

## AGRI-HORTI SYSTEMS ADOPTED BY FARMERS IN DOON VALLEY (UTTAR PRADESH, INDIA)

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### ABSTRACT

Based on the survey conducted by a multi-disciplinary team in Sahaspur-Vikashnagar Blocks of the Doon Valley during 1993-94, it was observed that due consideration was given by the farmers on various fruit based agroforestry systems. A large number of *rabi* and *kharif* crops were grown as ground storey crops based on the need and specific site conditions. All the tree-crop combinations were studied properly but, overall, the productivity of the system was not satisfactory in many cases because of the poor technological knowledge and unscientific management practices. The result on woody perennials, shrubs and grasses grown all around the boundary of the orchard showed preference for multipurpose tree species, mainly *Morus alba*, *Grewia optiva*, *Eucalyptus* sp., *Bauhinia purpurea*, *Toona ciliata*, *Ficus* spp. etc.

**Key words :** Agri-horti system, Boundary plantation, Farmers response, Ground storey crops.

### Introduction

With increasing population pressure, there is a tremendous demand for food, fuel, fodder, fibre, fertilizer etc. The only alternative seems to adopt an appropriate land use system or sustained productivity by integrating various agroforestry components. In recent years, fruits are recognised as an important perennial component in various agroforestry systems for their multifarious uses (Singh and Singh, 1990; Chundawat, 1993). Moreover, the need and problems of the people are area specific. It is therefore, pertinent that before planning any research and development activities, the diagnostic survey of the area be undertaken to understand the existing systems and determine major constraints for designing and developing eco-friendly agroforestry models.

### Material and Methods

The survey was conducted by a multidisciplinary team during 1993-94 in Sahaspur-Vikashnagar blocks of Dehra Dun district. Geographically, the area is located in sub-humid foothill zone of Western Himalayan region. The elevation ranges from 600-900 m above msl. The average annual rainfall is about 1634 mm. Climatic conditions are fairly good for farming. April to mid June are the dry months while December to February are the cold months.

For this study, a schedule was prepared for recording various observations related to agri-horti system. The opinion of orchardists were also taken into consideration for seeking necessary informations. A total of 120 orchards of different fruit types were surveyed

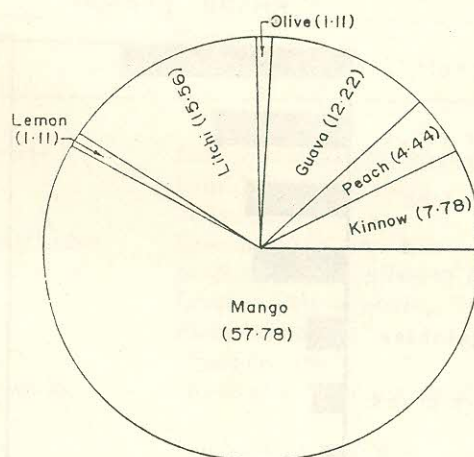
from 24 villages representing major sites of the locality. The orchards were classified into various categories, based on their age group, site conditions, irrigation facilities and nutritional management. All the tree-crop combinations were studied properly during both *rabi* and *kharif* seasons. The various ground storey crops were listed and farmers response to relative adoption of fruit trees, agronomical crops and boundary plantations were analysed.

### Results and Discussion

The average size of orchard was about 0.37 ha. In most of the cases, farmers were managing their orchards by family members only. However, about 22 per cent orchard owners were residing in the city and their orchards are managed by local farmers on temporary basis. Some of the prosperous orchardists allowed local farmers to cultivate and manage the orchards during initial years and they are taking return obtained only by auctioning of fruit trees. There is absolutely no problem in disposing the produce. It was observed that more than 85 per cent of the orchardists were disposing their produce on auction basis, which took place during the fruit set stage.

The different fruit types were categorised into various age groups i.e. young (<8 years), middle age (9-14 years), fully grownup (15-21 years) and older ones (>21 years). Mango was the main fruit types adopted by the farmers followed by litchi, guava, mandarin and peach. Very little importance was given to lemon and olive cultivation (Fig.1). In general, orchards were established on the table top land but few orchards were also grown on mild slopy land (2-5% slope). Most of the orchards were irrigated but few orchards were also grown on rainfed conditions. Visual observations indicated that even on slopy

Fig. 1

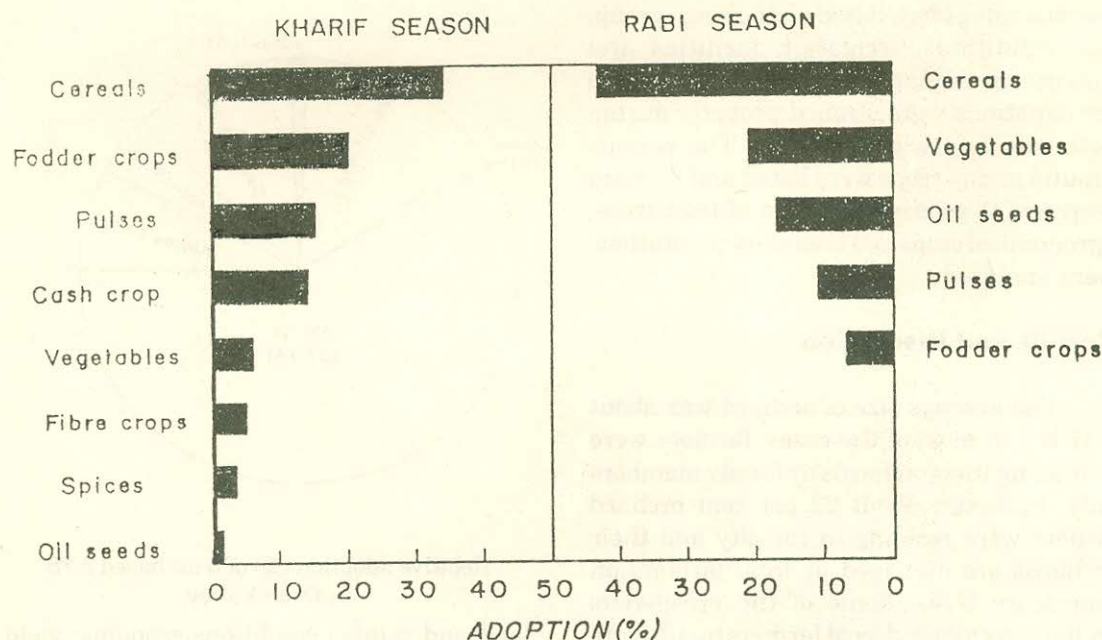


Relative adoption (%) of fruit based AFS in Doon Valley

land and rainfed conditions economic yield can be obtained by proper management. Nutritional status of the orchards were also not proper; only 50 per cent orchards were fertilized during onset of monsoon.

The farmers were growing a large number of *rabi* and *kharif* crops based on the needs and growing conditions which showed diversification of the produce. Among various *rabi* and *kharif* crops, the cereals were given first preference while other crops varied according to season. Fibre (sunhemp) and spices (turmeric and ginger) were the additional crops grown in the *kharif* season, though the relative proportion of fibre, spices and oilseeds were very marginal. Sugarcane was one of the major crops grown all the year round. The farmers' response to relative adoption of different ground storey crops were depicted in Fig. 2. The crop sequence changes greatly with change in canopy coverage of over storey fruit types. It was also observed that only 35 per cent of the farmers

Fig. 2



Farmers response to relative adoption of different ground-storey crops with fruit trees

were using seeds of improved varieties while rest were using locally available seeds, which was one of the main reasons for poor yield. It is also pertinent to explore that in most of the cases, vegetables were grown as groundstorey crops but in smaller plots or a portion of the orchard, indicated that vegetables are the essential commodity for culinary purpose, though the requirement is less as compared to cereals.

In general, there were three components i.e. fruit trees, crops and forest trees as boundary plantation, hence the system is called as horti-agri-silviculture in true sense. A large number of plant types were grown as boundary plantation (Table 1) to meet out the fuel and fodder requirements as well as protection against biotic interference. The observations clearly indicated that farmers

gave more preference to mixed plantations by accommodating various multipurpose trees (fruits and forest species), shrubs and grasses as compared to growing of single rows by a particular plant species.

By interacting with farmers, a few observations emerged-out as follows, which need to be tested to give a scientific basis.

- (i) In establishing orchards, preference was given to grow sugarcane, as they were opined that sugarcane is a long duration crop which acted as guard crop for the fruit plants. Sugarcane also create competition with fruit trees, so that they grew quickly with single stem and attained the height beyond the reach of the animals. The crop is irrigated during summer which is the main debicative

**Table 1**  
*Plant species grown on the boundary of the orchards*

Plant types	Adoption rate (%)	Purpose	Species
A. Mixed plantation	86.2		
Forest trees	65.2	Timber wood	<i>Dalbergis sissoo</i> , <i>Eucalyptus</i> hybrid, <i>Populus ciliata</i> , <i>Toona ciliata</i> .
		Fuel and fodder	<i>Grewia optiva</i> , <i>Bauhinia purpurea</i> , <i>Morus alba</i> , <i>Leucaena leucocephala</i> , <i>Ficus</i> species.
		Fibre Wicker works	<i>Grewia optiva</i> . <i>Morus alba</i> , <i>Bambusa</i> species.
Fruit trees	7.3	Fruits	<i>Eriobotrya japonica</i> , <i>Pyrus communis</i> .
		Fruits and timber	<i>Mangifera indica</i> , <i>Aegle marmelos</i> .
		Fruits and fuelwood	<i>Prunus persica</i> , <i>Prunus domestica</i> .
		Fruits and fodder	<i>Artocarpus heterophyllus</i> .
		Fruits, fodder and fuel wood	<i>Psidium guajava</i> .
		Timber, fodder and Fuel wood	<i>Sizygium cumini</i> .
Shrubs	10.6	Fuel wood and protection	<i>Vitex negundo</i> , <i>Lantana camara</i> , <i>Woodfordia fruticosa</i> , <i>Carissa carandus</i> .
		Fibre and protection	<i>Agave americana</i> .
Grass	3.3	Thatching	<i>Saccharum munja</i> .
B. Pure plantation	13.8		
Forest trees	9.2	Poles	<i>Eucalyptus</i> hybrid, <i>Populus ciliata</i> .
Fruit trees	4.6	Fruits	<i>Pyrus communis</i> , <i>Eriobotrya japonica</i> .
		Fruits and timber wood.	<i>Mangifera indica</i> (seedlings)

period for plants also, therefore, no additional irrigation is required for establishing plants.

- (ii) Farmers suggested that if banana plant is planted in the basin of mango plant, there is no need of additional irrigation

during summer due to fact that under ground rhizome of banana plant stored sufficient moisture during rainy season, which is utilized during summer by both the plants. In this way, banana plants develop a conducive microclimate and act as nurse plants for the establishing

fruit plants.

- (iii) Farmers wisdom was also involved in planting boundary plantations e.g., plantation of fruit trees towards the side of farm houses while the thorny shrubs and bushes towards the side of more biotic interference.

Though, various tree-crop combinations were adopted by the farmers but due to inadequate technical know how about specific crop combination, improper tree spacing,

unscientific selection of groundstorey crops, improper training and pruning, use of local seeds, imbalance nutrition, poor plant protection measures etc. productivity was not satisfactory. The fragmented and smaller holding size are the other limiting factors, for establishment of fruit based agroforestry system. Besides these, there were some general problems in the locality like least emphasis on small scale cottage industries, no fruit processing units as well as poor extension linkage regarding technological advancement.

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