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Agroforestry systems and their potential in the mid-hills of Himachal Pradesh

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Abstract

The study was undertaken in Mandi district of Himachal Pradesh. A sample of 120 agroforestry growers from 12 randomly selected villages of two development blocks viz. Drang and Sadar was taken through disproportionate stratified sampling technique (controlled sampling). For the purpose of this study, functions (role output of components) of the system have been used as the criteria for classification of the systems. In the present investigation nine agroforestry system viz., agripastoral silvicultural (APS), agripastoral silvihorticultural (APSH), agripastoral horticultural (APH), agripastoral hortisilvicultural (APHS), agripastural (AP), pastural agrihortisilvicultural (PAHS), pastoral agrisilvihorticultural (PASH), pastoral hortiagrisilvicultural (PHAS) and hortipastoral agrisilvicultural (HPAS) have been identified and out of which APS, PAHS and APHS were found dominantly practicing in most of the farmer's field. As far as biological yields (products) of identified systems were concerned it was found that APSH system yielded more (190.24 q) than APHS system (181.40 q) in the study area.

Key words: Agroforestry system, mid hills, Himachal Pradesh.

Introduction

Agroforestry as a innovative farm activity had also been exiting in traditional farming systems in one or the other form. In hilly and mountainous regions of Himachal Pradesh, the yields of food crops have not achieved up to the required level. The circumstances have forced the farmers to opt for intensification of agricultural practices on existing arable land and also extend agriculture on sloppy marginal land.

An ideal combination and utilization of available natural resources, through agroforestry systems can help the state to meet its, required target of food, fodder, and fuel wood in a sustainable manner. Agroforestry is a potential system to promote the sustainability of hilly and mountainous regions, like Himachal Pradesh, where the problems of soil erosion, deterioration of soil fertility and land scarcity have affected the livelihood of its people adversely. It also ensures environment stability and economic security of its rural people. Though a considerable work on the development of the agroforestry has been done but still a lot of work is required to develop the appropriate tree-crop combination as well as to explore the existing agro forestry systems at the grass root level (village level) to enhance its potentiality. Therefore, keeping the above facts in view the present investigation has been undertaken to identify the existing agro forestry systems and to understand their potential in form of biological yield in the prevailing agricultural systems with following objectives:

i) To identify the existing agro forestry systems in the mid-hills of Himachal Pradesh, and
ii) To study the biological yields and gross returns of the existing agro forestry systems.

Material and Methods

The study was conducted purposively in Mandi district of Himachal Pradesh. Out of a total of 10 blocks, two blocks namely Drang and Sadar were selected randomly and further six villages from each of these blocks were also chosen randomly. Later on a sample of 120-agro forestry growers from these villages was taken through disproportionate stratified sampling technique (controlled sampling). The data were collected through structured interview schedule and was analyzed by using percentage, mean value etc.

Identification of agroforestry system

Agroforestry systems were classified using the classification criteria given by Nair (1985). Functions (role output of components) of the system have been used as the criteria for categorizing the systems. However, stratified classification of agroforestry practices devised by Zou and Sanford (1990) has been used to indicate the system types and the system units. System type has been named considering the major components whereas, system units, termed as basic functional unit, have been identified as combination of specific crop species within a component. Hence, functional units like food grains, vegetables and

pulses, in agriculture; specific fruit species in horticulture; grasses and animals in pastures and tree species in forestry component have been taken under consideration in the present investigation.

Results and Discussion

Existing agroforestry systems

In the present investigation nine agroforestry systems have beenn identified and presented in table-1. Theses systems were agripastoral silvicultural (APS), agripastoral silvihorticultural (APSH), agripastoral horticultural (APH), agripastoral

Table 1. Existing agroforestry systems in the study area (N =120)

Sr. No.	Name of System	Number
1.	Agripastoral silvicultural (APS)	52 (43.33)
2.	Agripastoral silvihorticultural (APSH)	9 (7.50)
3.	Agripastoral horticultural (APH)	5 (4.17)
4.	Agripastoral hortisilvicultural (APHS)	14 (11.67)
5.	Agripastoral (AP)	4 (3.33)
6.	Pastoral agrihortisilvicultural (PAHS)	30 (25.00)
7.	Pastoral agrisilvihorticultural (PASH)	2 (1.67)
8.	Pastoral hortiagrisilvicultural (PHAS)	2 (1.67)
9.	Hortipastoral agrisilvicultural (HPAS)	2 (1.67)
	Total	120 (100)

Figures in parentheses indicate the percentages

Hortisilvicultural (APHS), agripastural (AP), pastural agrihortisilvicultural (PAHS), pastoral agrisilvihorticultural (PASH), pastoral hortiagrisilvicultural (PHAS) and hortipastoral agrisilvicultural (HPAS). Upadhaya (1997) and Kachru (1997) also identified eight agroforestry systems in Himachal Pradesh comprising almost same components of system as well as major functional units of the component as in the present investigation in their respective studies. It is observed that in agricultural component-the major functional units were cereals viz., maize, wheat, paddy and barley, vegetables – potato, tomato and cauliflower. Pulses – rajmash, mash, soybean and gram. Garlic was being grown as a cash crop. Forestry component -comprised the following tree species viz., *Grewia optiva* (Buel), *Celtis australis* (Khirik), *Morus alba* (Shehtoot), *Albizia* spp., (siris+ohi), *Bauhinia varigata* (kachnar), *Prunus padus* (Paza), *Bamboo* spp.(Bans), B*ombax ceiba* (Simbal), *Ficus palmate* (Fegra), R*obinia pseudoacacia* (robinia), *Toona ciliata* (Tuni), *Dalbergia sisoo* (Shisham), *Eucalyptus spp.*(Safeda), *Popular ciliata* (popular), *Pinus roxburghii* (Chil), *Sapindus mukorossi* (ritha), *Terminala chebula* (harde) and *Phyllanthus emblica* (aonla). Horticultural component -was represented by peach, pear, plum, citrus, guava, banana, pomegranate, almond, walnut, mango, litchi and papaya. Pasture component included natural growing grasses in the grassland, planted grasses and rearing animals in the area. Almost same component wise functional units were identified by Upadhyaya (1997) in Balh valley of Mandi district of Himachal Pradesh and in sub temperate and sub-humid region of Himachal Pradesh Kachru (1997).

Biological yields and gross returns of different agroforestry systems

Biological yields in terms of produced utilizable biomass and the economic returns accruing from each component have been calculated and presented as per farm on per annum basis in table 2. System wise production and gross returns have been described below:

Agripastoral silvicultural system (APS)

Agripastoral silvicultural system was found to be practised by 52 households (Table 1) in the sample of 120. A total biological yield obtained from this system per farm per annum was 162.52 q. with the gross returns of Rs 53856. Agriculture and pasture were the leading components of this system and were respectively contributing Rs. 29218 and Rs. 21288, towards the total gross return. This is perhaps due to the fact that agriculture and livestock components are complementary to each other and growers of the study area were fully aware of this.

Agripastoral silvihorticultural (APSH)

Agripastoral silvihorticultural system was found to be practised by nine households and total biological yields obtained were 190.24 q per farm per annuam giving Rs. 55538 gross returns. Contribution of agriculture component towards the gross returns was Rs. 27650 followed by pasture Rs. 20854. The remaining two components viz., forest and horticulture of this system were contributing Rs. 4901 and Rs. 2133, respectively, which might be due to non-availability of suitable nursery plants and lack of awareness towards the plantation of both forest trees as well as fruit plants in the study area.

Table 2. Biological yield and gross return of different components of agroforestry system in the study area N=120

Sr. No.	Name of System	Biological yield (q/farm) and gross return (Rs./farm) of different components									
		Agriculture		Pasture		Forest		Horticulture		Total	
		BY	GR	BY	GR	BY	GR	BY	GR	BY	GR
1.	Agripastoral silvicultural (APS)	75.16	29218	22.39	21288	64.97	3350	-	-	162.52	53856
2.	Agripastoral silvihorticultural (APSH)	70.27	27650	33.11	20854	84.87	4901	1.99	2133	190.24	55538
3.	Agripastoral horticultural (APH)	71.68	29970	13.60	17900	-	-	14.99	13875	100.27	61745
4.	Agripastoral hortisilvicultural (APHS)	79.66	35419	23.69	21200	70.07	3500	7.98	10004	181.40	70123
5.	Agripastoral (AP)	101.48	36334	36.51	31252	-	-	-	-	137.99	67586
6.	Pastoral agrihortisilvicultural (PAHS)	65.76	28582	18.92	28920	67.30	3460	4.65	5130	156.63	66092
7.	Pastoral agrisilvihorticultural (PASH)	46.50	15375	20.00	16250	65.86	3711	2.62	3072	134.98	38408
8.	Pastoral hortiagrisilvicultural (PHAS)	20.76	7535	8.00	15550	59.95	3100	16.29	11750	105.00	37935
9.	Hortipastoral agrisilvicultural (HPAS)	43.15	15730	30.00	21150	84.76	4500	12.70	27700	170.61	69080

BY=Biological yield
GR=Gross returns

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Agripastoral horticultural system (APH)

This system was adopted by five households of sampled growers and total biological yields obtained was 100.27q. per farm per annum giving Rs. 61745 gross returns. The major contribution among the three components of this system units came from agriculture (Rs. 29970) followed by pasture component (Rs. 17900). Horticulture was the third component observed under this system, contributing Rs 13875. This trend was could partly be attributed to the lack of knowledge about the fruit plantation, and partly to non-suitability of climatic conditions in the area.

Agripastoral hortisilvicultural system (APHS)

The result in table 2 depicted that APHS system was prevalent among fourteen households. This system produced total biological yield of 181.40 q. with gross returns of Rs. 70123 per farm per annum basis. The major share among the four components of this system unit was contributed by agriculture (Rs. 35419) followed by pasture (Rs. 21200) and horticulture (Rs. 10004). Forest trees were contributing only Rs. 3500, which may be due to the fact that sample households were maintaining less number of fodder/fuel wood producing forest plants on their farm.

Agripastoral system (AP)

This system has been found to be practiced by only four growers using agriculture and pasture components. It was found to be producing 137.99 q of biological yield giving the gross returns of Rs. 67586. Out of total gross returns, contribution of agriculture was Rs. 36334, whereas pasture component contributed remarkable values (Rs. 31252). It might be due to fact that agriculture is the main occupation of the farmers of Himachal pradesh.

Pastoral agrihortisilvicultural system (PAHS)

Pastoral agrihortisilvicultural system was found to be practised by thirty growers (Table 2). This system produced 156.63 q of biological yield with gross returns of Rs. 66092 per farm per annum basis. Pasture and agriculture were two main leading components of this system, contributing Rs. 28920 and Rs. 28582, respectively. Horticulture and forest trees were contributing only Rs. 5130 and Rs. 3460, respectively under this system. This shows that these households were growing more crops and rearing improved milch animals on their farm.

Pastoral agrisilvihorticultural system (PASH)

This system was found to be practiced only two households in the sampled households. This system produced 134.98 q of biological yield giving gross returns of Rs. 38408. Under this system, pasture and agriculture were the main components contributing Rs. 16250 and Rs. 15375, respectively towards the gross returns of system. Silviculture (forest trees) and horticulture components were contributing very less Rs. 3711 and Rs. 3072, respectively. Growers who practicing this system gave more importance to rearing of domestic animals and agriculture due to fact that both the components are essential to fulfill most of the domestic requirements of these farmers and their families.

Pastoral hortiagrisilvicultural system (PHAS)

This system has also been found to be followed by two growers (Table 2). The biological yield obtained from this system was 105 q with the gross returns of Rs. 37935. Under this system, highest gross returns were contributed by pasture (Rs. 15550) followed by horticulture (Rs. 11750) and agriculture (Rs. 7535). The lowest gross returns (Rs. 3100) were contributed by silviculture (forest trees), which perhaps might be through leaf fodder and fuel wood.

Hortipastoral agrisilvicultural system (HPAS)

Hortipastoral agrisilvicultural system has also been found to be used by only two households. It produced 170.61 q of biological yield with gross returns of Rs. 69080.00 on average basis (Table 2). Under this system, horticulture was the dominant component contributing Rs. 27700 towards the gross return. It may be due to the reason that the households practising this system were fully aware of the best returns from the fruit plants and also due to fact that they have sufficient land holdings to grow the fruit trees on their land. Pasture was the next leading component contributing Rs. 21150 followed by agriculture (Rs. 15730). The lowest share was found to be from silviculture (Rs. 4500) through their leaf fodder and fuel wood.

Conclusion

In the present investigation nine different agroforestry systems have been identified with their lot of scope to popularize modern agroforestry systems, as climatic conditions of the area is most suitable for the adoption of this concept. Gross income from the different component of these identified agroforestry systems ranged Rs. 37935 to Rs. 70123 per farm per annum basis in the present study. Such results are the evidences for the potential of agroforestry. To make these systems more profitable, these agroforestry growers need to be educated and

trained to equip them with scientific agro forestry technologies and further be motivated to adopt the same. For this purpose state development agencies in collaboration with research scientists should design appropriate agroforestry system, which may act as pilot model for the area. For this multipurpose tree species, suitable forage grasses and legumes should be provided to farmers to plant on the field bunds, grasslands and on marginal land. Further, the horticulture component was the weaker component in identified systems, contributing lesser proportion to the gross income. In this regard suitable agri-horti systems can be popularized in the area by giving more attention toward this system in the study area.

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