Indian Journal of Traditional Knowledge
Vol. 9 (2), April 2010, pp. 361-365

Learning and testing the farmers' knowledge: Conservation of location specific indigenous paddy varieties

Ranjay K Singh[1*], B S Dwivedi[2] & Rajesh Tiwari[3]

[1]Department of Agricultural Extension, College of Horticulture & Forestry, Central Agricultural University, Pasighat 791 102, Arunachal Pradesh; [2]Department of Soil Science, [3]Department of Horticulture, JNKVV, Adhartal, Jabalpur 482 004, Madhya Pradesh
E-mail: ranjay_jbp@rediffmail.com

Received 4 February 2008; revised 12 August 2009

The local farmers possess an immense knowledge of their environment. An effort was made to carryout a research on the conservation and testing of nitrogen effect over the location specific indigenous paddy varieties in purposively selected tribals' villages from Dindori Developmental Block of Dindori district, Madhya Pradesh. The results indicate that tribal farmers have developed location specific knowledge to identify varied micro-farming situations and accordingly they grow and conserve number of indigenous paddy varieties. Study suggests that instead of macro, the micro level of planning of research and conservation strategy would be required for sustaining the biodiversity and related socio-ecological systems.

Keywords: Farmers' knowledge, Indigenous paddy varieties, micro-farming, Agrobiodiversity, Conservation
IPC Int. Cl.[7]: A01K, A01N3/00

Recent research on agro-biodiversity management has shown a resurgence of interest on community-based conservation and resource management systems using customary practices and local knowledge in many parts of the world[1-3]. The argument and curiosity of the creation and development of knowledge is important with regard to the nature of community-based biodiversity and resource conservation[4-6]. A wide variety of conservation strategies have been documented, ranging from cultural teachings against harvesting specific resources, harvesting at specific times or places, selective or limited harvesting, traditional ecosystems modification and sanctions against waste[7,8]. Nevertheless, conservationists and policymakers accorded little credibility to local knowledge systems and institutional regimes of agricultural systems management[4,9]. However, a growing recognition of the importance of examining the linkages between social and traditional ecological systems in managing the way we use and relate to our resources is attempting to bridge gaps in our understanding of the functioning and sustainable use of their home-yard ecosystems, including agroecosystems[3,10-14]. The green revolution vastly increased productivity of resource-poor and well-to-do farmers by improved varieties in India, but it did little change in the productivity of resource-poor farmers those who are residing in the far flung and risk prone agro-ecosystem[15]. Due to lack of appropriate and location specific varieties, resource poor and tribal farmers have evolved their location specific knowledge and conserved varieties of various crops. These varieties are grown under varying micro-farming situations. Varieties grown and used are holistic in nature and compatible to the socio-cultural and environmental conditions of such communities[16]. Looking to the importance of indigenous varieties and traditional ecological knowledge of farmers, an attempt was made to carryout research with tribal farmers on indigenous varieties of paddy. The objective was specific to know about the types and characteristics of indigenous paddy varieties, conservation mode and to test the response of nitrogen level on the selected varieties.

Methodology

The research was undertaken in the village of Dindori block of Dindori District, Madhya Pradesh, selected on the basis of purposive sampling method. In the first stage, 10 villages were visited to see the diversity in the indigenous knowledge systems associated with paddy crop. At the second stage, out of these, only one village has been selected for the investigation. After establishing a well rapport with

*Corresponding author

the tribal community, transect walk was done and focus group discussion was organized with the farmers to identify different micro-farming situations in which indigenous paddy varieties are planted and grown (Fig. 1). It helped to learn about the variations between different types of soils, cultural practices and cropping system diversity related to paddy crop. It has also helped to find out the interested farmers who can provide the plot for testing the nitrogen effect over paddy yield. To know the details of indigenous varieties of paddy crop and variability in the perception of male and female towards their values, 20 male and 20 female farmers have again been selected randomly from the village to have focus group discussions for exploration of name of paddy varieties and conservation practices. To fulfill the objective of testing of nitrogen level on selected paddy varieties, a farmer who possessed diversified varying micro-farming situations (MFS1,2,3) was selected on purposive manner. Different dosage of nitrogen levels (0,5,10,15,20,25 kg/ha) were decided to test over yield response of indigenous paddy varieties. The varieties *sathiya, badi lochai* and *patharchatt*i were sampled for the testing of nitrogen effect over yield in MFS-1,2, and 3, respectively.

Results

Micro-farming situations

On the basis of biophysical indicators, four micro-farming situations were identified (Table 1). The empirical result revealed that soil of MFS-1 is heavy textured, black in colour (*dhari chipti*), depth varies from 2.50-3.05m, fields are flat to slight sloppy and *nala* (big natural drainage) is only the natural source provide water for irrigation to the paddy crop under the moisture stress conditions. Major vegetation is covered by perennial wide leaf tress. Only late paddy is the crop, which is grown under this MFS, and weeds and water logging are the common problems under this MFS. Whereas in case of MFS-2, soil is medium textured, light black to yellow in colour (*kachhar mitti*) depth varies from 1.80-2.50m, fields are slightly sloppy and mango, *mahua* (*Madhuca indica*)*, neem* and *arjun* are the major perennial trees biodiversity. Only the paddy varieties- which require moderate period of maturity, is the crop which is grown. Soil erosion and moisture stress are the major problems of this system. MFS-3 is characterized by the light textured (*tickrai mitti)* and yellowish coloured, soil depth varies from the 60-90 cm and topography is moderate to heavy sloppy. The area is completely un-irrigated and *neem, tendu* and *mahua* are the major trees in perennial vegetational community. Under the soil moisture stress and less fertility, farmers grow diversified crops like early paddy with sorghum and maize with black gram and green gram as mixed crops to reduce the degree of risk associated with yield. While, MFS-4 is characterized by very light red soil (*marhan*), depth varies from 15-50 cm, completely unirrigated situation and *kosum, neem* and *tendu* are major naturally grown tress under this situation. These indicators cause heavy risk prone to this situation and framers reduce risk by growing diversified crops like drought resistant early paddy, black gram, green gram, sesame and sorghum. Soil erosion, poor soil fertility and moisture stress are major problems associated to MFS-4 and cause for low yield of crops.

Table 1—Micro-farming situations for the indigenous paddy varieties

Bio-physical indicators	MFS-1	*MFS-2*	MFS-3	MFS-4
Soil texture	Heavy textured (*dharichipti*)	Medium textured (*kachhar* m*itti*)	Light texture (*tickrai mitti*)	Very light (*marhan*)
Soil colour	Black	Light black	Yellowish	Red
Depth	8-10’	6-8’	2-3’	0.5-1.5’
Topography	Flat to slight slope	Slight to moderate sloppy	Moderate to heavy sloppy	Highly sloppy
Irrigation	Nala	Unirrigated	Unirrigated	Unrrigated
Vegetation	Semar, mango,*mahua*, *arjun*, tamarind, *saal*	Mango, *mahua*, *neem*, *arjun*	Mahua, *neem*, *tendu*	Kosum, *neem*,*tendu*
Crop	Paddy, tall late variety	Paddy, medium period variety	Paddy early,black gram, green gram, maize	Paddy early, black gram, green gram, sesame, jowar, finger millet
Problem	Weeds, water logging	Soil erosion & moisture stress	Soil erosion, moisture stress & soil infertility	Soil erosion, moisture stress, soil infertility

Indigenous paddy varieties

Result indicates that farmers have conserved 16 local land races of paddy crop viz. *chapti, lachhmi bhog, vishnu bhog, kamodh, chingo, motisar, nag kesar, chhoti lochai, badi lochai, newari, rai buta, pathar chatti, sathiya, karanga, sukhdas* and *lal dhan* (Table 2). These varieties are location specific in nature and characterized with maturity period and yield potential of these varieties varies from each other (Fig. 5).

Effect of nitrogen dosage over the yield performance

To see the potential of yield in response of varied dosage of nitrogen under farmers managed conditions, the varieties *sathiya* (Fig. 2), *badi lochai* (Fig. 3) and *patharchatti* (Fig. 4) were selected using PRA tool with farmers. The reason behind selection of such land races was that each variety must fall in the corresponding MFS and should be managed by the farmers. Beside, the popularity of sowing and degree of consumption were two major criteria to select these varieties for testing against nitrogen. As per the suitability of MFSs and farmers perception, the varieties *badi lochi*, *sathiya* and *pathorchati* were planted under MFS-1, MFS-2 and MFS-3, respectively. After cropping, different combination of recommended nitrogen dosage was applied and the responses over yield of these varieties were progressive in comparison to non-treated plots' varieties. Under the controlled conditions (0 kg) the yield of *sathiya, badi lochai* and *patharachatti* was found to be 26.0, 22.1 and 19.0 q/ha, respectively (Table 3). With the increase in the level of nitrogen (0-5 kg), the yield of *sathiya* (MFS-1, *badi lochai, (*MFS-2) and *patharchatti* (MFS-3) progressively increased as 27.7, 23.1 and 19.5 q/ha, respectively.

The optimum level of nitrogen was observed to be 20 kg/ha to get the yield of 30.60 q/ha from *sathyia*, 26.0 ql/ha from *badi lochai,* and 20.5 q/ha from the *Patharchatti.* Although, the response of level of 25 kg nitrogen has been found rational to increase the yield for all the three varieties under varying micro-farming situations, but it was not economically viable for the tribal people. The mean (28.8) yield was higher of *sathiya* variety in response to the nitrogen dosage of 25 kg/ha of area followed by the *badi lochai* (24.53 kg) and *patharchatti* (19.93 kg). Over all variability in response of nitrogen dosage and corresponding yield effect was more in *badi lochai* (6.25%) followed by *sathiya* (6.93%) and *pathachatti* (3.16%). The variability was not much in *patharchatti,* while it was almost equal in *sathiya* and *badi lochai*. Whereas, the

Table 2—Indigenous paddy varieties and their characteristics

Indigenous paddy variety	Suitability under varying MFSs	Type of maturity
Chapti	MFS-1&2	Early variety and drought tolerant
Lachhmi Bhog	MFS-3	Early and drought tolerant
Vishnu Bhog	MFS-3	Medium period variety and drought tolerant
Kamodh	MFS-2&3	Medium period variety and drought tolerant
Chingo	MFS-1	Late variety and water logging tolerant
Motisar	MFS-1	Late variety and water logging tolerant
Nag Kesar	MFS-1&2	Late variety and water logging & drought tolerant
Chhoti Lochai	MFS-2&3	Early variety and drought tolerant
Badi Lochai	MFS-1&2	Early variety and water logging & drought tolerant
Newari	MFS-2&3	Medium late variety and drought tolerant
Rai Buta	MFS-1&2	Late variety and water logging & drought tolerant
Pathar Chatti	MFS-2&3	Early variety and drought tolerant
Sathiya	MFS-2&3	Early variety and drought tolerant
Karanga	MFS-2&3	Medium period variety
Sukhdas	MFS-1&2	Early variety and water logging & drought tolerant
Lal Dhan	MFS-2&3	Late variety and drought tolerant

Table 3- Effect of treatment on the progressive yield of paddy varieties

Level of N doses	MFS-1, *sathiya* (yield in q/ha)	MFS-2, *Badi lochai* (yield in q/ha)	MFS-3, *Patharchattu* (yield in q/ha)
0kg	26.2	22.1	19.0
5.0 kg	27.7	23.1	19.5
10.0 kg	28.0	24.1	19.8
15.0 kg	29.5	25.6	20.1
20.0 kg	30.6	26.0	20.5
25.0 kg	30.8	26.3	20.7
Mean yield	28.8	24.53	19.93
SD	1.80	1.70	0.63
CV	6.25%	6.93	3.16

'Z' values *Sathiya* vs Badi *lochai* = 4.23**; *Sathiya* vs *Patharchatti* = 11.51**; *Badi lochai* vs *Patharchatti* = 8.36

** Significant at 0.01 probability level of significance

Fig 1–Focus group discussion

Fig 2–Average productivity of indigenous paddy varieties

Fig 3–*Sathiya* variety of indigenous paddy

Fig 4–*Badi lochai* variety of indigenous paddy

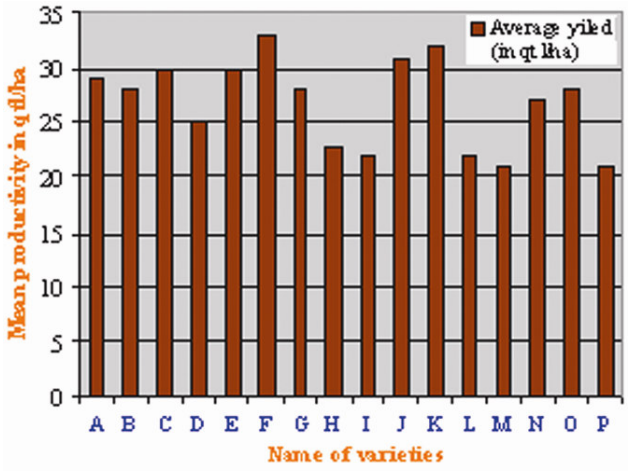

Fig 5–*Patharchatti* variety of indigenous paddy

'z' statistics reveals that the yield of these tested indigenous varieties vary in yield significantly from each other and *sathiya* was better in yield response towards nitrogen over the *badi lochai* and *patharchatti*. Though limited, but this observation led to conclude in identification of MFSs and accordingly selection of a particular variety, the farmers' wisdom is rational for the paddy crop. This result provides a guideline to the researcher that blind recommendations of varietals selection and nutrient application irrespective of MFSs and respective parameters serve a very limited purpose of crop production and conservation of varieties as well as natural resources in general. Hence, micro-farming situations identified by the farmers have immense use in varieties selection and affect the yield as well as the package of practices on indigenous land races.

Discussion and conclusion

It has been concluded that, the tribal farmers have location specific ecological knowledge and traditional varieties of paddy crop. They select and conserve these varieties on account of socio-cultural and environmental conditions, thus the farmers' varieties having considerable level of adaptability under different risk prone agro-ecosystem. These varieties having potential to respond the different levels of the nitrogen and yield can be increased significantly to improve the economic status of the tribal community and also to discourage the farmers of using hybrid seeds of private companies which leads farmers towards credit and debt. To enhance the conservation process of indigenous varieties through increasing productivity, the role of plant breeder and biotechnologist would be required in leading manner to make these varieties productive, lucrative and competitive to hybrid seeds produced by private companies. Such strategy will boost up the process of conservation of indigenous and location specific paddy varieties even in the pace of commercialization and privatization of agriculture sector.

As it has been experienced with this research that small indigenous and tribal populations with relatively low densities and using basic technologies and traditional varieties tend to depend more on human relations and social capital in their subsistence economies as reported elsewhere also[12]. The tribal farmers were seen as pro-conservationists against the groups who are experiencing population growth, applying modern, industrial scale technologies, and producing products for the globalized market economy tend to be generally incompatible with biodiversity conservation and sustainability prospects, as it has been the problem worldwide[3]. Expanded markets and private sectors are aggravating and influencing in commercializing food production system as in other parts of country[17]. Thus, it can quickly undermine local conservation efforts for indigenous crops and threaten the knowledge base and traditional practices required for maintaining these local varieties[18]. Injudicious government programs and policies that aim to promote mono-cultivation through only improved varieties of rice; and make agriculture and natural resource use more efficient can also damage the long-term

relationships between local populations and environments[3,19-21]. The findings can be utilized to formulate hypotheses for designing and implementing research projects on location specific and farmers' knowledge based participatory research about conservation of agrobiodiversity, breeding programme and varietal development to a specific micro-ecosystem. Environmental managers can incorporate such elements of indigenous knowledge as a component of a systems-level approach to natural resource management, where biological, social, cultural, economic, and symbolic aspects of natural resource use are nested within a broader socio-ecological system.

Acknowledgement

Authors acknowledge contribution of women and men of selected village for their inputs and describing the micro-farming situations. Authors also acknowledge the inputs of farmer in terms of providing piece of land for testing the nitrogen effect over yield of selected varieties.

References

1 Alcorn JB, Bamba J, Masiun S, Natalia I & Royo A, Keeping ecological resilience afloat in cross-scale turbulence: An indigenous social movement navigates change in Indonesia, In: *Navigating Social-Ecological Systems*, by Berkes F, Colding J & Folke, C (Cambridge University Press, UK), 2003, 299-327.

2 Hunn ES, Johnson D, Russell P, & Thornton TF, Traditional environmental knowledge, conservation, and the management of a "wilderness" park, *Curr Anthro*, 44 (2003) S79-S103.

3 Holt FL, The Catch-22 of conservation: Indigenous peoples, biologists, and cultural change, *Human Ecol*, 3 (2) (2005) 199-215.

4 Berkes F, Colding J & Folke C, Rediscovery of traditional ecological knowledge as adaptive management, *Ecol Appl*, 10 (5) (2000) 1251-1262.

5 Berkes F & Turner NJ, Knowledge, learning and the evolution of conservation practice for social-ecological system resilience, *Human Ecol*, 34 (4) (2006) 479-494.

6 Singh RK & Sureja AK, Community knowledge and sustainable natural resources management: Learning from *Monpa* tribe of Arunachal Pradesh, *J Transdisc Res Southern Africa*, 2 (1) (2006) 73-102.

7 Berkes F, *Sacred Ecology: Traditional Ecological Knowledge and Resource Management*, (Taylor & Francis, Philadelphia, Pennsylvania, USA), 1999, 40-45.

8 Turner NJ, Berkes F, Coming to understanding: Developing conservation through incremental learning in the Pacific Northwest, *Human Ecol*, 34 (2006) 495-513.

9 Feeny D, Berkes F, McCay BJ & Acheson JM, The tragedy of the commons: Twenty years later, *Human Ecol*, 18 (1990) 1-19.

10 Alcorn JB, Indigenous resource management systems. In: *Beyond Fences: Seeking Social Sustainability in Conservation*, edited by Borrini-Feyerabend G, (Gland, Switzerland: IUCN), 1997, 120-1130.

11 Ostrom E, *Governing the Commons*, (Cambridge University Press, Cambridge, UK), 1991, 126-156.

12 Pretty JN, Social capital and the collective management of resources, *Science*, 302 (2003) 1912-1914.

13 Altieri M, *Agro-ecology: The Science of Sustainable Agriculture* (West View Press, Boulder, USA), 1995, 140-150.

14 Sillitoe P, What, knows natives? Local knowledge in development, Grassroots Voice: *Int J Indiginous Knowledge Dev*, 4 (1) (2001) 1-27.

15 Maurya DM, The innovative approach of the Indian farmers: In: *Farmers First: Innovations and Agricultural Research*, edited by Robert C, Arnold P & Lorri AT (International Technology Publication, Southampton, London, UK),1989, 9-14.

16 Schoomaker-Frendenberger K, Challenges in Collection and Use of Information on Livelihood Strategies and Natural Resource Management, In: *Beyond the Farmers First*, edited by Scoones I & Thompson J (IIED, International Technology Publication, Southampton, London, UK), 1994, 124-133.

17 Singh RK & Singh D, Indigenous approach to the sustainable conservation of agrobiodiversity: learning from the *Bhar* community, *Indigenous Knowledge World Wide*, (2004), 2-3.

18 Langton MZ, Rhea A, Ayre M & Pope J, *Composite Report on the Status and Trends Regarding the Knowledge, Innovations and Practices of Indigenous and Local Communities- Regional Report: Australia, Asia and the Middle East*, (UNEP Secretariat, Montreal, Canada), 2003, 40-90.

19 Ferrari MF, Protecting biodiversity and indigenous people/local community's rights: The challenge in South East Asia, IUCN, theme on indigenous/local communities, equity and protected areas (TILCEPA), In: *Composite Report on the Status and Trends Regarding the Knowledge, Innovations and Practices of Indigenous and Local Communities-Regional Report: Australia, Asia and the Middle East*, edited by Langton M, Rhea ZM, Ayre M & Pope J (UNEP Secretariat, Montreal, Canada), 2003, 29-110.

20 Singh RK, State of traditional knowledge of plant genetic resources for food and agriculture, In: *Composite Report on the Status and Trends Regarding the Knowledge, Innovations and Practices of Indigenous and Local Communities-Regional Report: Australia, Asia and the Middle East*, edited by Langton M, Rhea ZM, Ayre M & Pope J, (UNEP Secretariat, Montreal, Canada), 2003, 132-133.

21 Bandara JMRS, Indigenous knowledge in rice cultivation: Nature farming, *Endog Dev,* 1 (2007) 8-11.