeding and hence are familiar with the network of scientists in the ICAR research institutes and various agriculture universities across the country. This has helped to build good partnerships with scientists.

There was a good understanding and successful partnership with Bioversity International which included regular consultations and coordination on planning and executing project activities. The national partners and collaborating institutions gave their support as did scientific and research establishments.

In addition to this, GC has a long history of working in rural areas and brings 20 years of experience in working together with rural and tribal communities. It has built good collaborations with women's groups, local NGOs and community based organizations in different areas. All these factors have helped to facilitate the conduct of project activities and ensured good outcomes.

A key factor also has been Gene Campaign's motivation to conduct project activities in a thoughtful, dedicated way because this project speaks to GC's long standing interest and commitment to conserving and adding values to agro biodiversity. Project goals were consciously linked to farmer welfare which led to farmer's enthusiasm and participation

Another element resulting in a good impact was the availability of a large number of traditional rice varieties from Gene Campaign's collection to use in studies and evaluations. This was the reason we could undertake a quite futuristic analysis with GIS and climate modelling to predict in which new locations these varieties could be adapted when the climate changes in 2020, 2040 and 2060.

An inherent problem faced in this project is systemic to the issue of crop genetic diversity in India. The agricultural research system remains committed to the Green Revolution model of increasing yield as the primary goal. India's vulnerability on the fronts of poverty and hunger reinforce the primacy of increasing food production at all costs. Here technologies are acceptable as a means of increasing food production but broadening the genetic base to make agriculture climate resilient, is not.

Although the National Agrobiodiversity Management Committee has been set up, the focus of conservation remains ex situ in the form of the national gene bank. On farm conservation and sustained use of crop genetic diversity as an enabling strategy to stabilize food production, especially in climate turbulent times, requires greater attention.

Future directions

-In my view it would be useful to conduct trait evaluation studies with rice and millet germplasm to screen varieties for valuable traits like drought tolerance and resistance/tolerance to specific diseases.

-Doing biochemical analysis and nutrition profiles of rice and millet germplasm would be another useful exercise. High value varieties like those with low GI (Glycemic Index) (good for diabetics), those varieties with high levels of micronutrients and proteins would have an obvious market value and bring cash incomes to farmers. This would serve as an incentive for the conservation of germplasm.

-Along with rice, finger millet needs attention as a climate resilient and nutritious crop that can grow in marginal conditions. Further studies to establish SMI as a cultivation model to increase yield would increase the acceptance of this important but neglected grain.

- Programs to introduce traditional varieties into the food basket based on their special properties would be an incentive for their conservation and use.

10. PLAN FOR INCLUSION OF MATERIAL IN MLS AND MAKING INFORMATION PUBLICLY AVAILABLE

10.1. The Governing Body of the International Treaty decided, at its Third Session, that plant genetic resources for food and agriculture listed in Annex 1 of the International Treaty resulting from projects funded by the Benefit-sharing Fund shall be made available according to the terms and conditions of the Multilateral System, and information generated by projects funded through the Benefit-sharing Fund shall be made publicly available within 1 year of the completion of the project. These requirements are reflected in the general provisions (m) and (n) of the Letter of Agreement signed with your institution

10.2. Provide details on the plan you will implement for the inclusion of plant genetic resources for food and agriculture listed in Annex 1 of the ITPGRFA that may result from the project into the Multilateral System. You could consider the following options:

The accessions collected during the project are already in the process of being included in Gene Campaign' s Zero Energy Gene- Seed Bank in Uttarakhand and Jharkhand.
The accessions collected during the project as well as 298 traditional varieties of lowland, medium land and upland rice are being finalized for deposit in the national gene bank in Delhi.

GC is in correspondence with NBPGR (see email) to provide some additional data as requested and as soon as that is done, the deposits will be made.

Genecampaign.

From: kailash <kailashbansal@hotmail.com>
Sent: Wednesday, January 14, 2015 1:32 PM
To: mail@genecampaign.org
Cc: dg.icar@nic.in; director nbpgr; rktyagi
Subject: Rice seed collection
Attachments: blank passport sheet.doc

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Dr. Suman Sahai:

Thanks for your email marked to Dr S Ayyappan, Director General, ICAR, New Delhi, and expressing your interest to deposit rice germplasm in the National Genebank at NBPGR. We appreciate this kind gesture and would welcome the deposit. However, to avoid any duplication in the Genebank, it is requested to send the list of the accessions along with the passport data in the Format that is attached. As you know, the passport data is pre-requisite for assigning the national ID to the accessions.

The date and time of deposit of the germplasm will be decided as per the convenience and availability of our Hon'ble DG, Dr S Ayyappan.

With best regards

Sincerely

KC Bansal
ICAR-NBPGR

10.3. Provide details on the plan you will implement to make information generated by the project publicly available.

All information and data generated during this project is being put on the GC website under a dedicated icon.

CDs of all the results and reports have been made to distribute to interested institutions and organisations.

A booklet recording the response of the community to project interventions has been prepared to share with interested stakeholders, donor organisations, national institutions etc.

*All the visibility materials made during the project is attached as **Annexure 15**.

11. SIGNATURE

Suman Sahai

Contact person (Name, position)

Dr. Suman Sahai
Chairperson

Suman Sahai

Author of this report (name and position).

Dr. Suman Sahai

This report must be signed by: i) the contact person; and ii) the responsible designated for monitoring the project as per information provided in the Project Proposal Form.

Explicatory note: Please indicate the name and the position of the person who is signing. Any variation with the information provided in the Project Proposal Form should be reported to the Secretariat of the IT-PGRFA.

12. ANNEXES

ANNEX 1: LOGICAL FRAMEWORK					
	Intervention logic	**Objectively verifiable indicators of achievement**	**Sources and means of verification**	**Assumptions**	**Status** ***Not achieved*** ***Partially achieved*** ***Well achieved*** ***Fully achieved***
Overall objective	Ensuring poor farmers' food security and the environmental resilience of their production systems in the face of climate change through the use of rice genetic diversity.	Four community gene banks established, operated & maintained by rural community. More adaptive rice varieties available to farmers Stronger seed systems Sustained/increased rice yield	Impact assessment reports Project reports Publications Websites	Willingness of all stakeholders to participate in the project	Fully achieved Fully achieved Fully achieved Partially achieved
Specific objectives	1 To explore means for strengthening link between national and community genebanks and local farmers in the context of adaptation to climate risks 2 To understand social and cultural barriers to adoption of adapted varieties and explore effective means of introducing new adapted plant genetic resources. 3 To understand the role of national and local seed systems in enabling adaptation under changing production constraints 4 To strengthen capacity of local institutions and farmers for climate variation adaptation and conservation of crop diversity 5 To set up community based gene bank and information dissemination system	More diversity maintained on farm Farmers knowledge regarding climate adaptation enhanced Four local seed distribution networks established Community based documentation system maintained and operated by communities	Availability of data through national database and relevant publication Scientific publication, project reports		Well achieved Fully achieved Well achieved Fully achieved
Outputs	1 Challenges presented by climate change for rice cultivation in Indo-Gangetic Plains assessed. 2 Rice diversity for climate change adaptation through use of GIS technologies, climate change prediction models and farmers' participation identified for project sites 3 Genebank accession-level climate suitability and evaluation database established at community level. 4 Framers varieties identified for climate resilience registered with Plant Variety Authority (PVA) of India. 5 Adaptive crop diversity validated and used by farmers for climate risks adaptation. 6 Participatory plant variety selection programmes in place	GIS modelling available and climate matching sites documented 112 varieties of Indian rice germplasm characterised for climate adaptation Twenty traditional rice varieties and 13 varieties of millets given for registration with PVA Twenty five varieties identified through participatory approach for climate adaptation Four community based database established	Scientific publications and project reports and articles in newspapers Policy fact sheets Notes from the web page/discussion blog maintained by the project	No extremely adverse climate conditions or civil unrest occurs during project implementation	Fully achieved Fully achieved Fully achieved Fully achieved Fully achieved

	that use climate adaptive diversity superior in marginal environments. 7 Easy communication tools developed and deployed which allow researchers and farmers to access information about crop genetic diversity and associated climatic information. 8 Developing and mainstreaming database to improve access to information on local genetic diversity along with associated climate information. 9 Community seed banks established at each project site to facilitate local access to PGR. 10 Community-based seed production organized for adapted materials. 11 Researchers and other users trained in the use of tools for rapid screening of germplasm, Geographic Information System (GIS), climate-based models and other areas important for ensuring project outputs. 12 Enhanced capacities of farming communities networked across project sites, in selecting & deploying adapted rice germplasm. 13 Leadership and capacity built to enable a higher level of involvement of indigenous and local communities in local and national decision-making fora related to climate change adaptation. 14 Recommendations to put policies and laws in place that ensure access to local crop biodiversity is compatible with national laws promulgated to comply with international treaties suggested.	More than 1000 village youth (men & women) trained in managing community seed banks and local seed system networks At least 1300 rural men & women and extension workers trained in activities relating to collecting, characterization, evaluation and documentation of local rice diversity for climate adaptation 10 diversity fairs organised Five farmers exchange visits organised Two policy training programme in national level and three policy workshops at local level organised. Also 2 policy dialogues for climate adaptation were conducted at national level.			Fully achieved Fully achieved Fully achieved Fully achieved Well achieved Well achieved Fully achieved
Activities	• Evaluate current and future rice production potential using GIS based prediction models (US$ 7,000). • Select pilot sites based on major discrepancies between current and projected future production potential (US$ 3.000). • Compile and synthesis information for characterization and evaluation of existing diversity to adapt to climatic variations (US$ 4,000). • Characterization of farmer variety with climate resilient trait(s) for registration with PVA (US$ 5,000). • Developing rice cultivation suitability models to allow identification of genebank materials best suited to	GIS modelling available and climate matching sites documented 112 varieties of Indian rice germplasm characterised for climate adaptation Twenty traditional rice varieties and 13 varieties of millets given for registration with PVA Twenty five varieties identified through participatory approach for climate adaptation Four community based database established	Scientific publications and project reports, fact sheets Notes from the web page/discussion blog maintained by the project	• Local level partners and communities motivated to join project Incentives identified can be provided within project	

	changing environmental conditions (US$ 6,000). • Document information on the identified accessions (US$ 5,000). • Undertake on farm trials to identify varieties/landraces suitable for climatic variations (US$ 60,000). • Initiate participatory variety selection programmes based on farmers' preferences to adapt to climatic variation (US$ 20,000). • Development of user friendly communication tools for researchers and farmers (US$ 10,000). • Undertaking house hold surveys to document indigenous knowledge and local seed system (US$ 5,000). • Collection of local rice germplasm and establishing community seed banks (US$ 40,000). • Information gathering and establishing database at each project site (US$ 2,000). • Organization of seed diversity fairs (US$ 5,000). • Developing/strengthening local seed-distribution systems (US$ 3,000). • Plan for multiplication of adapted crop diversity for distribution in future. • Organise training programmes for researchers (US$ 10,000) • Training for farmers, extension workers and communities for participatory plant variety selections (US$ 12,000). • Exchange visits of progressive farmers across project sites (US$ 10,000). • Establishment for farmers Field Schools for training of local communities on conservation and use of crop diversity (US$ 30,000). • Workshops/training programmes for policy makers at national and local levels (US$ 5,000). • Organization of policy dialogues for climate adaptation (US$ 5,000).	More than 1000 village youth (men & women) trained in managing community seed banks and local seed system networks At least 1300 rural men & women and extension workers trained in activities relating to collecting, characterization, evaluation and documentation of local rice diversity for climate adaptation 10 diversity fairs organised Five farmers exchange visits organised Two policy training programme in national level and three policy workshops at local level organised. Also 2 policy dialogues for climate adaptation were conducted at national level.		conext	

ANNEX 2: MONITORING QUESTIONNAIRE

Assessing performance in project implementation
Monitoring Questionnaire

Section A: General information

1. Letter of Agreement number: PR-LoA/TF/PR- 113/INDIA/2012/AGPMT

2. Project title: Using rice genetic diversity to support farmers' adaptation to climate change for sustainable production and improved livelihoods in India

3. Start date 22.05.2012

4. End date 22.11.2014

5. Implementing institution (name): Gene Campaign

6. Type of the implementing institution:

- ☐ Governmental organization
- ☐ National research institute
- ☐ International research institute
- ☐ University
- ☒ National non-governmental organization (NGO)
- ☐ International non-governmental organization
- ☐ Gene bank
- ☐ Other

7. Target country/ies: India

8. Crop/s addressed: Rice & Finger Millet

Section B: Project characteristics

9. Indicate the districts/villages covered by the project activities and their extension in (km²):

UTTARAKHAND

District Nainital: 3860 km^2
- Villages: Buribana, Chaukhuta, Gajar, Kaul, Kokilbana, Majhera, Parbara, Pokhrar, Sunkiy, Badet, Bairoli, Bajothiya, BoharaKot, Dahra, Dadima, Gairadi, Galla, Gargaon, Harinagar, Hartola, Jhutiya, Kafuda, Kilor, Kumati, Lod, Loshgyani, Mauna, Myaura, Nathuwakhan, Naikana, Orakhan, Satkhol, Simayal, Supi, Suralgaon

District Almora: 3082 km^2
- Villages: Dhyari, Daniya, Chamtola, Bhanoli ,Dungra, Jaiti, Birkham, Chaukuna, Ganau

District Bageshwar: 2302 km^2
- Villages: Gar-shakira, Chougaunchina, Ganotiparli, Agar, Chona, Belori, Karala, Bholnanagar, Kabhara, Bhatkhola, Jadh, Jatha, Kabhara, Okhalisirod

District Pithoragarh: 7110 km^2
- Villages: Dungari, Sann, Dwalisera, Pipli, Dhamigaon, Pankholi

BIHAR

District Muzaffarpur: 3173 km^2
- Villages: Bishunpur Bakhri, Chimnapur, Dharmagatpur, Kathauli, Malpur Agrail, Balua, Markan, Kharauna, Dwarkapur, Nigopur, Mahammadpur Lalse, Pilkhi Gajpatti, Sambaha, Dholi, Itha Rasulnagar, Bakhri, Bedhipur, Chakdah, Ganiari, Keshopur, Mundiari, Saraiya, Chhapra Bahar, Donwan, Bharwari, Firozpur Asli, Katesar

District Samastipur: 2904 km^2
-Villages: Bhagwanpur, Bhairo patti, Harpur Mohamda, Sekhopur, Dighra, Gopalpur, Jagdishpur, Morsand, Nawa Chak, Pusa Deopur

District Vaishali: 2,036km^2
- Villages: Mukundpur, Bhatadasi, Rajapakar, Patand, Dohanji, Simbupatti, Mahadevmath, Hajipur, Subhai,

Hilalpur, Daulatpur, Daulatpur new tola, Askaranpur

HIMACHAL PRADESH

District Kangra: 5,739 km^2
- Villages: Pundar, Mudhi, Birta, Railu, Gaggal, Dhamba, Sornu, Patti, Dharmad, Gadiara, Ambotu, Badghawar, Badsar, Badera, Rajal, Palera, Bari, Behru, Dandesar, Darman, Dhati, Gujrehra, Hanglo, Jamula, Kailashpur, Kasba, Utredh, Dharoon, Gadiyada, Kanal Patt, Pudwa, Palwala, Bhedi

District Chamba: 6,528 km^2
- Villages: Baror, Chamrauli, Bhowen, Biali, Diggar, Gagla, Ghagrauta, Gond, Kundi, Ladda

UTTAR PRADESH

District Siddharthanagar: 2,752 km^2
-Villages: Agaya, Alidapur, Bagulhawa, Chiliya, Dodhwa, Dohriya Khurd, Gajheri, Ganakul, Jamuni, Khunuwa, Khurahuriya, Ledawa, Madrana Khas, Manawa, Mahmudawa, Pakari, Parsohiya, Ramwapur, Sitarampur, Santora, Taniya, Jogibari, Khusmi, Naderpur, Kodertal, Koeri Diha, Narura, Mahali, Palta Devi**,** Bagahi, Bastiya, Bhagwanpur, Bahrami, Jogipur, Tola Dubripur, Jogiya

District Unnao: 4,561 km^2
- Villages: Dehmu, Adoli, Butaladaulat, Nanduaha, Bhawanipur

District Badaun : 5,168 km^2
- Villages: Jagatpur, Bhutiya, Bangarmau

10. Rank the level of vulnerability of the targeted areas / regions involved with respect to:

1. Food insecurity	☐ Low	☐ Medium	☒ High
2. Poverty	☐ Low	☐ Medium	☒ High
3. Climate shocks	☐ Low	☐ Medium	☒ High
4. Genetic erosion	☐ Low	☒ Medium	☒ High

11. Select the characteristics that better describe the approach of this project and give a short justification/example, if possible supported by data/numbers:

☒ Multi-sectoral and participatory [1]
The project has been conducted in an inclusive manner, involving all stakeholders and in participatory mode where there was regular interaction with stakeholders and the target population. Channels were created through project staff to receive inputs and suggestions, including for trouble shooting.
The project activities were conducted in collaboration with research scientists, field researchers, educational institutions, local NGOs and community based organisations, panchayats (local self government bodies), mahila samuhs (women's groups), women's and men's self-help groups (SHGs), farmer clubs and individual farmers.

[1] A multi-sectoral approach implies the involvement of multiple sectors of the society, as well as coordination and development of partnerships. Participatory refers to the inclusiveness of all project stakeholders as well as of those directly concerned and/or affected by project activities.

These agencies were also involved in monitoring some field activities and their inputs were sought for preparing the final report.

☒Gender sensitive [2]

Care was taken to include women's views, their needs and their areas of interest in all aspects of agriculture. The gender component of all activities like access to seeds and genetic diversity, participation in trials, position in seed networks etc was ensured. Women were included in all skill and capacity building activities and their perceptions on aspects like climate change and the value of traditional varieties and genetic diversity were noted as they were for men.

Women either collectively or individually were involved in all activities their views were sought in designing, implementing and monitoring activities, as also discussing the results.

In those states where women are not able to be as forthcoming as they would like, due to the social and cultural mores and restraints, such as obtains in Bihar and Uttar Pradesh, the project teams made a special effort to include women by organising separate workshops, trainings and discussions for women farmers. The team also took the trouble to understand the needs of women and elicit their views and responses in their homes rather in open or public spaces where they were constrained. Women in the mountain states of Himachal Pradesh and Uttarakhand are able engage freely in public so it was not difficult to include them and their needs.

☒Community based[3]

The project was formulated in the way that it was because of a broad understanding of the problems the rural community is facing with agriculture and food production, the manner in which climate change is beginning to impact agriculture in different agro ecological zones and the growing genetic erosion reducing farm choices.

Having worked with farming communities, GC is familiar with the problems of small and marginal farmers, their lack of access to quality seed and inputs, as well as their inability to restore lost crop varieties.

Before starting project activities, our interactions with village elders, group discussions with the communities and some interviews with key persons reinforced our impressions and gave us an insight into the current thinking, needs and aspirations of the farming communities in each of the regions.

☒ Complementary / synergic[4]

[2] This approach integrates gender perspective in project activities, pays particular attention to the differential experiences and views of women and men and creates equal opportunities for participation in project activities.

[3] This approach constantly involves local communities in project activities, shapes interventions on assessed local needs and builds on collective strengths and shared resources.

[4] This approach integrates and builds on activities of existing programmes and/or projects that address the same objectives.

☒ Integrated[5]

12. Indicate who are the partners involved in the implementation of this project and specify:

Name of the partnering institution	**Type of the institution[6]**	**Areas of collaboration**
Bioversity International	International Research Institute	Planning and implementation; conducting the crowd sourcing trials and field trials of HYV to evaluate performance and farmer preference, training programs and technical support
Mahila Kisan Samitis, Uttarakhand	Women farmers Associations	Participating in project activities, engaged in monitoring activities, collecting genetic diversity and disseminating information about the value of genetic diversity to climate resilience, sustainable agriculture and food security. Involvement in setting up seed bank
Vivekananda Parvatiya Krishi Anusandhan Sansthan (Vivekanand Mountain Agriculture Research Center), Almora	Institution of Indian Council of Agricultural Research	Training programs , technical support
NBPGR, Bhowali	Agricultural Research Institute	Provided seeds of traditional and improved varieties of finger millet varieties for trials
Central Institute of Temperate Horticulture (CITH), Mukteshwar	Institution of Indian Council of Agricultural Research	Scientists provided trainings
Govind Ballabh Pant University of Agriculture and Technology, Pantnagar	Agricultural university	Training programs and technical support
Central Himalayan Rural Action Group (CHIRAG)	Non-governmental organization	Participation in collecting genetic diversity, awareness generation about genetic diversity and the need to conserve it
Aarohi, Nainital	Non-governmental organization	Awareness generation about project activities

[5] This approach puts together interventions that deal with different aspects of the same problem from a multisectoral and multidisciplinary perspective.

[6] For example: Governmental organization, national research institute, international research institute, university, national non-governmental organization (NGO), international non-governmental organization, gene bank etc.

Vimarsh, Nainital	Non-governmental organization	Disseminating information about the value of genetic diversity and farmers rights
Himalayan Seva Samiti (HSS), Kumaon	Non-governmental organization	Awareness generation
IARI regional research station, Samastipur	Agricultural Institution	Scientific and technical support, training programs, lending infrastructure
Rajendra Agricultural University (RAU), Samastipur	Agricultural university	Provided seeds for trials, training & monitoring, programs, trouble shooting
Borlaug Institute for South Asia (BISA), Samastipur	Non-profit research institute	Provided seeds for trials
Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalay (CSKV), Palampur	Agricultural university	Provided seeds of traditional and improved rice varieties for trials, training programs for farmers and field staff
Krishi Vigyan Kendra (KVK), Palampur	Agriculture Science Center	Provided information on local conditions related to agriculture
Kisan Clubs, Palampur	Farmer clubs	Participating in implementing and monitoring activities , generating awareness about the importance of genetic diversity to food security, participation in collecting genetic diversity
Mahila Samooh, Kangra	Womens' groups	Provided information on local varieties, villages cultivating traditional varieties, generating awareness about the importance of genetic diversity to food security, participation in collecting genetic diversity , engaged in monitoring
Narendra Deva University of Agriculture & Technology, Faizabad	Agricultural University	Technical support, training programs, seeds of improved rice varieties for trials
Shohratgarh Environmental Society, Shohratgarh	Non-governmental Organization	Collaborating to implement project activities, generating awareness about relevance of genetic diversity to sustainable agriculture, participation in collecting traditional crop varieties and setting up seed bank
Krishi Vigyan Kendra, Faizabad	Agriculture Science Center	Training programs, troubleshooting for problems in cultivation
Humana People to People India (HPPI)	Non-governmental Organizations	Collaborating in conducting trials in Uttar Pradesh, awareness generation about genetic diversity

13.Indicate the number of stakeholders involved in the project activities and give details by filling in the table below:

Number of stakeholders	Share of women (%)	Status (farmers, researches, government officials etc)	Institution (name)	Type of institution (NGO, University etc.)	Areas of involvement (consultations, workshops, planning, training)
25046	48%	Farmers			Participated in project activities
513	100%	Farmers	Womens' Groups	Community organization	Participated in project activities, engaged in monitoring activities, collecting genetic diversity and disseminating information about the value of genetic diversity to climate resilience, sustainable agriculture and food security. Involvement in setting up seed bank
116	70%	Farmers	Self Help Groups	Community organization	supported in collecting seeds of traditional varieties of crops
265	20%	Farmers	Farmers' Clubs	Community organization	Participated in implementing and monitoring activities , generating awareness about the importance of genetic diversity to food security, participation in collecting genetic diversity
43	65%	Field Assistants, Field Researchers	SES, CITH, CHIRAG, Arohi, Vimarsh, HSS	Local NGOs	monitoring field trials, conducting surveys, participation in collecting genetic diversity
400	61%	Scientists and researchers	Bioversity International, VPKAS, CSKV, IARI, NBPGR, RAU,	Agricultural Institutions and research institutes	Scientific and technical support, training programs, lending infrastructure
30	43%	Field Staff	SES, VPKAS	Staff of collaborated	conducting Project activities in

				institutes as well as GC's appointed field staff	collaboration with GC HO and local stakeholders
Total	26,413 stakeholders involved in the project				

14. Indicate the number and socio economic status of the direct[7] beneficiaries of this project by filling in the table below:

Number of direct beneficiaries	**Status of direct beneficiaries[8]**	**Share of women (%)**	**Organization (CBO, University, NGO, Government etc)**
25046	Farmer	48%	
513	Womens' Groups	100%	
116	Self Help Groups	100%	
70	Panchayats		
265	Farmers' Clubs	0%	
121	Community organizations & Local NGOs	40%	SES, CITH, CHIRAG, Arohi, Vimarsh, HSS
664	Scientists, researchers and policy makers	35%	Bioversity International, VPKAS, CSKV, IARI, NBPGR, RAU
63	Project Staff	55%	Gene Campaign , Bioversity International and other staff from other collaborated NGOs
Total	26858 people directly benefitted from the project		

15. Indicate which of the following criteria have been used in selecting project beneficiaries:

☒ Poverty level ☒ Vulnerability to climate change ☒ Vulnerability to food insecurity	☐ Knowledge in farming the targeted varieties ☒ Potential multiplier effect ☒ Gender balance	☒Geographic distribution ☐Other(specify)

16. Indicate the estimated number of the indirect beneficiaries that will indirectly benefit from this project by filling in the table below:

Number of indirect beneficiaries	**Status of beneficiaries**	**Share of women (%)**	**Organization (CBO, University, NGO, Government etc)**	**Other**
202000	Individuals from 202 villages	60%		

[7] Direct beneficiaries can be defined as those who are participating directly in the project, and thus benefit from its activities (e.g. access to seeds, training, orientation sessions, workshops, field activities etc.).

[8] Beneficiaries' status may include: farmers, plant breeders, national gene banks managers and their staff, community/grassroots organizations members, government officials (Ministry of Agriculture, Ministry of Environment) etc.

Total	202000 individuals indirectly benefitted from the project

17. Did your organization undertake any surveys/assessments of the needs and challenges faced by the target population?

Before the project activities were initiated, baseline surveys with the local community were done in all the four sites of the project: Uttarakhand, Bihar, Uttar Pradesh & Himachal Pradesh. The following baseline studies were done:

1. Seed systems and Indigenous knowledge
2. Farmers' Perception of Climate Change & Adaptive Responses
3. Farmer perception of agrobiodiversity/ traditional varieties

☒ Yes ☐ No

18. If yes to Q 17, please provide details by filling the table below:

Total number of people surveyed	Categories of surveyed people (farmers, students etc)	Share of women (%)	Problems identified	Coping strategies	Possible solutions
1516	farmers	60%	Seed systems had weakened & seed exchanges rarely happened in areas where intensive agriculture was practiced..	Keeping in mind the differences between sites regarding agro ecological, institutional and socio-economic conditions, a facilitation of germplasm conservation and exchanges can be attempted. Women take the decisions on seed-related activities at household and community level and are responsible for seed selection, processing and storage and maintain informal collective exchanges in goods and services, including seed exchange. Hence reinforcing the institutions of women groups and facilitating information access will enable increased choices and opportunities to utilize a more diverse seed portfolio.	- Seed banks -Trainings in seed conservation, seed selection and seed production.
1245	farmers	55%	Higher temperatures disturbed monsoon,	As an adaptive response, farmers are shifting their	Increased diversity of varieties available to them

			longer summer season due to which their cropping season has shifted leading to decline in yields.	preferences of crops and time of planting.	which will help them to select resilient varieties and cope with climate change Establish seed bank
1350	Farmers	55%	Due to the promotion of HYV and hybrids, the value of traditional varieties has declined.	Farmers have preferences for traditional and HYV for different reasons.	Seed production trainings and trainings on how to use and maintain a seed bank will help the farmers adopt traditional varieties for even commercial cultivation

Section C: Field activities

19. Indicate any collection mission related to PGRFA conducted by your organization, providing details on:

19.1. Crop/s collected:	**Rice**	**Finger Millet**				
19.2.Number of collected accessions	**487**	**215**				

19.3.Indicate whether the collected accession have been stored in

☒Community/farmers genebank	☐Local genebank	☒National genebank	☐International genebank	☐International research center

19.4.Indicate the provenance of the material collected:

☐ multi-locations across countries ☒multi-location within a country ☒multi-location in the same region ☐ single location

19.5. Indicate the importance of the provenance area for genetic diversity in the country:

☐Unknown ☐ Low ☒ Medium ☒ High

19.6. Indicate the importance of the provenience area for in-situ conservation:

☐Unknown ☐ Low ☐ Medium ☒ High

19.7. Indicate the importance of collected crops for food security

☐Unknown ☐ Low ☐ Medium ☒ High

20. If evaluation and characterization activities occurred, please detail the importance of the following criteria in evaluating and characterizing crop germplasm (from 1=not important to 4=very important)

	Name of crops/material evaluated					
Traits	Rice					
20.1. Morphological	3					
20.2. Agronomic						
good yield	4					
resistance to pests/diseases	4					
resistance to heat	4					
resistance to drought	4					
resistance to salinity	3					
early maturity	3					
good post-harvest/processing quality	3					
20.3. Gastronomic						
good cooking/eating quality	4					
high nutritional value	4					
20.4. Socio-economic						
good market value	4					

selling markets established and well functioning	4					
availability of planting material	4					
other						

20.5. Total accessions evaluated	112 varieties of rice were evaluated

20.6. What was the type of evaluated material

☐ crop wild relatives	☒ traditional cultivar/landrace	☒ genebank material

20.7. What was the origin of the evaluated material

☒material obtained through project collection missions	☒ national gene bank
☐ farmers/field genebanks	☐ international gene bank
☐ local gene bank	☐ private sector/commercial agencies

21. Has the data obtained from the evaluation process been incorporated into an information system?

☐ Yes ☒ No

22. What was the role of farmers in the evaluation and selection activity?

☒selection of pilot sites	☒setting selection and evaluation priorities	☒ implementing the activity
☐choice of germplasm	☒ definition of preferable traits	

23. **Did this project directly contribute to the establishment/construction of community seed banks? If yes, give the number of seed banks established and the main crops stored.**

Yes.

Four seed banks were established and approximately 1050 varieties of local germplasm was collected including 487 rice varieties

24. Indicate which of the following activities have been carried out to promote and facilitate the use of crop varieties and specify the duration of these activities (days):

☐seed days	☐agricultural shows	☒ diversity fairs	☒demonstrations
☒field studies	☒study tours	☒ field trials	

25. If any breeding activity has been implemented during this project, please enter below the following information:

Name of crop/s: Rice and Finger Millet

Trait (s)/characteristic(s) addressed: For paddy trials, the qualitative and quantitative characterization of the varieties was done by Gene Campaign which included characteristics like: plant height, number of tillers, length of panicle, flag leaf length, flag leaf width, sheath length and the length of the roots of the plants, presence of awn (Jhoos) in the grains, the height and width of the paddy grains, the colour of the rice, the weight of panicle per plant, the weight of 100 paddy grains, apiculus colour and lemma colour

Trials of millets were done using PVS. An innovative technique, System of millet intensification (SMI) helped to increase production of finger millet.

Estimated importance of the improvement in terms of food security: ☐ Low ☐ Medium ☒ High

Participatory breeding involved farmers in :

☐setting breeding priorities	☐select from segregating populations
☒ select from fixed lines (PVS)	☐ making crosses and/or determine parents

Main outputs produced:

26. If any genetic enhancement (including base-broadening) occurred during the implementation of this project, please enter below the following information:

Type of activity:

☐genetic enhancement by introgression for specific traits
☐population improvement through incorporation or base broadening

Rationale of the activity:
☐poor gain in breeding programmes
☐ specific trait not available in current breeding materials
☐ evidence of narrow genetic base

Assessment of genetic diversity was made through:

☐molecular markers ☐pedigree studies	☐ other methods ☐ N/A

Starting materials:

☐local varieties/landraces ☐ improved varieties in your country	☐wild varieties

27. Specify whether seeds of the target crops have been distributed /made available to local communities specifying :

Crop variety	*Quantity (kg)*	*Number of beneficiaries*		*Status (e.g. farmers, breeders)*	*Purpose (plantation, multiplication, selection, improvement, conservation etc.)*	*Channel of distribution (formal/informal seed system)*
		male	*female*			
1. **Rice**	6.2 Tonnes	70%	30%	220 farmers	Seed production for their own use as well as for community exchange	Distributed by Bioversity
2. **Millets**	76 quintal	35%	65%	65 farmers	Seed production for their own use, for conservation, for seed exchanges and for selection.	Farmer to farmer sale

Section D: Training and capacity building related to PGRFA

28. Indicate what subjects have been addressed through capacity building and training during the implementation of the project and provide details by filling in the table below:

Subject of the training	*Country/ region*	*Frequency*	*Duration*	*Female*	*Male*	*Status (e.g.farmers, breeders)*	*Methodology (workshops, demonstrations)*
1. Trainings for farmers and researchers on the use of the services of Kisan Call Centers & ClimMob	Uttarakhand, Bihar, Uttar Pradesh & Himachal Pradesh	-10 trainings provided on the farmer communication tool developed by the Government of India called the Kisan Call Centre 8 trainings provided to researchers on using the ClimMob application		35% 35%	65% 65%	500 farmers 20 researchers and members of local NGOs	Workshops & demonstrations
2. Trainings for researchers on agrobiodiversity, germplasm characterization and trait	Uttarakhand, Bihar, Uttar Pradesh & Himachal	2 trainings conducted		55%	45%	-10 project staff - 10 GC staff - 5 staff from collaborating	Demonstrations & hands-on trainings

specific evaluation, GIS tools and climate stimulation modelling	Pradesh					institutions -14 researchers	
3. Trainings of farmers' on Farmers' Rights	Uttarakhand, Bihar, Uttar Pradesh & Himachal Pradesh	6 trainings conducted		60%	40%	2450 farmers including: -38 NGOs -170 womens' groups	Workshops
3.Trainings for farmers and local communities on maintaining the seed collection and the seed bank	Uttarakhand, Bihar, Uttar Pradesh & Himachal Pradesh	4 trainings held		60%	40%	1300 farmers	Workshops
4. Trainings for farmers, extension workers and communities on participatory varietal selections	Uttarakhand, Bihar, Uttar Pradesh, Haryana & Himachal Pradesh	27 trainings conducted		65%	35%	1600 farmers	Workshops and trainings on trial layouts
5.Trainings for local communities on conservation and use of crop diversity through farmer field schools	Uttarakhand, Bihar, Uttar Pradesh, Haryana & Himachal Pradesh	11 Farmer field schools were conducted		55%	45%	1650 farmers	Workshops and Hands on trainings on rice descriptors
6.Trainings for farmers and researchers on Database management	Uttarakhand, Bihar, Uttar Pradesh & Himachal Pradesh	3 trainings on database management were conducted		40%	60%	100 farmers	Group discussions and interactive workshops
7.Trainings for farmers in seed production and multiplication	Uttarakhand, Bihar & Uttar Pradesh	5 trainings conducted		45%	55%	400 farmers	
8.Training programmes for policy makers at national and local levels	Delhi, Uttarakhand, Bihar	2 training workshops at national level and 3 training workshops were conducted at local level		30%	70%	300 farmers and 48 scientists from the ICAR system, academics from Delhi University and affiliate colleges ,graduate & post graduate students	Powerpoint presentations of project interventions
Total							

29. Indicate the type of products developed, media used and audience targeted by your organization in implementing the visibility plan to date. Please, make sure that those communication products are shared with the Treaty Secretariat, as per Communication and Visibility Manual provisions.

29.1. Products developed:

☐ Audio-visual products (enter references/links) ☒ Display panels and posters ☐ Fact sheets (enter references/links) ☐ Newsletters (enter references/links)	☒ Reports (enter references) ☐ Magazines (enter references) ☒ Accessories (t-shirts, caps, bags, etc.) /gadgets

29.2. Media used

☒Press ☒Television	☐Radio ☒Internet	☒Diversity fairs ☒Conferences	☐Educational events

29.3. Audiences targeted

☒ Policy makers ☒ Scientists	☐ Plant Breeders ☒ Farmers	☐ Gene bank managers ☒ Students	☒ General public ☒ Other: NGOs, Women Farmers' Associations, Panchayts, Farmer clubs, etc.

30. Indicate the major benefits gained by the targeted country/ies through the activities sponsored under this project:

☒ Expanding characterization, evaluation and number of core collections of germplasm ☒ Increased availability of resistant to climate change seeds ☐ Increased availability of high yielding/quality seeds ☒Exchange of germplasm ☒ Backup safety duplication of germplasm	☒ Increased resilience of local communities to climate change ☒Increased food security of local communities ☒ Increased capacities for sustainable agricultural practices ☒ Exchange of technical expertise ☒Exchange of information ☒ Establishment of networks for PGRFA ☒Increased stakeholder participation ☒ Development of new seed markets	☒Transfer of technology ☒Introduction of improved varieties ☒Improved knowledge ☐Improved access to markets for PGRFA products ☒Development of information systems on PGRFA ☒Increased awareness on PGRFA ☐Other (please specify)

Section E: Project efficiency

31. To what extent have the projects objectives been achieved to date?

☒ Highly satisfactory ☒ Satisfactory ☐ Moderately satisfactory ☐ Moderately unsatisfactory ☐ Unsatisfactory

32. List the main risks faced during the implementation of the project to date (e.g. political turbulence, economic crisis, climate shocks etc.)

Nothing dramatic or insurmountable occurred but continuing genetic erosion and lack of interest in traditional varieties due to high promotion of hybrids, proved a challenge.

33. Were the funds received sufficient to fully cover the proposed activities and produce the expected results?

☒ Yes ☐ No

34. If no to Q 33, specify what factors contributed to the non adequacy of the planned budget (e.g. inflation, fluctuancy of exchange rates, bureaucracy, transaction costs higher than expected etc.)

35. Did the project receive co-financing from other funding sources? If yes, indicate: No

Source:					
Amount USD					

36. Was the co-financing delivered as planned? ☒Yes ☐ No

38.Is there any additional co-financing envisaged after the end of the project implementation? ☐Yes ☒ No

ANNEX 3: Annex 1 crops of the ITPGRFA

LIST OF CROPS COVERED UNDER THE MULTILATERAL SYSTEM Food crops		
Crop	**Genus**	**Observations**
Breadfruit	*Artocarpus*	Breadfruit only.
Asparagus	*Asparagus*	
Oat	*Avena*	
Beet	*Beta*	
Brassica complex	*Brassica* et al.	Genera included are: *Brassica, Armoracia, Barbarea, Camelina, Crambe, Diplotaxis, Eruca, Isatis, Lepidium, Raphanobrassica, Raphanus, Rorippa*, and *Sinapis*. This comprises oilseed and vegetable crops such as cabbage, rapeseed, mustard, cress, rocket, radish, and turnip. The species *Lepidium meyenii* (maca) is excluded.
Pigeon Pea	*Cajanus*	
Chickpea	*Cicer*	
Citrus	*Citrus*	Genera *Poncirus* and *Fortunella* are included as root stock.
Coconut	*Cocos*	
Major aroids	*Colocasia, Xanthosoma*	Major aroids include taro, cocoyam, dasheen and tannia.
Carrot	*Daucus*	
Yams	*Dioscorea*	
Finger Millet	*Eleusine*	
Strawberry	*Fragaria*	
Sunflower	*Helianthus*	
Barley	*Hordeum*	
Sweet Potato	*Ipomoea*	
Grass pea	*Lathyrus*	
Lentil	*Lens*	
Apple	*Malus*	
Cassava	*Manihot*	*Manihot esculenta* only.

Banana / Plantain	*Musa*	Except *Musa textilis*.
Rice	*Oryza*	
Pearl Millet	*Pennisetum*	
Beans	*Phaseolus*	Except *Phaseolus polyanthus*.
Pea	*Pisum*	
Rye	*Secale*	
Potato	*Solanum*	Section tuberosa included, except *Solanum phureja*.
Eggplant	*Solanum*	Section melongena included.
Sorghum	*Sorghum*	
Triticale	*Triticosecale*	
Wheat	*Triticum* et al.	Including *Agropyron*, *Elymus*, and *Secale*.
Faba Bean / Vetch	*Vicia*	
Cowpea et al.	*Vigna*	
Maize	*Zea*	Excluding *Zea perennis, Zea diploperennis*, and *Zea luxurians.*

LIST OF CROPS COVERED UNDER THE MULTILATERAL SYSTEM **Food crops**		
Crop	**Genus**	**Observations**
Breadfruit	*Artocarpus*	Breadfruit only.
Asparagus	*Asparagus*	
Oat	*Avena*	
Beet	*Beta*	
Brassica complex	*Brassica* et al.	Genera included are: *Brassica, Armoracia, Barbarea, Camelina, Crambe, Diplotaxis, Eruca, Isatis, Lepidium, Raphanobrassica, Raphanus, Rorippa*, and *Sinapis*. This comprises oilseed and vegetable crops such as cabbage, rapeseed, mustard, cress, rocket, radish, and turnip. The species *Lepidium meyenii* (maca) is excluded.
Pigeon Pea	*Cajanus*	
Chickpea	*Cicer*	
Citrus	*Citrus*	Genera *Poncirus* and *Fortunella* are included as root stock.
Coconut	*Cocos*	
Major aroids	*Colocasia, Xanthosoma*	Major aroids include taro, cocoyam, dasheen and tannia.
Carrot	*Daucus*	

Yams	*Dioscorea*	
Finger Millet	*Eleusine*	
Strawberry	*Fragaria*	
Sunflower	*Helianthus*	
Barley	*Hordeum*	
Sweet Potato	*Ipomoea*	
Grass pea	*Lathyrus*	
Lentil	*Lens*	
Apple	*Malus*	
Cassava	*Manihot*	*Manihot esculenta* only.
Banana / Plantain	*Musa*	Except *Musa textilis*.
Rice	*Oryza*	
Pearl Millet	*Pennisetum*	
Beans	*Phaseolus*	Except *Phaseolus polyanthus*.
Pea	*Pisum*	
Rye	*Secale*	
Potato	*Solanum*	Section tuberosa included, except *Solanum phureja*.
Eggplant	*Solanum*	Section melongena included.
Sorghum	*Sorghum*	
Triticale	*Triticosecale*	
Wheat	*Triticum* et al.	Including *Agropyron*, *Elymus*, and *Secale*.
Faba Bean / Vetch	*Vicia*	
Cowpea et al.	*Vigna*	
Maize	*Zea*	Excluding *Zea perennis*, *Zea diploperennis*, and *Zea luxurians*.