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Apriori to agricultural problems emerged through participatory rural appraisal in temperate zone of the Himalayas

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ABSTRACT

The participatory rural appraisals were exercised during 2014 in temperate Himalayas in eight gram panchayats of Sangrah block of district Sirmour of Himachal Pradesh. The purpose was to unravel the problems being faced by the farmers, prioritise them and devise apriori based solutions for the upliftment of the peasants. The project area had 22 villages spread over 5611.09 ha. Out of which, 701.02 ha was the cultivable area in the possession of 12906 cultivators. The area was rugged, had steep topography and was stratified into ladder type fields. The matrix analysis extrapolated the prime problem of monkey and wild animals menace. Other problems ranking in the descending order were: erratic irrigation and drinking water supply, lack of awareness about new techniques, ginger rot, poor connectivity by road and communication, migration of youth from villages to cities, unavailability of agricultural inputs like seeds, fertilizers etc., soil erosion, hindrance due to local politics, erratic electricity supply, abandoned agriculture due to public distribution system, lacking minimum support price and crop insurance of each crop, unconsolidated land, lacking higher education facility, labour scarcity due to MGNREGA and migration, defunct apple cultivars, frequent blockage and breakage of irrigation kuhals (channels) and invasion of obnoxious weeds. The insight solutions and the unleashed problems lies in farming bi-pronged strategy which must concentrate on i) convergence of schemes, and ii) apriori based approaches for the upliftment of rural community of the temperate Himalayas. The outcome of the present study suggested seven proposals for improving income resources of hilly peasants.

Key words: Matrix analysis, MGNREGA, PRA, Resource mapping, Time line, Transect walk

The temperate regions of the Himalayas, so called mid-hill zone, are confined between 1523 m and 2472 m above mean sea level. The region experiences medium to heavy rainfall (100-200 cm) in the monsoon. Low temperature prevails from November to March, with the inception of snow. Summers are pleasant for the movement, growth and development. Climate is congenial for successful production of stone fruits, walnuts, apple, pomegranate, olive, kiwifruit, peas, French bean, Cole crops, garlic, potato (seed), carnation, gladiolus, chrysanthemum etc. at commercial scale.

Participatory Rural appraisal (PRA) emerged and developed in the 1970s as a reaction to the alleged shortcomings of conventional ways of working with local people and conducting development related research (McCracken *et al.* 1988). The weaknesses of the conventional approaches (Rural development, tourism, survey, slavery, rural poverty unobserved) have been well documented by Chambers (1983). This gave rise to the maturation of a methodology which perceived the knowledge and views of villagers as basic determinants of the development path to be followed. Chambers (1992) has defined PRA as an approach and method for learning about rural life and conditions from, with and by rural people. He further stated that PRA extends into analysis, planning and action. PRA closely involves villagers and local officials in the process.

In agricultural research, PRA attempts to challenge the assumption of conventional ways of perceiving farmers, where knowledge is the exclusive area of the researcher and where the farmer is a passive recipient of information (Pretty and Chambers 1993). This indicates that a combination of push and pull factors was involved in the spread of PRA. A significant pull factor in this process was the recognition that local people appear to have a greater capacity to analyze their own situations and conditions than the professionals normally imagined. Another pull factor is the cost-effectiveness of the approach and timely delivery of information which appeals to development workers and researchers. Thus, PRA is the simplified and systematic approach following the pathways involving i) live among

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the people, ii) search the people's knowledge, iii) learn from the people by confronting the problem, iv) plan with the people, and v) work with the people.

Though working with local people on this basis, the process of interactive participation leads to the strengthening of the capacities of local people (Richards, 1985), notably it, i) enables local people to collect information, to assess its relevance, to cross-check its validity and document and present the findings, ii) enhances capacities to prepare project proposals (planning, management), and iii) improves local skills for dealing with potential conflicts between different interest groups. Changes have been inevitable, but ameliorative, since the inception of the Universe till the present age of e-existence. Shiwalik hills have not been any exception and so are true to our project area. With this background of mountainous and temperate rugged terrains, it was imperative to manevour scientific roadmaps for the upliftment of sincere, arduous, dedicated natives of hills with the objective approach as (i) to unleash conjoint problems of the rural hilly people through self-appraisal (ii) to enlist and priorities the problems through matrix analysis and (iii) to devise apriori based solutions/means for the upliftment of the poor ruralites by adopting cognizant agricultural approaches.

MATERIALS AND METHODS

PRA exercises were conducted in eight gram panchayats of district Sirmour of Himachal Pradesh, separately, during September 2014 to unravel the conjoint problems being faced by the natives. PRA being complex in nature, involving many steps and methods, varied with the location, social milieu, literacy etc.

The project area was confined to eight gram panchayats. The altitude data of the project area conforms to temperate region, hence, the selection of the panchayats was appropriately chosen. The data pertaining to the project area have been collected with own resources (Table 1).

This exercise was conducted in each panchayat, separately. These gram panchayats were Beyong Tatwa (2 villages, 216 families), Badol (2 villages, 299 families), Bharari (3 villages, 529 families), Bhatgarh (4 villages, 392 families), Bhawai (2 villages, 534 families), Charna (2 villages, 325 families), Dana Ghaton (4 villages, 343 families) and Satahan (4 villages, 135 families). There existed 2773 families, of which 972 belonged to scheduled castes and 482 to other backward classes. The deprived have been supported under below poverty line and Antodya (313 families) schemes, 238 under NFMS, 64 pensioners and 32 under RAY. The literacy rate was around 26 to 30% and up to 4% individuals were graduates. The per capita income ranged from 35,000 to 1,00,000 per annum for 33.62% of the population. Agriculture emerged as the main stay of the representing panchayats which had 71.37 per cent area under active cultivation. Cultivable land holding was computed to be 3.11 bigha/family or 0.484 bigha/head. Miscellaneous land constituted 87.5% area. Major cropping systems in the area were based on vegetable crops and cereal crops.

Table 1 Baseline data of the project area

Parameter	District Sirmour	Block Sangrah	Project area
Altitude (m amsl)	400-2174	736-2174	1048-2174
Villages (No.)	968 (228 panchayats)	121 (41 panchayats)	22 (8 panchayats)
Total persons (No.)	4,72,690	70,410	18,084
Cultivators (No.)	1,82,534	57,050	12,906
Geographical area (ha)	22,47,60,000	47,270	5611.09
Net cultivable area (ha)	4,03,07,000	6135.9	701.02
Cultivable area (%)	32.56	35.28	30.75
Fallow land (ha)	1,14,81,000	-	445.63
Pastures (ha)	5,95,83,000	-	2072.40
Shamlaat (ha)	2,37,34,000	-	7804.76
Forest (ha)	4,86,82,000	-	1474.08

(Anonymous, 2014)

Ginger, peas and chilli had been the major cash crops of the area, which has been replaced with more remunerative crop, garlic. Women have been the main labour force, to be essayed for drudgery.

Personal contact with the individuals, panchayat pradhans and secretaries, beneficiaries and user groups were mobilized to collect base line data. The veterans were given due regards in drawing the time line of each panchayat. The interaction with the veterans made startling revelations. The first evidence of civilization dates back to 600 years, when people migrated from Bishad ka Bag and settled in Bharari village. Wide spread settlement started around 400 years ago. People migrated from Mehli Shimla, Shilai and Pachhad area of Sirmour. However, the original natives of this area have further migrated to Bhawai and Ghandhuri. People migrated from Katah Shilla since the time immemorial. Then a person from Saindhar near Dadahu came here in Bhawai, where Katah people helped him to settle down. In 1900, flash floods in the area destroyed life and the property was washed away. First primary school was opened at Korag, Badol in 1951 and was upgraded to middle school by 1956 and high school in 1970, whereas, the road to the school is yet to be metaled. Electrification of the area started from 1972. Since then the area has produced numerous educated persons, who has been instrumental in developing the area. Agriculture started with the cultivation of small millets (manduwa, koda), wheat and maize by leveling the barren land. Manual labour, mainly drudgery, was the practice in vogue. Tenancy is missing, rather own farming is prevalent.

Mapping and modeling are good techniques which involve several people, stimulate much discussion and enthusiasm, provide the PRA with an overview of the area, lead to transect walks, perhaps accompanied by some of the people who have constructed the map (Chambers 1992,

Table 2 Cropping pattern and seasonal activities

11 Harvesting of Toria/Sarson and early pea. Uprooting of ginger. Sowing of wheat, pea. Harvesting of Mandua crop. Hoeing in garlic.	12 Uprooting of ginger, sowing of wheat, pea, weeding and hoeing of all crops. Harvesting of Mandua crop		1 Irrigation in wheat, peas, weeding and hoeing in peas, garlic, sowing of potato		2 Weeding and hoeing in potato. Irrigation in garlic, potato, wheat. Raising of Tomato nursery in semi protected conditions.
10 Maize harvesting. Grass cutting from Ghasni/ grassland for storage. Hoeing in garlic and pea.	11 November	12 December	1 January	2 February	3 Irrigation and weeding in potato, garlic and wheat. Sowing of tomato and chilli.
	10 October			3 March	
9 Sowing of garlic, early pea and Toria/ Sarson. Irrigation and hoeing of all crops grown in August including ginger and turmeric. Spraying pesticides in ginger, tomato and vegetables.	9 September			4 April	4 Harvesting of wheat. Curing of garlic in standing crop. Transplanting of tomato
	8 August	7 July	6 June	5 May	
Weeding in ginger, Colocasia and turmeric, manduwa (finger millets), kali-zeeri, and other crops. Spraying pesticides in ginger, tomato and vegetables.	Sowing of Mandua (finger millet). Weeding in ginger, Colocasia and turmeric etc. etc. Time to time harvesting of tomato. Spraying pesticides in ginger, tomato and vegetables.		Sowing of maize, kali-zeeri, turmeric, Colocasia. Irrigation of crops grown, uprooting of potato. Irrigation and staking operations in tomato fields. Time to time harvesting of tomato.		Ploughing of fallow fields. Harvesting of garlic. Transplanting of tomato, sowing of ginger.
8	7		6		5

Theis and Grady 1991). Various aspects, particularly related to agriculture were portrayed, viz. (a) terrains, slopes (b) forest, vegetation, tree species (c) soil type, fertility, erosion, depth (d) land and land use pattern, and (e) water, water bodies, irrigation units. SWOT analysis of each panchayat was done after mapping each village. And the final analysis of the project area, by pooling the SWOT aspects, have been discussed further

Appraisal on topography, hydrology, soil type, indigenous knowledge technology (IKT), cropping patterns including yield, production, and productivity etc. were done. The walk was organized by trekking from top of the panchayat to the bottom by covering all the villages under the panchayat.

PRA was followed to have appraisal of the problems of the natives and further developing apriori. The PRA was conducted with the participation of at least 15 persons from each village stratified in a panchayat. The problems were enlisted with the appraisal of the farmers. Preferential choice was exercised between the two problems. The preferred one was scored in the corresponding cell in the upper half diagonal chart. The row was converted into column for filling the other half of the diagonal. The frequency of each problem appeared in the different cells, was counted to take the final score. The problem with the highest score was ranked number 'I' and others were ranked in descending order. The method of matrix analysis as proposed by Chambers (1994) was adopted, which has earlier been used by Brahmi *et al.* (2015). Further, the problem with maximum cumulative score over the eight panchayats was ranked number 'I', while others were put in the descending order of pooled problems for ranking (Table 3).

Taking the cognizant view of the villages in each panchayat, finally the actions for holistic development of the natives would be designed into (i) convergence of actions of line departments, and (ii) approaches for the holistic development of the panchayat.

RESULTS AND DISCUSSION

Revelations of survey and surveillance

The project area was typically temperate in climate, situated at an altitude of 1048 to 2174 m amsl. The mid-Himalayan villages, chosen as project area, 22 in number, were representing 25.7% general population and 22.6% cultivators. As a sample mean, only 2.2% represented the district. Agriculture was practiced in small ladder type fertile fields, capable of accommodating low-volume high-value crops. The project area had only 701.02 ha (30.75% under irrigation) cultivable area for the consideration of emerging remunerative proposals. Pastures were huge (2072.4 ha) and forests (1474.08 ha) were generally reserved/protected, to be left un-touched. Land in the form of culturable fallow (445.63 ha) and Shamlaat (7804.76 ha) could be brought under remunerative agricultural activities (Table 1). There were 18084 persons, mostly educated, as only 13% emerged illiterate (Fig 1). Agriculture was the main occupation of 72% natives (Fig 2).

Livestock population included hilly cows (4925), cross bred cows (558), buffaloes (314), mule (118), bullock (4060),

Table 3 Revelation of the problems, suggestions of the villagers and scientific interventions

Rank	Problem identified	Suggestions from villagers	Apriori (Scientific solution)
I	Monkey and wild animals menace	Hunting/Exported to distant places; and compensation for damage of crops should be provided	Plantation of fruiting trees in their natural habitat be strengthened; Forest department to protect wildlife. Chain linking fencing around the cultivable fields be taken up.
II	Erratic irrigation and drinking water supply	Be regulated	Local resources be managed. All sources be tapped and linked. Rainwater harvesting to be strengthened.
III	Lack of awareness about new techniques	Impart trainings	Interventions from extension department be increased+ access to IT be initiated. Deputation of Gram Sewaks.
IV	Ginger Rot	Be controlled at any cost	Follow 20 point integrated approach for its control
V	Poor connectivity-road and communication	Frequent bus service be provided	Frequent bus service be provided + unemployed youth be engaged in operating taxis/buses.
VI	Migration of youth from villages to cities	Lucrative option in MGNREGA and urban areas, turning youth back to agriculture	Retail management, hospitality management, IL&FS. Value addition of fruits and vegetables through SHG. Expression of MGNREGA field.
VII	Non-availability of agricultural inputs like seeds, fertilizers etc.	Assured and timely supply of generic input be regulated	Let local youth be involved in supplying inputs in entrepreneur ventures. Let the seed chain in public sector, be revived.
VIII	Soil erosion	Should be checked	Use of soil conservation methods like Gully plugging, check dams etc.
IX	Hindrance due to local politics	No reply	No solution
X	Erratic electricity supply	Be regulated	Local inputs be given due attention viz., Water mills (Ghrats). Renewable resources be managed.
XI	Abandoned agriculture due to public distribution system	Interest in agriculture be inculcated.	MGNREGA work area to be expanded to agriculture by involving every youth.
XII	Lacking minimum support price and crop insurance of each crop.	Insurance and MSP of each crop be fixed.	Govt. to intervene and intervening now.
XIII	Non-consolidated land	Consolidation be done	Consolidation be done on priority basis.
XIV	Lacking higher education facility	Elevation of school status	Elevation of school status
XV	Labour scarcity	Local jobs be created for confine the youth to villages.	Agriculture venture be made remunerative. Mechanized farming be encouraged.
XVI	Defunct apple cultivars	-	Replacement of cultivars according to altitude adaptability.
XVII	Frequent blockage and breakage of irrigation kuhals (channels)	Funds in abundance be provided to the panchayats	All such Kuhals be replaced with LDPE pipes (2"-5"diameter).
XVIII	Invasion of obnoxious weeds	Be controlled	Eradication is the only solution.

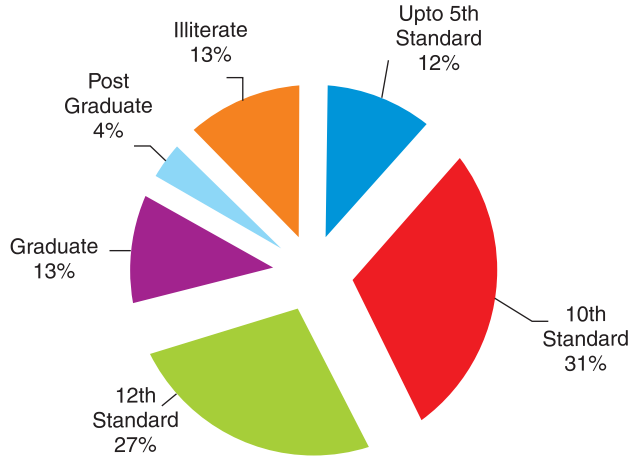

Fig 1 Educational status

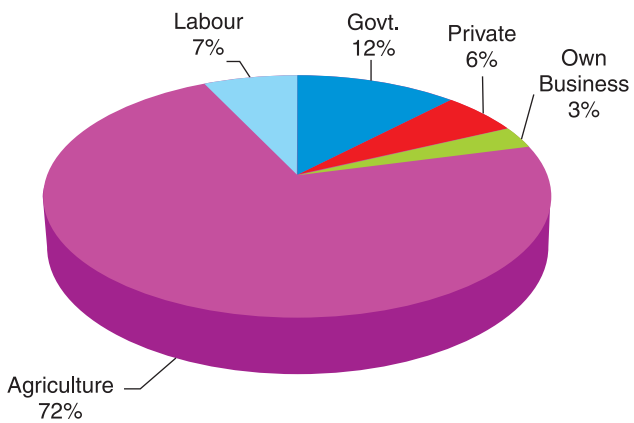

Fig 2 Employment status

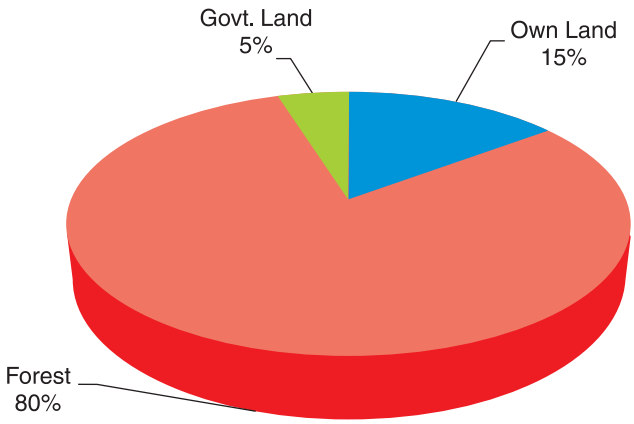

Fig 3 Availability of fuel wood

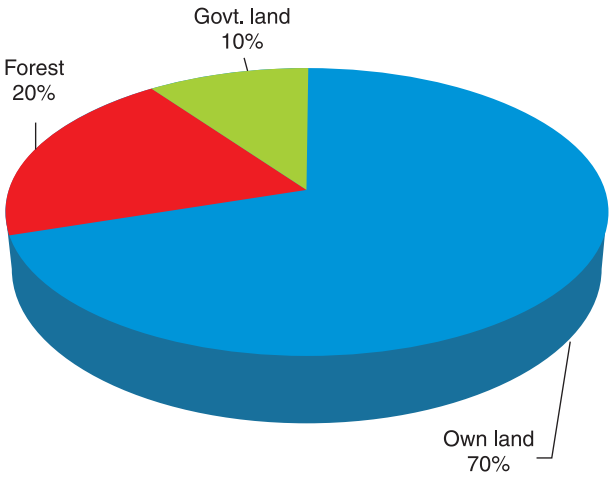

Fig 4 Availability of fodder

calf (1800), goat (10870), sheep (440), poultry (72) and pigs (25). Average fuel wood requirement per day was 7 kg and fodder requirement per day was 40 kg (Green-20 kg, Dry-20 kg). The availability of fuel wood was mainly met from forests (Fig 3) and fodder from own land/pastures/ forests (Fig 4).

Revelations of resource mapping

The special character of the area was the fertile soil supporting the cultivation of diverse crops. The SWOT analysis reflected the true face of the block. The Strengths were innumerable. Innovative attitude of the natives, fertile soil supporting higher productivity, availability of local manpower, congenial micro-climate for growing all type of temperate crops and accessibility to basic amenities at door step were some of the qualitative features bestowed to the area.

Their Weaknesses lied in rain fed and obsolete traditional farming practices, deteriorating road conditions for quick transportation, lack of awareness about the latest technology, local politics playing hindrance in every rise, blind and non-judicious use of agro-chemicals, deficit in fodder availability, unable to harness full potential of soil due to unmanaged irrigation water, lack of local market facilities and poor knowledge of livestock management.

There existed plethora of Opportunities in value addition and post-harvest management of agricultural Pahari produce, scope of diversification of crops for remunerative returns, scope of protected cultivation, scope of bringing more area under irrigation by rain water harvesting or existing water sources, exploring livelihood opportunity in goatary by-products, strengthening dairy farming with the introduction of high yielding milching cow breed, scope for area expansion under horticultural crops particularly floriculture and management of available water resources. Beyond control were the Threats emerging in the form of changing climatic factors like erratic monsoon, erratic temperature, hail storms, flooding, cloud bursting, stone rolling from the hill tops etc. Other scaring threats included frequent road blockage, soil erosion due to local rivulets (nullahs/ khads), spurious supply of seeds/ planting materials/ insecticides/ pesticides, squeezing area per family, extenuating compost, and above all, monkey and wildlife menace.

Revelations of the transect walk

Fallow land attracted while walking through the villages. Why abandoned? Instant thought appeared to utilize such wasted land but otherwise fertile fields. The fowl smell emitted from carcass also attracted. Major farming systems observed in the area were:

1. Agriculture-Agriculture
   - Maize/Rajmash/Cowpea/Ginger/Turmeric/Colocasia/Kalizeeri were the kharif crops.
   - Wheat/Sarson/Garlic/Pea was the rabi season crops.
   - Early Pea and Toria were the autumn/spring zaid crops.
2. Agriculture-Silviculture
   - Agriculture crops + tree species on the bunds (Behul, Leucaena, Khirk, etc.)
3. Agriculture-Silviculture-Horticulture
   - Agriculture crops + tree species+ stone fruits on the bunds. No crop was cultivated underneath the fruit orchards grown exclusively for fruit production.
4. Agriculture-Silviculture/Horticulture –pastoral
   - Agriculture crops + tree species/ fruit species + Grasses (Napier, Steria, local grasses etc.)

Main stay of the farmers had been vegetable based. Crops grown during rabi and kharif seasons have been depicted in Fig 5, 6. Cropping pattern and seasonal activities have been depicted in Table 2, indicating laborious months of the farmers to grow crops like garlic, wheat, peas in rabi , maize, ginger, turmeric, potato, tomato and beans in kharif season. The culture of wheat–maize pattern was broken with the introduction of more remunerative crops viz. chilli and ginger. By the end of 20th century, chilli had further been replaced with more paying vegetables like tomato and beans. The advent of poly-culture had made the farmers passionate for floriculture by the beginning of 21st century. The developments in agriculture were concomitant to the developments made in other sectors like roads, communication, health, education and other line departments. Agricultural productivity was low.

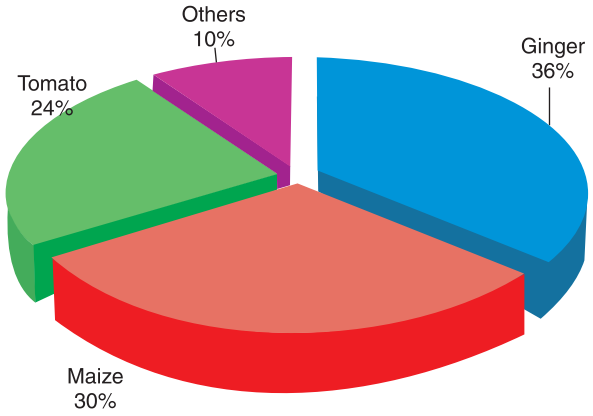

Fig 5 Area covered under *kharif* crops

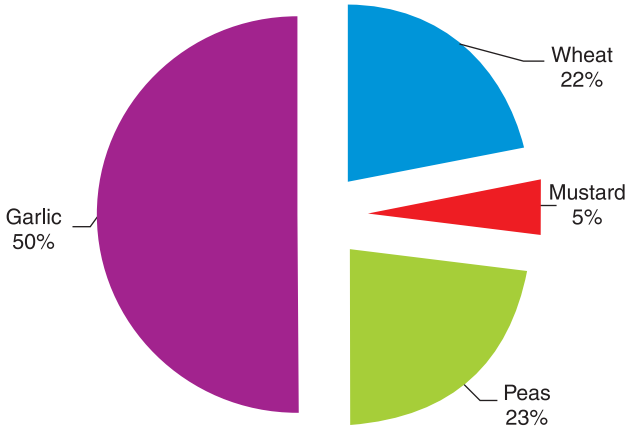

Fig 6 Area covered under *rabi* crops

Revelation of PRA

The meeting with the villagers ushered a plethora of problems. These problems were enlisted, scored by following the preference pattern and then ranked in the descending order for each panchayat. The sum total of score assigned to each problem, in each panchayat, was cumulated and pooled for ranking the problem. The solution, provided to each problem by the villagers was a step ahead in learning. Suggestions of the villagers and scientific interventions have also been columnised in the same Table 3. Similar PRAs were exercised on livestock and animal husbandry (Leyland 1993, Maranga 1993, Young 1993). Kumar *et al.* (2015) conducted PRA exercises with the aim to study perceptions of farmers on apple farming along the altitudinal gradient and subsequently, the data were collected through interviews/ discussions with individuals and the focus groups within the farmer's community. Farmers were also interviewed on the trends in snowfall, extreme events and changes in seasonality, cropping system and pest attack.

Analytical hypothesis on agriculture

The appraisal revealed many bottlenecks in the technology being adopted. Some villagers were still confined to the traditional practices, even the seed was conserved from pedigree to pedigree. Simply adoption of improved varieties, in association with 1 or 2 refined agronomic practices, could improve the yield by 50%. For example, in maize, the sowing of local variety with broadcast method is yielding 2.0 q grains/bigha (Table 4). While the adoption of improved variety, through line sowing method, would yield 3.0q grains/bigha. Same is true for Wheat.

Similarly, agroecosystem analysis (Conway 1985, 1986, 1987) was developed in Thailand drawing on system properties (productivity, stability, sustainability, and equitability) with pattern analysis of space (maps and transects), time (seasonal calendars and long-term trends), flows and relationships (flow, causal, Venn and other diagrams), and relative values (bar diagrams of relative sources of income etc.). Farmer participatory research/ farming systems research and problem identification and analysis by farmers has also been documented properly (Guijt and Pretty 1992, Lightfoot *et al.* 1992, Chambers 1993, Drinkwater 1993, Lightfoot and Noble 1993).

Shortcomings in agriculture production	Scientific interventions
Rainfed area	Introduction of improved seeds / planting material
Lack of awareness about improved seed and technologies	Introduction of abiotic resistant varieties
Transportation problems and connectivity to markets	Establishment of vermi-compost units and compost pits.
Extenuating compost.	Afforestation with suitable multipurpose plant species.
Diseases in ginger.	Revigoration of wasteland.

Shortcomings in horticulture production	Scientific interventions
Second choice crop: Meager area available	Introduction of improved seeds / planting material of pomegranate apple and kiwifruit.
Marketing problem	Poly-house culture for as high returns as ₹ 3 lakhs/bigha/ annum.
Non-availability of elite planting material/ seed	Establish vermi-compost units.
Lack of adoption of new technology.	Fruit orchards for additional income (Proposal-3).

Unveiling remunerative agricultural proposals

The proposals may seem unrealistic, but handsome lucrative returns can keep the youth confined to the village boundaries for earning daily bread and butter. These proposals are based upon the earlier findings of Joshi *et al.* (2015). The proposals are being made for micro-climatic regions within the project area, based upon the geo-specific resources available in the area.

Vegetable based proposals for cultivable areas under irrigation: The general practice of 300% cropping intensity

Table 4 Comparison of existing and proposed returns from different crops (PRA analysis)

Crop	Existing			Proposed			Remarks
	Technology adopted	Yield/bigha (q)	Returns/ bigha (₹)	Technology Intervention	Yield/ bigha (q)	Returns/ bigha (₹)	@ rate of….
Maize	Local Broadcasting	2.0	2800	Improved var, viz. Akash, Ganga, Kaveri, or Kanchan-9454 (more Sucrose) Line sowing	3.0	4200	₹ 1400/q B:C will improve
				Popcorn	2.0	5000	₹ 2500/q
				Sweet corn	2.0	6000	₹ 3000/q
				Baby corn	4.0	32000	₹ 8000/q
Wheat	Local Broadcasting	3.0	3600	Improved var. viz. HPW-236, HPW-349, UP-2338, Line sowing	3-4 q/ bigha	4200	@Rs 1200/q B:C will improve
Turmeric	Local	3.0-4.0	12000-16000	Poplar+Palam Pitamber Palam Lalima	150poles/ bigha + 20.0q	82000/- annum or 50000/- from turmeric	192000 from poplar + 300000 from turmeric over 6 years.
Ginger	Local	3.0-4.0	18000-24000	Local+ 10% Maize+ 25% Coriander	4.0	24000+ 420+ 8000=32420+ 4800	Ginger as mixed crop
Early pea	Arkel in Sept.	5.0	12500	Palam Triloki	6.0	15000	@ ₹ 2500/q
Paddy	Parmal var. Arise 6444 Arise Swift Pusa 1121	8.0 4.0-5.0	16000 5600-7000	Kasturi	12.0 3.0-4.0	24000 7200-9600	@ ₹ 2000/q @ ₹ 1400/q for Parmal @ ₹ 2500/q for Basmati
Garlic	Local var.	5.0	17500	GHC-1	10.0	35000	@ ₹ 3500/q
Potato	Kufri Jyoti Dhakri	5.0	5000	Sathee (60thee) Sept-Nov.	3.0-4.0	3000-4000	@ ₹ 1000/q
French bean	Contender	6.0	12000	Pencil beans, Phalguni/ Lakshmi	13.0	26000	@ ₹ 2000/q
Blackgram (Urd)	Local var.	1-1.5 q	5000-7500	Him Mash-1	1.0 q	5000	@ ₹ 5000/q
Cowpea	Local var.	0.5 q	2500	Palam Lobia	1-1.5 q	5000-7500	@ ₹ 5000/q
Sarson	Local var.	1.5 q	7500	Toria Bhawani	2.0 q	10000	@ ₹ 5000/q
Local rajmash	Local var.	0.5 q	2500	Kinnauri type (Baspa, Trilocki, Jawala, Kilash)	1.2 q	6000	@ ₹ 5000/q

of maize+french bean in kharif followed by garlic in rabi will fetch ₹ 32,300 per bigha per annum. Proposal-1 is involving two years cropping pattern of 400% and 200% cropping intensity which would fetch ₹ 64,960 per bigha per annum. Proposal-2, unleashed by an innovative farmer Sh. Anil Tomar would generate highest remuneration of ₹ 2.5 lakhs per bigha per year. Proposal-3 fruit based cropping system, will fetch Rs. 1.80 lakhs/bigha/annum with kiwi fruit plantation. All the three proposals are better than the traditional system, depending upon the suitability of the proposed pattern to mini-agro-climate prevailing within the panchayat.

MGNREGA intervention for community usufruct: Proposal 4 and 5 have had focused on the utilization of waste land (fallow+Shamlat) available at the disposal of the natives. If such land is brought under cultivation, with the involvement of MGNREGA labour, the returns can be enormous. Proposal-4 is envisaging returns worth ₹ 79.65 crores and proposal-5 is projecting ₹ 1395.1 crores during the first six juvenile years. These figures are lucrative enough to attract and involve youth in agriculture activities.

Allied avenues: Milk from cows and goat/sheep has had been in great demand. Both fodder and rearing of livestock are complimentary, hence, generate work for the youth. Flesh has been the fancy food to supplement. The remuneration of ₹ 18.38 crores may prove lucrative to the youth.

Proposal 1 Alterations in the existing cropping pattern for higher returns

1st Year (400% CI for 1 bigha)	Period	June-Dec.	Jan-May	June-Aug	Sept-May	Returns/bigha	Per annum returns from the same bigha
	Crop	Ginger+++	Potato	Cowpea	Garlic	₹ 79920	
	Returns (Min.)	32420	5000	7500	35000		
2nd Year (200% CI for same bigha)	Period	June-Sept.	Nov.-May			₹ 50000	₹ 64960
	Crop	Pencil bean	Pea-Pb-89				
	Returns	26000	24000				

Proposal 2 Most profitable intervention adopted by selected farmers (PRA based)

	Intervention	Farmer's practice		Total returns/bigha (₹)
Crop	Garlic + Pea	Inter-culture	Tomato + Pencil bean	2.50 lakhs
Returns in ₹ lakh	1.50+0.30		0.35+0.35	

Proposal 3 Interventions in horticulture

Status	Particulars	Pomegranate	Kagzi Lime	Peach	Apple	Walnut	Aonla	Kiwifruit
Existing	Area	0.5 bigha	1 bigha	-	-	-	-	-
Proposed	Increase in area	80 bigha	110 bigha	25 bigha	30 bigha	35 bigha	25 bigha	100 bigha
	Adoption of new Variety	Kandhari, Ganesh	K Lime/lemon	July Elberta		Gobind, Ureka, Kotkhai Selection	Chakaya, NA7, NA 10	Allison, Haywords
Returns (₹/bigha)		40000	80000	100000	125000	125000	30000	180000

Proposal 4 Management of fallow land

Fruit orchard	Fallow land	Yield (q) /bigha	Total production (q)	Rate (per q)	Returns (₹)	Remarks
Apple (Vance Delicious) 67 plants/ bigha at 4 × 3 m spacing	5570.37 bigha	25	139259.25	@ ₹ 5000	696296250	Returns are expected from 6th year of planting
Local rajmash	3342.2 bigha (less 40%)	0.5	1671.11	@ ₹ 10000	16711110	Rajmash will be grown for first six years only

Proposal 5 Management of Shamlat land

Fruit orchard	Shamlat land	Yield (q) per/bigha	Total production (q)	Rate (per q)	Returns (₹)	Remarks
Apple (Vance Delicious) 67 plants/ bigha at 4 × 3 m spacing	97559.5 bigha	25	2438987.5	@ ₹ 5000	12194937500	Returns are expected from 6th year of planting
Local rajmash	58535.7 bigha (less 40%)	0.5	29267.85	@ ₹ 10000	292678500	Rajmash will be grown for first six years only

Total income from the fallow land over the six-year period = ₹ 12194937500 + (292678500 × 6 = 1756071000) = 13951008500

Proposal 6 Demand and supply gap of fodder (tonnes/year)

Available (Supply)			Required (Demand)			Deficit		
Green	Dry	Total	Green	Dry	Total	Green	Dry	Total
77450	45179	122629	157052	58895	215947	79602	13716	93318

Proposal 7 Comparative returns from goatary and milching animals

Comparison	Number	Total production	Total returns (₹)
Milching animals	5797	235503.12 L	1.18 crore
Meat (goatry) animals	11310	565500 kg	18.38 crores

Action plan

The revelations made through resource mapping particularly SWOT analysis, transect walk and PRA exercise lead to plan some actions for the development of temperate villages. Bi-pronged strategy has been proposed.

Convergence of actions

Convergence is the execution of schemes by the respective line departments for appropriately utilization of the funds released by different agencies. The following activities, indirectly related for the development of agriculture, have been taken into account for convergence:

- Road construction by PWD, laying out optical fibre cable by IT companies and irrigation layout by IPH run simultaneously on the same piece of land which can pool their resources for effective functioning, maintenance and fund utilization.
- Generate work for MGNREGA in the State department of Agriculture, SAUs and research stations.
- Distribution of improved seeds, planting material, fertilizers, insecticides and pesticides can be converged with State Agriculture Department, Horticulture Department & Block Development Offices, through the panchayat.
- Construction of polyhouses and other subsidized farm tools and implements are distributed either by the State Department of Horticulture under Horticulture Technology Mission (HTM) or under State department of Agriculture and Pandit Deen Dayal through Upadhaya Krishi Yojna. Both the departments should work cohesively by the panchayat only.
- Construction of water harvesting tanks are being facilitated by Watershed Development Projects, Mid-Himalayan Project, mini-mission, MIDH and many other schemes. All these need to be converged through the panchayat.
- Income generating activities and micro enterprises installation and development with help of rural development, Small Scale Industries, Prime Minister Employment Generation Programme, self-employment scheme etc. may be concentrated on the dexterous youth through the panchayat.
- Livestock development programme with animal husbandry department and Doodh Ganga Pariyojna run by NABARD, need to be converged through the panchayat.

These schemes, if converged under the guidance of agricultural scientists posted in the regional research stations will add more weight-age to the scheme. Other schemes in particular, need to be converged, have been texted in Table 5.

Approaches for the holistic development of the panchayat

The proposals being made in the following text are the outcome of the analytical views of the authors, emerged through the data and observations collected from the panchayats included in study.

HAD (Holistic Approach for Development)

1. Increase in area under commercial crops
   - 5570.37 bighas fallow and 97559.5 bighas shamlat land to be brought under cultivation.
   - MGNREGA work field to be expanded with the revigoration of fallow and shamlaat land.
   - The introduction of improved species of grasses (napier, steria, ginni,) and tree species (beul, kachnar, shahtoot, sain) will certainly strengthen the fodder bowl of the village.
2. Livestock
   - Milk productivity ought to be improved through the introduction of cross-bred cows.

Table 5 Convergence of State Departments

Problem identified	Convergence of executing agencies
Frequent road blockage in rainy days	Departments of PWD, IPH.
Land sliding + soil erosion	DRDA/ SC/DWDO.
Monkey menace and wildlife menace	Forest Department
Revigoration of fallow and shamlat land	DDA /DDH/ DRDA
Improvement in pastures	Deptt. of Forests/ KVK/RRS of SAUs.
Crop diversification	DDA/ KVK/RRS.
Precision farming-even for ginger	DDA/ KVK/RRS.
Value addition, Goatary by-products	Deptt of Industry/ DDAH/ Forest deptt./ NABARD
Promotion, conservation and protection of farmer's rights w.r.t. native species.	DDA/RRS
Enhancement of milk and meat production.	DD Animal Husbandry/RRS/ NABARD
Power generation from the 'Ghrats' and Sun energy	Himurja/ Deptt. Of Energy/IPH
Burial of Carcass to prevent epidemics	Panchayat Pradhan/ Dept. of Industry
Regularization of seed and planting material	Panchayat Pradhan/DDA/DDH/ NABARD
Promotion of Goat/ sheep rearing over cattle and value addition to its by-products.	DD Animal Husbandry/DDH/DDA/processing industry/ NABARD
Interlinking of water resources	IPH/DRDA/ Mid-Himalaya/DWDO/ NABARD
Abridging of gap between the farmers and the scientists	DDA/DDH/DDA/ATMA/ NABARD etc.

- Flesh is the fancy food of the area. Goatary, as business, will certainly fetch handsome remuneration for the farming community of the village.
- Enterpreneuring in goatary by-products. Branded milk, paneer, yoghurt etc. to be manufactured.

3. New agricultural avenues

i) Diversification of crops
- Round the year cultivation of radish, marigold and cauliflower.
- Orchard floor farming with different vegetable crops is to be brought in practice.

ii) Precision farming
- Introduction of new high yielding varieties.
- Adoption of refined technology in the existing cropping pattern.
- Hi-tech farming like adoption of poly culture/ low cost protected structures.

iii) Non-farming avenues
- Meat production by rearing goat (He), pig, poultry etc.
- Mushroom culture particularly dhingri or shitake mushroom (high temperature tolerant).
- Catching pace with the goatary flesh, leather and crockery.
- Anardana (Darhoo) to be rejuvenated in the light of increasing export.
- Carcass disposal for generating extra income.

4. Community avenues as usufruct rights
- Shamlat land, if brought under cultivation, will raise the economic status of the farmers.
- Wasteland development into community orchard of pome/stone fruits or even the introduction of forest species of economic use, viz. deodar, bann, willow, poplar etc.
- Introduction of fodder tree species, viz. beul, kachnar, shahtoot khirk, leucaena in the pastures.
- Harnessing sun energy.
- Entrepreneurship in mineral mixture production for livestock.
- Establishment of composting pits in every household at personal level and in every shamlat at community level.
- Management of dung, cattle litter, household waste etc. with the renovation of cowshed, kitchen and washroom.

Conclusion

The PRA unleashed 18 problems of the villagers in the temperate Himalayas. The matrix analysis extrapolated the prime problem of monkey and wild animals menace. Other problems ranking in the descending order were erratic irrigation and drinking water supply, lack of awareness about new techniques, ginger rot, poor connectivity by road and communication, migration of youth from villages to cities, non-availability of agricultural inputs like seeds, fertilizers etc., soil erosion, hindrance due to local politics, erratic electricity supply, abandoned agriculture due to public distribution system, lacking minimum support price and crop insurance of each crop, non-consolidated land, lacking higher education facility, labour scarcity due to MGNREGA and migration, defunct apple cultivars, frequent blockage and breakage of irrigation kuhals (channels) and invasion of obnoxious weeds. These problems were common and directly infesting every field of the farmer. The cognizant expression of views for the upliftment of the community lies in (i) convergence of allied schemes, (ii) area expansion under crops by cultivating waste lands, (iii) ameliorating livestock production and productivity, (iv) changing cropping patterns by way of diversification, precision farming and adopting allied non-farming avenues, and (v) adopting community avenues in the form of usufruct rights. The outcome of the present study gave seven proposals for ameliorating income resources of peasants in the hills.

REFERENCES

Anonymous. 2014. Statistical abstracts of Himachal Pradesh. Department of Economics and Statistics, Govt. of Himachal Pradesh.

Brahmi M K, Joshi A K, Gupta B K, Kumar P and Thakur P. 2015. Matrix Analysis of Farmers Problems through Participatory Rural Appraisal in Paonta Block of District Sirmour. National Symposium on Modern Agro-Technologies for Nutritional Security and Health organized w.e.f. 21-23 April, 2015, YSPUHF, Nauni, Solan, Himachal Pradesh.

Chambers R. 1983. *Rural Development: Putting the Last First*. Longmans Scientific, Essex, England and Technical Publishers; John Wiley, New York:

Chambers R. 1992. Rural Appraisal: Rapid, Relaxed, and Participatory. Discussion Paper 311, Institute of Development Studies HELP, Sussex:

Chambers R. 1993. Methods for analysis by farmers: The professional challenge. *Journal for Farming Systems Research Extension* **4**(1): 87–101.

Chambers R. 1994. Participatory Rural Appraisal (PRA): Analysis of Experience. *World Development* **22**(9): 1253–68.

Conway G. 1985. Agroecosystem analysis. *Agricultural Administration*, **20**: 32–55.

Conway G. 1986. Agroecosystem Analysis for Research and Development, Winrock International Institution for Agricultural development, PO Box 1172, Nana Post Office, Bangkok.

Conway G. 1987. Rapid rural appraisal and agroecosystem analysis: a case study from Northern Pakistan. *KKU Proceedings*, pp 228–54.

Drinkwater M. 1993. Sorting fact from opinion: The use of a direct matrix to evaluate finger millet varieties, *RRA Notes*, **17**: 24–8.

Guijt I and Pretty J N. 1992. Participatory Rural Appraisal for Farmer Participatory Research in Punjab, Pakistan.

Joshi A K, Brahmi M K, Gupta B K, Kumar P and Thakur P. 2015. Apriori to the problems emerged through Participatory Rural Appraisal in Sangrah Block of District Sirmour in Himachal Pradesh. National Symposium on Modern Agro-Technologies for Nutritional Security and Health organized w.e.f. 21-23 April, 2015 at YSPUHF, Nauni, Solan, Himachal Pradesh.

Kumar P, Joshi A K, Gupta B K, Brahmi M K and Thakur P. 2015. Exploring the potentials of apple farming in sirmour: PRA based local perceptions and responses. (*In*) *National Symposium on Modern Agro-Technologies for Nutritional Security and Health*, organized w.e.f. 21-23 April, 2015 at YSPUHF, Nauni, Solan,

Himachal Pradesh.

Leyland T. 1993. Participatory rural appraisal in Afghanistan. (In). Livestock Services for Smallholders. Daniels P.W. *et al*. (Eds) Indonesian International Animal Science Research and Development Foundation, Bogor, Indonesia.

Lightfoot C and Noble R. 1993. A participatory experiment in sustainable agriculture. *Journal for Farming Systems Research Extension*, **4**(1): 11–34.

Lightfoot C, Dalgaard P, Bimbao M and Fermin F. 1992. Farmer participatory procedures for managing and monitoring sustainable farming systems. *Second Asian Farming Systems Symposium*, BMICH, Colombo, Sri Lanka.

Maranga S. 1993. Participatory information collection in Kenya and Zimbabwe. (*In*), Livestock Services for Smallholders. Daniels PW *et al*. (Eds.), Indonesian International Animal Science Research and Development Foundation, Bogor, Indonesia.

McCracken J A, Pretty Jules N and Conway G. 1988. *An introduction to rapid rural appraisal for Agricultural Development*. IIED, London.

Pretty J N and Chambers R. 1993. Towards a Learning Paradigm: New Professionalism and Institutions for Agriculture: Discussion Paper No. 334, IDS, Sussex, England.

Richards P. 1985. *Indigenous Agricultural Revolution*. Hutchinson, London and Westview Press, Colorado.

Theis J and Grady H. 1991. *Participatory Rapid Appraisal for Community Development*. Save the Children Fund, London.

Young J. 1993. Alternative approaches to the identification of smallholder problems and opportunities. (*In*) *Livestock Services for Smallholders*. Daniels P W et al. (Eds.), Indonesian International Animal Science Research and Development Foundation, Bogor, Indonesia.