PRA FOR NATURAL RESOURCES MANAGEMENT AND RESEARCH PRIORITIZATION TO IMPROVE PRODUCTIVITY OF RAINFED LANDS

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Land area is bound to decrease, but population and demand for dryland products will increase. Unless the productivity of dryland agriculture shows a spectacular increase, the challenges to agriculture cannot be met. The rapidly changing global market economy, urbanization and growing need for value added products is gradually changing subsistent agriculture to commercial agriculture. While the dryland farmer is looking for a change, the dryland research scientist also needs to have a critical look at his past performance and future research priorities and strategies (Kanwar, 1999).

Main thrust should be given on critical assessment of the available technologies in terms of local farmers' natural and socio-economic situations. In addition, there is need for concerted efforts to identify the problems faced by farmers and plan to solve these problems through research and social motivation for improving sustainability of the cropping systems and for meeting the challenges to augment food production from our limited land (Kar etal., 2002). In this regard, Participatory Rural Appraisal (PRA) is one of the most effective tools which can be utilized to understand the technology adoption profile of the farming community and to get the first hand information about the needs, resources available, priorities, problems and prospects of the farming community. This process helps understand the technology dissemination process, rural development activities, linkage mechanisms existing among research, training and extension, credit and input supply systems etc (Jones, 1995).

The PRA also helps to provide an opportunity to gain insight and appreciation about the indigenous technologies (Maharana, 2001). The data was collected during the Field Experience Training programme at IVRI as a part of Foundation Course for Agricultural Research Scientists. The study was conducted with the following objective.

To analyze the agricultural problems and prospects with reference to the local resource base, agro-ecology, technology adoption for improvement of the socio-economic status of the villagers.

METHODOLOGY

PRA was carried out by a multi-disciplinary team of scientists in Kheda village of Bithari Chainpur block of Bareilly district of Uttar Pradesh. It is located approximately 10 kms away from Indian Veterinary Research Institute, Izatnagar on Bareilly-Pilibhit state highway. The climate of the study area is semi-arid to subtropical with extreme summers and winters.

Triangulations–Different methods were used for data collection to ensure objectivity

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of the data. These methods are briefly discussed here.

On the spot Visualization–On different aspects of village like resource base, crops and cropping systems practiced, animal husbandry etc.

Personal and group interview–Information on daily routine, livelihood, input analysis, general information of the village and wealth ranking was collected through personal and group interviews.

Key Informant Interview–The constraints, adoption gap and problems related to rainfed agriculture were analyzed first on the basis of key informants information.

Secondary Data Source–District Agriculture Officer, Block Development Officer, Training Organizer, KVK and Officials of SOTEC, a non-government organization, IFFCO were interviewed.

Semi-Structured Interviews–In this method, a set of questions was prepared before hand by discussing with various organizations for collection of data. The questions that emerged during the course of discussion were also taken care of.

Cartographic Representation or Mapping–The maps like social map, agro-ecological map, transect, technology map were drawn with the active participation and help of the villagers to know the agro-ecological, social resources, social stratification, technology generated etc. of the village.

The major researchable problems were identified using Rank Based Quotient (RBQ).

$$\text{RBQ} = \sum_{n=1}^{n} \frac{Fi(n+1-i)}{N-n} \times 100$$

Fi = Frequency of Key informants for the ith rank
n = number of rank
N = number of key informants

RESULTS AND DISCUSSION

The existing natural resources of the village were analyzed utilizing PRA tools with special reference to the local resource base, agro-ecology, technology adoption and change in agricultural sector for improvement of the socio-economic status of the villagers through social motivation and research prioritization. Data related to some PRA tools were given below to get an overall idea of the village.

Transect–Transects are observatory walks or tracks across the countryside and fields in any given area, village or watershed. After establishing the extreme east and west boundaries of the village, as delineated by the key informants (KIs), an east to west farm walk was undertaken across the village and the observations made are given in table-1.

Table 1. Transect of the Village

Attributes	Particulars of the Village		
Topography	Plain	Upland	Plain
Soil type	Sandy loam	Loamy soil	Clayey loam
Water table	40-45 ft	105-110 ft	80-90 ft
Crops	Wheat, Paddy, Sugarcane, Pulses, Maize	Cucurbits, Capsicum, Beans, Tomato	–
Trees	Pipal, Sheesham, Eucalyptus, Neem	Banyan, Neem, Pipal, Eucalyptus, Moonj	Sheesham, Acacia,
Livestock	Goats	Buffalo, Back yard, Poultry, Cow, Dog	Goats
Primary land use pattern	Agriculture plus Grazing strip	Dwelling units, Livestock rearing	Forest
Irrigation	Diesel Pumpsets, Canal	Backyard waste water	Rainfed
Horticulture	Mango, Banana, Date-palm, Ber,	Papaya, Banana, Mango, Jackfruit, Bel, Shrubs	Ber, Jamun,

Social Map–Kheda village has total population of about 485 heads. Except one family of scheduled caste (Valmiki) all others are backward class (two family are Jatar and rest all being Yadav) of Hindu religion. The main occupation of inhabitants is agriculture. Joint family system is prevalent Co-operation exists among the villagers. Social evils like early marriages, untouchability, dowry, gutkha, smoking and alcohol are common. There is one temple and one primary school in the village. About 75% population of the village is literate, women literacy is about 25%.

Resource Information–The Village resources were assessed through resource mapping technique. It revealed that the village was mainly agrarian with total cultivated area of 594 Bighas. Wheat, Gram, Paddy and Sugarcane were the main crops grown by the farmers. Commonly found trees in village were neem, sheesham, banyan, mango, pipal, eucalyptus, date palm, banana, papaya, jack fruit, bel, ber, lasoda and acacia. Irrigation was done by means of tube wells and pump sets. Apart from indigenous implements like desi plough, sickle, spade etc., modern farm implements for agriculture like tractor, thresher, harrow, cultivator, puddler, chaff-cutter, catch wheel, leveler and hari (furrow maker) were also available with the farmers.

Three types of soils were prevalent in the village Viz. sandy, clayey and loamy soils. There was only one entrophic pond in the village, which was used to dig out mud from it and not for any other productive purpose. There were three wells, out of which two were non-functional. Drinking water source was hand pumps. On an average, a house had 2-3 milk buffaloes. Poultry was owned by 5-6 families only. Cow dung cakes were used for domestic fuel. Ten to fifteen families maintained 100-120 goats. Some families maintained cattle also. One credit agency existed in the village, which gives seeds, fertilizers etc. on credit to the villagers. There was no milk collection center. Villagers who want to sell their milk go to nearby town to sell their milk.

Agro-ecology–The average maximum temperature is approximately 45oc and average minimum temperature is approximately 5.2oc. Soil type varies between sandy loam to clayey loam. The average annual rainfall is 1133mm. Atmosphere is very humid during monsoon season, whereas summer seasons are very hot and dry when maximum humidity is only 20%. The western fringes of the village with sandy loams is well drained and does not suffer from water logging. The central zone of the village has loamy soil which again is well drained but the eastern skirts of village with clayey loam becomes water logged.

There is a marked variation in water table from western to eastern direction with water table varying from 40-45 ft, 105-110 ft and 80-90 ft respectively. The low water table in the central area is due to elevation of village. This is also the reason due to which wells in the village area are more or less dry and not used for portable water. The principal weeds encountered were parthenium, croton, cynodon, achyrenthus and solanum. There were some plants of datura also the small entropic pond of village contained water hyacinth. Irrigation in the western field was earlier done by canal which remains mostly dry now. Whereas, in the central area, irrigation is done only by diesel pump-sets.

Matrix Ranking and Technology Adoption–The purpose of matrix ranking was to get better understanding of farmers' decision making processes and to identify criteria used to prioritize and select certain items or activities over others. Highly adopted varieties of wheat were UP-2003, PBW-154, UP-2338 and HD-2329. Similarly for rice, they were Pant-4, Pant-10, Pant-7112, IR-24 and

Sarbati. A variety named Indrasana was over adopted due to good taste though a bit course. The sugarcane varieties adopted were COS-1167, COS-1148, COS-8432, COS-797, COS-7918 and COS-90269. These adopted varieties of wheat, rice and sugarcane were the result of replacement, discontinuance of many low yielding and disease/pest susceptible varieties.

Farmers of Kheda use fungicides, weedicides and pesticides. BHC was over adopted but to its effectiveness and low cost. Farm machines like tractor, thresher, plough, harrow etc were much in use. Organic manures and inorganic fertilizers (NPK, Urea) and Zinc oxide treatment to replenish soil fertility were adopted. Some crops Viz., a dwarf jowar variety, groundnut, soyabean were actively rejected because they attract the blue bulls and were consumed by them to a large extent.

Time Line–Time Line is a chronological sequence of events that have taken place in the village, pertaining to the general history of the village or to specific subjects or sectors such as health, education, agriculture, animal husbandry etc. The time line for different agricultural activities were studied and are given in Table-2.

Table 2. Time line

S.No	Year	Event
1.	1965	Urea was introduced
2.	1968	HYV were introduced
3.	1968	Veterinary hospital
4.	1970	Use of pesticide in sugarcane
5.	1971	Tube wells
6.	1972	Harrow
7.	1974	Pesticide in paddy
8.	1975	Bajra, jowar hybrids
9.	1979	Drought
10.	1986	Tractor
11.	1990	Zinc application in paddy
12	1992	Use of sprayer

Problem Identification for Research Prioritization Under Rainfed Agro-eco System–For problem identification thirty farmers were contacted with snow ball sampling techniques. During the discussion, various problems were identified and categorized into two groups Viz., researchable and non researchable. The researchable problems were ranked depending on severity and extent of loss as perceived by them. After that, an analysis was performed to ascertain the frequency of the ranks and how the farmers ranked each problem using Rank Based Quotient (Table 3.).

Table 3. Calculation of RBQ, MV Values and Ranks for different problems prevailing in the Village Kheda

S. No.	Problems	I	II	III	IV	V	VI	VII	VIII	RBQ	Av. % loss	Area/ Animal I No.	MV	Rank
1.	Low yield of paddy	9	5	8	2	-	-	-	-	65.41	30	406	7,96,693	1
2.	Low yield of wheat	9	7	4	4	-	-	-	-	68.75	25	395	6,78,906	2
3.	Pyrilla in sugarcane	5	2	7	2	2	2	-	-	50.00	15	48	36,000	9
4.	Yellowing in sugarcane	3	3	2	7	2	1	-	1	46.25	10	48	22,200	11
5.	Negligible yield of groundnut	-	-	-	3	2	2	-	-	12.08	95	24	27,542	10
6.	Mundi in wheat	-	3	-	1	3	6	1	2	25.00	10	395	98,750	6
7.	Katila in paddy	-	-	2	2	5	1	5	-	22.91	10	406	93,014	7
8.	Stem borer in paddy	-	3	-	2	2	5	4	-	25.83	15	406	1,57,304	4
9.	Calf mortality	1	2	2	1	4	2	1	2	27.08	30	154	1,25,109	5
10.	HS in buffaloes	-	-	1	1	1	1	-	1	7.91	15	154	18,272	12
11.	FMD in buffaloes	-	-	2	5	-	-	3	2	12.50	25	154	48,125	8
12.	Low milk yield in buffaloes	3	3	1	-	6	5	3	2	40.83	50	154	3,14,391	3

Research Priorities–Majority of the farmers felt that, rice in rainfed lands was risky and resulted in unstable yields. Hence, legumes and oilseed crops which require less water should be grown. Inter crops like maize + Pigeon pea, Maize + Turmeric or Ginger can be considered (Umrani. Et al., 1999). Growing of sequential crops could be better option legume-cereal sequence or cereal-legume sequence could prove efficient. These combinations are good for improving the soil fertility also.

High yielding varieties of different crops which can withstand dry spells and which can give high yields should be developed. Integrated nutrient management, integrated pest and disease management practices should be followed for better nutrient, pest and disease management of the crops.

Crop diversification should be followed, vegetables can be grown. Alternate land use systems like, agri-silvi culture, agri-horticulture, silvi-pasture can be introduced to have more remuneration for the farmers. Better seeding and tilling practices need to be developed for the region. Modern agricultural implements like seed-cum-fertilizer drill, weeders, planters can be introduced. Costly implements like tractor, orchard sprayer, tractor drawn seed cum fertilizer drill can be introduced on custom hire basis.

Soil and water conservation measures Viz., contour bunding, conservation tillages gully control structures, runoff water recycling methods, drainage measures should be followed so as to conserve the soil and water. Rain water should be harvested in-situ. These practices would help making agriculture as a profitable enterprise and endure sustainability.

CONCLUSION

PRA is an effective tool to get first hand information on available natural resources, technology adoption, rejection, problems and prospects of the farming community to exploit vast natural resources of the region. The study revealed that the rice in rainfed lands was risky and resulted in unstable yields. Hence, legumes and oilseed crops which require less water should be grown. Intercropping and sequence cropping should be followed for better land management. Alternate land use systems, improved farm implements, soil and water conservation measures should be introduced for sustainable productivity of the rainfed lands.

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