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Farmer – agroforestry land use adoption interface in degraded agroecosystem of Bundelkhand region, India

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Abstract

The studies on agroforestry development was conducted on 80 household during 2005-2008 in Garhkundar-Dabar watershed with an aim to analyze farmerôs willingness to plant trees on crop lands, reasons prohibiting its adoption, choice of tree species, system of plantation and the actual adoption of agroforestry over the years. During the course of study, farmerôs willingness to adopt agroforestry land use increased by 50% (45% for fruit trees and 5% for timber trees) with time due to constant persuasion and developmental activities particularly water harvesting and management. Nearly 44 and 53% of the farmers preferred boundary plantation system for fruit and timber trees, respectively. Source of inspiration with respect to choice of species changed with time and was considerably influenced by demonstrations (34%) and expert advice (44%). Efficient land use (41%) and high production and income producing capability (31%) were the main motives of farmers to adopt agroforestry. Farmer considered reduced damage from hot and cold winds (24%), improved soil fertility (21%), reduced weed growth (20%) and improved microclimate (15%) as major positive tree crop interactions while competition for light and space (74%) and for soil moisture and nutrients (24 %) emerged as negative interactions. Adoption of agroforestry land use was very slow even after subsidy offers but it increased steadily to the extent that within three years not only farmers from within watershed area but also from neighbouring area started approaching for inclusion of trees in their farmlands.

Key words: Agroforestry adoption, Bundelkhand, Farmerôs perception, Land use, Watershed

Introduction

Traditionally, agroforestry has been practiced by farmers to meet the household requirements of fruit, fodder, fuel and fibre, yet, over the years small-scale tree production has gained momentum due to development of marketing avenues. Tree crops have been widely introduced as a way to re-establish a protective cover in environmentally fragile ecosystems (Arnold and Dewees, 1999; Pimentel and Wightman, 1999) and restore the soil fertility status. Agroforestry is a self reliant and risk proof system which balances environmental conditions by way of micro-climate moderation and degraded land rehabilitation and simultaneously enhances productivity. It is being promoted within the framework of rural development programmes as an alternative source of livelihood and income diversification, securing a greater degree of self reliance. Besides providing employment to millions of people, agroforestry also supplies over 95% of fuel wood and 40% of the forest products.

Organized agroforestry research is now more than sixty years old and despite some impressive scientific and technological advances over the last four decades, agroforestry rural development projects have experienced uneven success rates in many parts of the world due to inadequate adoption rates and/or abandonment soon after adoption (Pattanayak *et al.,* 2003). Agroforestry interventions have also been included in the watershed development programmes. Despite great scope, opportunities and efforts, there are several reports on farmers facing limitations in their attempt to extend agroforestry for commercial purposes and the larger issue of its adoption and impact on the economy and environment remains unclear. Faced with such situation, Sanchez 1995; highlighted the need to develop a predictive understanding of how farm households make decisions regarding land use, as others argued for more socioeconomic research on agroforestry (Current *et al.,* 1995; Mercer and Miller, 1998). In order to understand the intricacies of agroforestry interventions in watershed development programmes a study was initiated in Garhkundar- Dabar watershed of Bundelkhand under

semi-arid rainfed Central Plateau and Hill region of India. While preparing Garhkundar- Dabar watershed development plan, major emphasis was given to water resource development and agroforestry promotion and both were targeted simultaneously. During the course of watershed development, farmerôs willingness to adopt agroforestry, reasons prohibiting agroforestry adoption, selection of tree species by the farmers and actual adoption over time were analyzed.

Study site: Bundelkhand region is located in the transitional zone between peninsular plateau and northern plain and comprises of seven districts of Uttar Pradesh and six districts of Madhya Pradesh. It is located between 23^0 8ô 26^0 30ôN and $78^0$11ô 81^0 30ôE covering a total geographical area of 7.085 million ha (2.15% of the total geographical area of India) and a forest cover of 17.63% (FSI, 2005). The agroecosystem of the Bundelkhand region is very fragile and degraded. Physiographically, Bundelkhand is among the most disadvantaged regions of India owing to undulating and rugged topography, highly eroded and dissected land, poor soil fertility, small land holdings, lack of irrigation facilities, scarce underground water resources and heavy biotic pressure on natural resources (Palsaniya, 2008). The rain fed agro-ecosystem of Bundelkhand is characterized by dry and hot summer, warm and moist rainy season and cool winter with occasional rain showers. The mean summer (April-June) temperature is 34^0C which may rise to a maximum of 46 to 49^0C during May and June while mean winter temperature (December-February) is 16^0C which may drop to 3-5^0C in December and January. The annual rainfall of the Bundelkhand region varies from 800 to 1300 mm, about 90% of which is received during South-West monsoon period in the month of July and August. The winter rains are erratic, occasional, meager and uncertain. It has been observed that in a cycle of 5 years, 2 are normal, 2 drought years and 1 is excessive rainfall year (Tiwari *et al.,* 1998). However, during last 8 years, 5 were severe drought years (2002, 2004-07, and 2009). This phenomenon is likely to be recurrent in view of rise in temperature due to global warming and resultant climate change. This acute drought led to heavy outmigration to the extent of 48% of total population towards big cities in search of livelihood in 2007-08 (Anonymous, 2008). Under such scenario, agroforestry adoption on watershed basis assumes great significance.

The general characteristics of the watershed area in terms of location, land use and resources are given in Table 1. This particular area was selected for the watershed development because of acute water scarcity, virginity from any kind of developmental work, majority of people from deprived classes and low level of socioeconomic development. Palsaniya *et al.* (2008b) while studying livelihood support system of the watershed dwellers revealed that majority of people (76.5%) depend on agriculture followed by labour (21%) while 2.3% people were engaged in other occupations like masonry work, driving, tailoring, pot making, carpentering, *etc*. The

Table 1: General characteristics of the watershed (study site)

Location and area	
Latitude	25^0 26ô24ò- 25^0 28ô31òN
Longitude	78^0 52ô41ò- 78^0 54ô44òE
Altitude	280 to 230 m above MSL
Relief	50 m
Area	850 ha
Land use	
Cultivated area	296 ha
Forest area	463 ha
Habitat	13 ha
Drainage network	46 ha
Scrub land	32 ha
Resources	
Total population	895
No. of households	191
Animal resources	2648
Land holding	1.55 ha/household
Main Rabi (winter season) crops	Wheat, pea, gram and mustard
Main Kharif (rainy season) crops	Groundnut, black gram and sorghum
Vegetation resource	Highly degraded forests of *Anogeissus* and *Butea*
Soil resource	Low in N, P, SOC and medium in K
Water resource	107 open shallow dug wells existed in unconfined aquifer

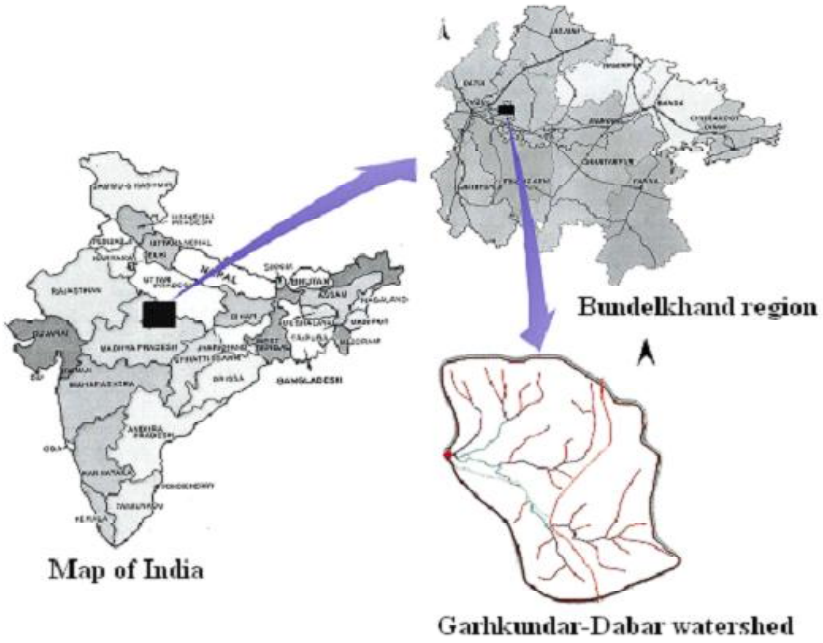

Fig. 1: Location of Garhkundar-Dabar watershed in Bundelkhand region

percentage of people employed in government services is only 1.2. Most of the cultivated area is mono-cropped due to lack of irrigation facilities. Not a single soil and moisture conservation measure, even field bunding, was taken/adapted by the farmers, which results into severe soil erosion along with nutrient from the area. Heavy erosion in the absence of field /contour bunds is the major reason for the development of multi-directional slopes in the watershed. Water resources were inadequate in the watershed.

The soil types of the watershed are locally known as *Rakar* and *Parwa* which are the variants of the red soils. *Rakar* soils (Alfisols) are the coarse textured, gravelly shallow, reddish to brownish in colour, poor in fertility and water retention capacity and suitable for cultivation of groundnut, millets, sorghum, black gram, green gram *etc*. The *Parwa* soils (Entisols) are grey to brownish, loam to sandy loam in texture, medium in depth and suitable for crops like soybean, sesame, black gram, green gram, wheat, gram and mustard. The forest cover is highly degraded and overexploited and has predominance of coppiced trees of *Anogeissus latifolia*, *Butea monosperma, Madhuca indica* and *Bombax ceiba,* mainly confined to hillock area and *Nalla* (water course) banks. There is no established agroforestry system in the watershed area. However, trees like *Butea monosperma, Azadirachta indica*, *Zizyphus nummularia*, *Madhuca indica*, *Acacia nilotica* and *Mangifera indica* are found here and there on field boundaries, near wells and habitats. The interventions taken up during the project for sustainable development of the watershed area and enhancement of the livelihood of watershed dwellers were divided into five categories, *viz*., soil and water conservation measures, agroforestry system demonstrations, crop demonstrations with improved package of practices, plantation activities and human resource development (Table 2).

Materials and Methods

This paper is based on a field study conducted in 2005-08 period at Garhkundar-Dabar watershed (Fig. 1) of Bundelkhand region of central India where National Research Centre for Agroforestry, Jhansi (Uttar Pradesh) is developing a model watershed based on agroforestry interventions since 2005.

Data collection: During the process of agroforestry development, almost all the 191 farm families of the watershed were contacted and encouraged to adopt agroforestry on their farms. However, for data collection, a total of 80 farmers (42% of total households in the watershed) representing all caste, creed, religion, gender and land holding class were selected at random for structured interview in all the three years. The data on farmerôs choice of MPTs, willingness to adopt agroforestry, system of plantation, motivating and inhibiting factors, *etc*. were collected through structured questionnaire.

Table 2: Interventions taken up to enhance the livelihood

A. Soil and water conservation measures	Number, Unit cost (Rupees in Lakh)
Check dam	7 (2.35)
Low cost check dam	2 (1.6)
Khadins/water spreaders	3 (0.08)
Gabion (3 cum.)	150 (0.01)
Spillways	15 (0.01)
Contour/field Bunding	3 km, 40 ha (Rs. 27 per running meter)
Well recharging unit	2
Gauging stations	6
B. Crop demonstrations with improved package of practices	
2006-07 (Groundnut, black gram, green gram, soybean and wheat)	14
2007-08 (Groundnut and wheat)	4
C. Agroforestry system demonstrations (2007-08)	
Psidium guajava based	3
Citrus based	1
Emblica officinalis based	4
D. Plantation activities	
Plantation of trees	6000 (mainly along water courses)
Ber rejuvenation	200 plants
Area under agrihorticultural system	2.5 ha
Area under agrisilvicultural system	0.4 ha
Development of live fence	1.7 ha
E. Human resource development	
Training	Budding/Pruning, Agarbatti (incense) making, fabrication of gabion mesh
Exposure visit	05
Self Help Groups (SHGs)	4 (2 male and female each)
Watershed committee	1
Employment generation (up to July, 2008)	1100 man days (skilled)
	6567 man days (unskilled)

Results and Discussion

Integration of trees in farming systems- farmerôs perceptions: Farmerôs willingness to adopt fruit based agroforestry system increased from zero to 45% from 2005 to 2008 and just 5% for timber. Even after three years of constant efforts and persuasion nearly half of the population did not accept incorporation of trees on their farm lands (Table 3). Further, for fruit trees, nearly 44% of the farmers preferred boundary plantation followed by intercropping (34%) while in case of timber trees, boundary plantation was preferred by 52.5% farmers followed by block plantations (30%). None of the farmers was ready to plant timber and forage trees in their farm in intercropping plantation method and preferred block plantation for them on degraded/waste lands only (Table 4). Farmers preferred fruit crops over others because of their economic value and ability to provide assured income even in drought years. Fruits can be sold in the local weekly markets even in smaller quantities to get regular income. The findings of Banninster and Nair (2003) that different farmers consider trees differently depending upon how they fit into their farm-family strategy and that farmer make decisions about tree culture based on house hold and field characteristics are confirmed during the present investigation.

Despite of low agroforestry adoption, nearly 41% of the farmers considered it as an efficient land use system (Table 5). The other motivating factors for the adoption of agroforestry were higher production and income, risk proofing capability and self sufficiency in terms of food, fodder, fuel and timber production. As far as source influencing selection of species was concerned, the influence of Watershed Development Team increased from 40 to 50% by the year 2008 (Table 6). In light of agroforestry demonstrations raised by Watershed Development Team in year 2007, many farmers insisted for the same species and as such, percentage of farmers influenced by the demonstrations increased to 33.75. By this period exposure visits of farmers to research institutes such as National Research Centre for Agroforestry; Indian Grassland and Fodder Research Institute; Horticulture Experiment Station, Barua Sagar were conducted which played an important role in the change in their mindset. Sincere efforts at village level definitely bear fruits though,

Table 3: Farmers willingness to plant trees on croplands (N=80)

Type of tree	2005		2006		2007		2008	
	N	%	N	(%)	N	(%)	N	(%)
Fruit	0	0	18	22.5	28	35.00	36	45
Timber	0	0	4	5.0	5	6.25	4	5
Not Willing	0	0	58	72.5	47	58.75	40	50

Table 4: Preferred system for tree plantation (2008, N=80)

System preferred	Fruit		Timber		Forage	
	N	(%)	N	(%)	N	(%)
Boundary plantation	35	43.75	42	52.5	20	25
Intercropping	27	33.75	-	-	-	-
Block plantation	5	6.25	24*	30*	48*	60*
Around habitat	13	16.25	14	17.5	12	15

*Farmers prefer timber and forage trees in block plantation on degraded/waste lands only

success was slow due to virginity of the area in terms of developmental activities.

Table 5: Farmers motives for agroforestry adoption (N=80)

Motive	Number	Frequency (%)
Efficient land use	33	41.25
High production and income	25	31.25
Risk proof land use	10	12.50
Self sufficiency	8	10.00
Protection from hot and cold winds	4	5.00

Constant efforts were made to develop agroforestry plantation on farmerôs field and several allurement schemes were tried and discontinued with a view to promote trees in their farming culture and distract farmers from subsidy oriented mindset. During the course, it was learnt that subsidy in terms of inputs works initially to limited scale but it failed to create mass movement. As evident from Table 7, during 2006, only 5 farmers agreed to plant trees on their croplands and that too on the offer of free of cost quality planting material and crop demonstration in interspaces (improved variety seed + fertilizer). Out of these farmers, only 4 actually planted *Emblica officinalis* and *Psidium guajava* based agrihorticulture. The plantation failed to survive after harvest of *Kharif* crops due to non protection of plant and poor interest of farmer. None of the farmer in 2006 came to adopt agroforestry on his own expenses or technical support. In the year 2007, total 9 farmers agreed for agroforestry plantation but only two of them finally adopted the landuse. This was consecutive 3rd year of drought which worsened farmerôs condition. The two farmers who adopted the system were camping in their fields round the clock which were located on the bank of water course (*Nallah*). Another 5 farmers, including those who failed to protect their plantation in 2006, agreed to replant trees but they were denied free supply of seed and fertilizer. As such only one farmer of this category came forward and replanted *Emblica officinalis* based agroforestry system. He protected his plants by brushwood fencing and provided life saving irrigation through transporting water from distance place on bullock cart using drums. The former two farmers got free of cost seed and fertilizer for sowing crop in interspaces while third farmer did not get the same primarily in accordance with policy decision and secondly due to non availability of water in the well near the plantation. Further, 3 farmers out side the watershed agreed to adopt agroforestry provided quality planting material is made available at subsidized rates (50% subsidy) but when asked to dig the pits before supply of plants, they did not turn up. It was learnt that due to continuous drought, no farmer either big or small was ready to plant trees for want of protection.

In the year 2008, looking to the mind set of farmers, it was decided to stop offer of crop demonstration for opting agroforestry landuse and introduce mere supply of free of cost quality planting material. They were encouraged by survival and growth of fruit plants in the demonstrations conducted in the watershed during previous year. Further, in the year 2008, rains started early and as such the area received 576.6 mm rainfall in June itself. This prompted farmers to adopt agroforestry landuse. Meanwhile, they were well convinced that trees can better withstand weather vagaries than crops alone and definitely yield higher returns in long term. However, only 4 of them actually planted trees in their cropland. This was because working hands of agreeing farmers returned back late (September) after migration. The survival of these plantations is 90% and till date they are growing well because farmers have

Table 6: Sources influencing choice of species in agroforestry system (N=80)

Source of influence	2006		2007		2008	
	N	%	N	%	N	%
Own choice	20	25	18	22.5	8	10.00
Demonstrations	-	-	-	-	27	33.75
WDT Member	32	40	39	48.75	40	50.00
Others	28	35	23	28.75	5	6.25

Table 7: Actual agroforestry adoption scenario (No. of farmers)

Persuasion & Assistance	2006			2007			2008		
	I	II	III	I	II	III	I	II	III
Free of cost QPM + crop demonstration	5	4	failed	9	2	survived	OS	OS	OS
Free of cost QPM	-	-	-	5	1	survived	8	4	90% survival
QPM on subsidized rate	-	-	-	3*	-	-	5*	-	-

QPM = Quality Planting Material I= No. of farmers agreed for lay out & pitting II= No. of farmers actually planted
III= Fate of plantation *= Farmers outside watershed (Control), OS = Offer stopped

tied their animals due to crops in field and partly because of greenery every where. The farmers are planning themselves to put brushwood fencing to protect their plants. The centre has decided to close this offer also from next season to see the effect on adoption and lateral expansion of technology. During the year, again 5 farmers from surrounding villages (outside watershed) approached Watershed Development Team to adopt the landuse, if quality planting material is made available to them on subsidized rates.

Tree crop interactions and socio-ecological considerations: Nearly 24% of the respondents maintained that incorporation of trees in farm land reduces the crop damage from cold and hot winds while 20% reported that tree canopy suppressed weed growth (Table 8). Similarly, about 21% of the farmers opined that trees might improve soil fertility due to litter fall. The other positive tree crop interactions reported are improved microclimate, better sharing of water and nutrients and reduced insects pests and diseases. Contrary to this, almost 74% of the farmers mentioned that tree competed with crops for light and space, while 24% recognized the competition for soil moisture and nutrients.

Major constraints in adoption of agroforestry: Attempts were made to ascertain reasons for non-adoption of agroforestry and to monitor farmers mind set change over years. Following the discussion with the farmers, inability to protect trees during off season, adverse effect of trees on crops, lack of irrigation facility, lack of knowledge regarding tree crop management, small holding size, marketing constraint and high investment emerged as major hurdles responsible for less or non adoption of agroforestry land use by the farmers. It is learnt (Table 9) that during initial year (2006), most of the farmers refused agroforestry land use for want of protection (28.75%) and lack of water (25%). A sizable percentage of farmers (17.5%) feared adverse effect of trees on crops. With the passage of time, in 2007, majority of farmers (33.75%) ranked water availability as the foremost limiting factor. Protection of plants was still a major issue for large percentage of farmers (21.25) as the watershed is surrounded by hillocks supporting scrub vegetation having Blue bull/stray cattle which damage anything green during summer. Fortunately, 2008 was a wet year (1271 mm rainfall) and by the time nine water harvesting check dams were also constructed in the watershed which ensured availability of water in water courses (*Nallah*) and wells. Of course, during the year (2008) percentage of farmers not willing to adopt agroforestry landuse reduced to 50% from as high as 72.5% in 2006, yet those not willing, due to any reason, attributed it (non adoption) to adverse effect of tree on crop (26.25%) and lack of protection (23.75%). Lack of irrigation facility appeared no more a big reason for non-adoption of agroforestry particularly in croplands near water courses (*Nallah*) as only 15% farmers ranked water scarcity as first problem. The other reasons for non adoption of agroforestry, *i.e.,* small holding size, marketing constraint and high investment were almost similar to those in 2006 and 2007.

Research and development projects have demonstrated in many instances that agroforestry increases household incomes, generates environmental benefits, and is particularly well suited to poor and women farmers. But in most cases these success stories have been confined

Table 8: Tree crop interactions and farmers assessment

Tree crop interaction	Number	Frequency (%)
Positive tree crop interaction (N=80)		
Reduced damage from cold and hot winds	19	23.75
Improved soil fertility	17	21.25
Reduced weed growth	16	20.00
Improved microclimate	12	15.00
Better sharing of water and nutrients	7	8.75
Reduced insect pests and disease infestation	5	6.25
Increased soil moisture	4	5.00
Negative tree crop interaction (N=80)		
Shade effect	59	73.75
Competition	19	23.75
Allelopathy	2	2.50

Table 9: Reasons for lesser adoption of agroforestry (N=80)

Reasons (%)	2006		2007		2008	
	N	%	N	%	N	%
Inability to protect	23	28.75	17	21.25	19	23.75
Adverse effect on crops	14	17.50	12	15.00	21	26.25
Lack of irrigation	20	25.00	27	33.75	12	15.00
Small holding size	7	8.75	6	7.50	4	5.00
Marketing constraint	6	7.50	7	8.75	10	12.50
High investment	5	6.25	7	8.75	7	8.75

to localized sites, often with usually concentrated institutional support from research and development organizations or industries. The issue of scaling up is particularly important to agroforestry and natural resource management innovations, because they are relatively knowledge intensive, and, unlike green revolution technologies, may not spread easily on their own. Moreover, farmerôs adoption behaviour, perception and preferences for tree cultivation may vary depending on farm accessibility and distance to local and regional markets, land tenure, market pressures, infrastructure limitations, incentives, risk and uncertainties, local capacity building, strategic partnership, biophysical factors and resource endowments (Snelder *et al.,* 2007; Suryanata, 1994; Roder *et al.,* 1995; Pattanayak *et al.,* 2003). Marketing constraints (arising due to rigid environmental and forest laws) along with poor policy and fiscal support by the government to tree based products and enterprises, poor infrastructure facilities *etc*. are the major obstacles for the large scale adoption of agroforestry (Palsaniya *et al.,* 2008a).

The farmerôs perceptions for non adoption of agroforestry in the above context can be generalized in this way. Firstly, farmers express their inability to protect the trees from stray and free grazing animals particularly during off season when fields are without crops. Annapratha system in this region and Blue bull are the major obstacles in tree plantation and minimize survival of plantation which needs adequate protection particularly during initial 2-3 years. Secondly, farmers argue that trees may have adverse effect on under story crops particularly after 3-4 years of plantation. The under story crops may starve off sun light during this period leading to less production and doubtful profitability. The third major constraint faced by farmers in adoption of agroforestry is lack of assured irrigation facility for plantation during summers. However, with the initiation of the watershed project, this problem has almost been solved. Fourthly, small land holding size is being viewed as a big obstacle in the agroforestry adoption. The marginal and small land holdings together comprise 86.3% and rest 13.7% are medium with no large land holdings in the watershed area. They opined that their holding is small and family size is large and as such, they canôt introduce any thing which may decrease seasonal crop yield and short term cash income. Fifthly, farmerôs knowledge regarding agroforestry in terms of tree selection, management practices, benefits, *etc*. proved to be inadequate, contributing indirectly to its low adoption rates. Sixthly, the investment for establishment of tree plantations, particularly fruit trees, is extremely high and out of the reach of the resource-poor farmers. They easily get loan from money lenders to cover their input costs associated with the cultivation of seasonal grain and cash crops, while, it is difficult to get loan for tree

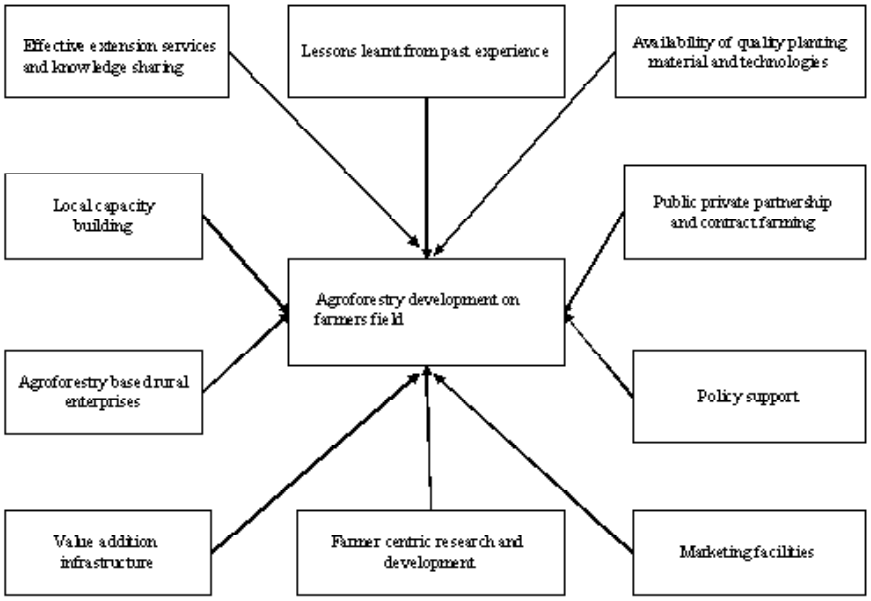

Fig. 2: Enhancing adoption of agroforestry on farmer's field

cultivation. The trees, at the best, can only yield enough income to redeem their loans after 6 or 7 years. This is perceived, as too long period and, therefore, too expensive and risky enterprise to by both the money lenders and the farmers themselves. Long-term investment in large orchards that are mainly in the hands of the well-to-do farmers often serve as farmerôs retirement plan, generating income in old days (Snelder *et al.,* 2007). Seventhly, farmers in the relatively remote areas express resistance to planting agroforestry tress at a larger scale because of absence of reliable and stable marketing facilities along with infrastructural and transportation facilities. Much of these problems can be solved by establishing cooperatives which may assume many of the functions like production, value addition, storage, transportation, marketing, *etc*. Eight, farmers also state that they lack in techniques and expertise required for agroforestry cultivation which is different from sole crop cultivation practices. Farmers also refer to a number of risks and uncertainties associated with resource endowment, knowledge and facilitation, policy support and incentives, environment and forest laws, marketing avenues, *etc*. which ultimately affect their decision making regarding inclusion of trees in crop lands. Further, insecure land tenure/rights withhold farmers from long term investment in agroforestry plantations. Keeping above facts and outcome in mind, the determinants shown in figure 2 can favourably be taken up to enhance agroforestry adoption by the farmers. The forces of globalization and liberalization have created opportunities for the integration of rural population in a larger marketplace. There is an urgent need for evolving appropriate policy packages to popularize agroforestry, covering aspects such as production, harvesting, processing, and utilization of farm-grown wood, as well as ensuring credit and extension services to smallholder producers. A variety of wood based rural enterprises involving not only growing and harvesting, but also value-added processing, packaging, and transport are available and can contribute to farmersô livelihoods or incomes. Development of infrastructural facilities in rural areas can promote the development of wood based industries which in turn will encourage taking up of agroforestry tree crops. Public-private-partnership should be promoted through appropriate incentives.

Conclusion

Despite concerted efforts and development in the watershed, the actual adoption of agroforestry land use by the farmers was not satisfactory. However, now it is amply clear that there is a need to create water resource on priority in drought prone areas like Bundelkhand, win the confidence of farmers by hard and honest efforts, encourage the farmers to adopt agroforestry on their own, educate them properly through exposure visits and initially support few of the farmers who take lead by providing incentives in terms of quality planting material, improved crop seeds and fertilizers. This together will lead to adoption of agroforestry system and thereby conserve soil, water and agroecosystem and enhance productivity. It would be desirable to extend to agroforestry all the benefits applicable to agriculture, so that farmers can be

encouraged to cultivate trees on their private lands including wastelands with equivalent benefits like price support, unrestricted movement of such produce, long term credit support on priority basis, and so on. However, we have to keep patience as agroforestry is more a livelihood sustaining and strengthening system whose potential on commercial scale is yet to develop or establish in India.

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