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## Trailing of agroforestry in Haridwar

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**ABSTRACT :** It is interesting to know about trailing of agroforestry by the farmers in any region particularly when it contains rural agrarian areas. This study is an attempt to understand fertilizer application, fuelwood collection, incentives and income supports. This work has focused on fertilizer sources, fuel sources, fuel wood–fodder collection, various incentives and income support provided by agroforestry to its adopters living in the study area. For this purpose field data was collected from 365 respondents reported who focused exclusively on agroforestry. Findings revealed that in agroforestry, chemical fertilizers were used by 98.36 per cent, FYM/organic manure by 95.89 per cent and green manures by 58.63 per cent farmers to increase the agroforestry production. Farmers use domestic manure and commercially available chemical fertilizers. Approximately 98 per cent farmers responded positively on income support that was considered very important (48.77%). It was concluded that fuelwood collection, incentives, income supports are some reasons behind agroforestry in the region and farmers are actively involving themselves to adopt methods like soil fertility enhancements to raise production and widespread promotion of agroforestry.

**KEY WORDS :** Agroforestry, Farmers, Income, Practice

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### INTRODUCTION

Earlier agroforestry was identified as a distinct discipline in agriculture science (Debbarma *et al.*, 2015). Today, as an obvious component of farming systems, agroforestry has been recognized by many regional and national development plans. The word ‘agroforestry’ is used to express combination of old set of principles that have merged with new technologies applied in land management. Agroforestry is an emerging discipline both

as science and as a practice (Dhiman, 2008), a traditional land use developed by subsistence farmers throughout in the world. Agricultural crops, vegetables, forest and horticultural trees, shrubs and grasses are the components of agroforestry which made it diverse and productive. (Zomer *et al.*, 2009). The relative advantage of agroforestry will vary with farmers need and objective (Parwada *et al.*, 2012) like incentives such as fuelwood, fodder, fruits etc. and provided income support. There is decreasing agricultural productivity as a result of increasing land degradation, reduced ability of forest resources (Gama *et al.*, 2013). As world population increases, the need of more productive and sustainable use of the land becomes more urgent (FAO, 2016). Agroforestry is a suitable farming system (Luumi, 2014)

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and in this context, agroforestry offers potential solutions to many such problems. Agroforestry enhances rural income and supports livelihood improvement through simultaneous production of food, fodder and firewood, resource conservation and employment generation (Sarvede *et al.*, 2014). In addition, through the diversification, agroforestry can increase farm profitability (Mbow *et al.*, 2014). This uniqueness of agroforestry is likely to influence adoption in a different way and hence the need for further investigation is required (Kabwe, 2010). The advantages of agroforestry are quite quantum (Alao and Shuaibu, 2013) as a cure to above said problems and hence its trailing needs to be understand well. In recent years, adoption and promotion of agroforestry have drawn attention of global community towards agroforestry farmers. Considering all above, it is interesting to know about trailing of agroforestry by the farmers in any region particularly when it contains rural agrarian areas. Therefore, this study is an attempt to understand expansion of agroforestry by the farmers. This work has focused on soil fertility enhancement methods applied by farmers, their fertilizer sources, fuel sources, fuelwood collection from tree species in agroforestry, fodder-forage from agroforestry, various incentives and income support provided by agroforestry to its adopters.

## EXPERIMENTAL METHODS

### Sampling and survey:

This study was carried out in Haridwar district of Uttarakhand, India. Surveys have been widely used in India in the past to collect information (Sood *et al.*, 2012). Survey conducted was based upon direct interviews and discussions with the farmers. Field survey technique was applied using pre-tested semi structured questionnaire based interview and discussion schedules as data collection instrument. About 36 villages from six blocks from all three tehsils were selected for detailed survey. The 432 random households in the selected villages were surveyed during year 2013-2014.

### Data collection:

We selected interviewed 426 sample households as 6 responses out of 432 interviews were discarded as they could not generate enough data and information to

analyze. Out of which 365 respondent were reported as agroforestry farmers who focused exclusively on agroforestry. Their responses were recorded to generate the required data. The farmers were allowed to express themselves without restraint to reduce chances of biasness in their responses with the opinion and expectation of researcher herself.

### Data analysis:

Data were cleaned, sorted and coded as 0 and 1 based upon farmers' response. Data were analyzed using simple statics like frequency counts and percentage calculation, mean, average and data tabulation.

## EXPERIMENTAL RESULTS AND ANALYSIS

The results obtained from the present investigation as well as relevant discussion have been summarized under the following heads :

### Application of fertilizers and manures as soil enhancement method:

Out of total surveyed agroforestry farmers, approximately 98 per cent farmers use chemical fertilizers in their fields. As compared to use of chemical fertilizers, 95.89 per cent farmers used farmyard/organic manure in farming and about 59 per cent used green manure also. Almost all farmers (99.73%) used manure and fertilizers either separately or in combination with other fertilizer types. Use of animal manure is restricted to farmers that own cattle and very less farmers wish to buy animal/organic manure locally (Fig. 1).

### Sources of fertilizers/manures:

As chemical fertilizers are reported maximum in application, market is the source of most of the fertilizers applied in agroforestry by 98.63 per cent of farmers. Home was reported in second position by (89.59%) farmers. Even in these cases, manure has not been available in sufficient amounts 96 per cent farmers applied FYM/organic/animal manure to cover entire fields. 61.64 per cent farmers brought fertilizers locally, rest 37.26 per cent purchased from blocks. Among sampled agroforestry farmers, 0.27 per cent adopted no soil fertility enhancement fertilizers/manures in their field as they believed in keeping soil unharmed from external agents like chemical fertilizers (Fig. 2).

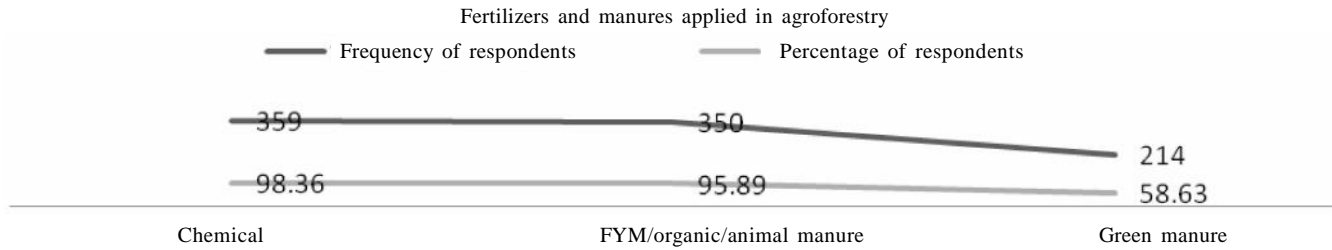


Fig. 1 : Frequency and percentage of different fertilizers and manures applied in fields

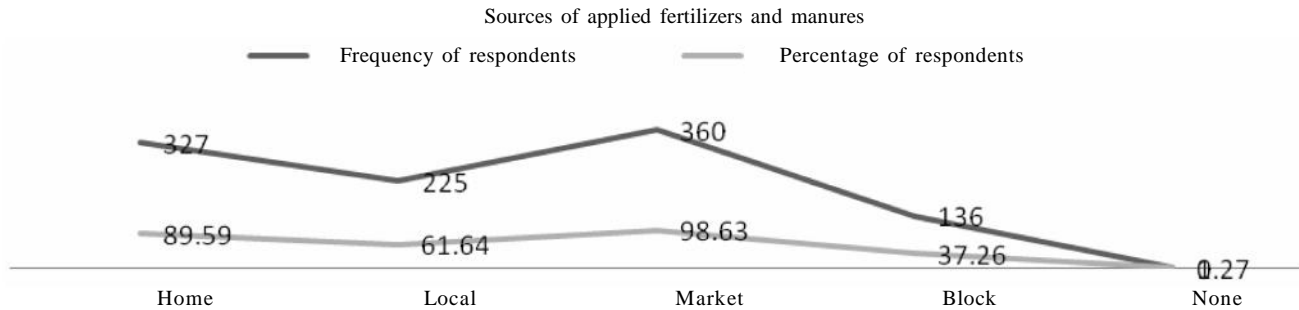


Fig. 2 : Frequency and percentage of sources of fertilizers/manures

**Sources of fuels:**

Tree species in agroforestry were reported a potential source of fuel as other than LPG (99.73%) most of the surveyed agroforestry households (98.36%) were using timber/firewood obtained from tree species planted in fields making major fuel supply to them. Agroforestry adoption for fuelwood can become an option for such households, where the unavailability, irregularities in gas supply or excess consumption is the most frequent (Fig. 3).

**Fuelwood collection and quantity in agroforestry:**

From Fig. 4, it is clear that maximum number of agroforestry farmers collected quantity of fuel/firewood through lopping-pruning done periodically. While 17 per cent collected it in indefinite time and rest (03%) collected it monthly (Fig. 4). This collection time also indicates the

pruning-lopping pattern of agroforestry tree species maintained by the farmers, as these activities facilitate farmers to used residue as fuel.

**Incentives from agroforestry practice:**

Incentives can be enhanced by an agroforestry in the study area through provision of basic needs such as fodder (15.07%), construction timber (97.81%) and fuel/ fire wood (93.70%), fruits (10.41%) and other attributes like cash income or decreasing labour or input costs (Fig. 5). All these incentives are considered well by the farmers while practicing agroforestry in their fields.

**Provided Income support from agroforestry practices:**

In survey, almost all respondent responded positively

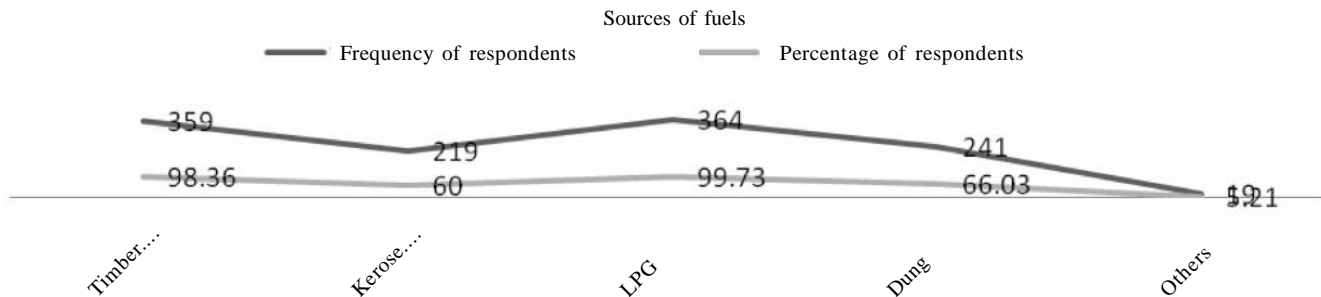


Fig. 3 : Sources of fuels in farmers' households

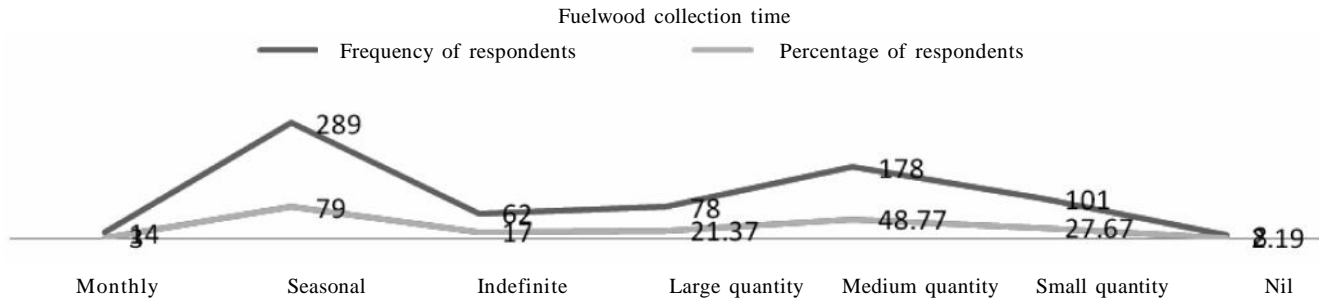


Fig. 4 : Fuelwood collection and quantity from agroforestry practices

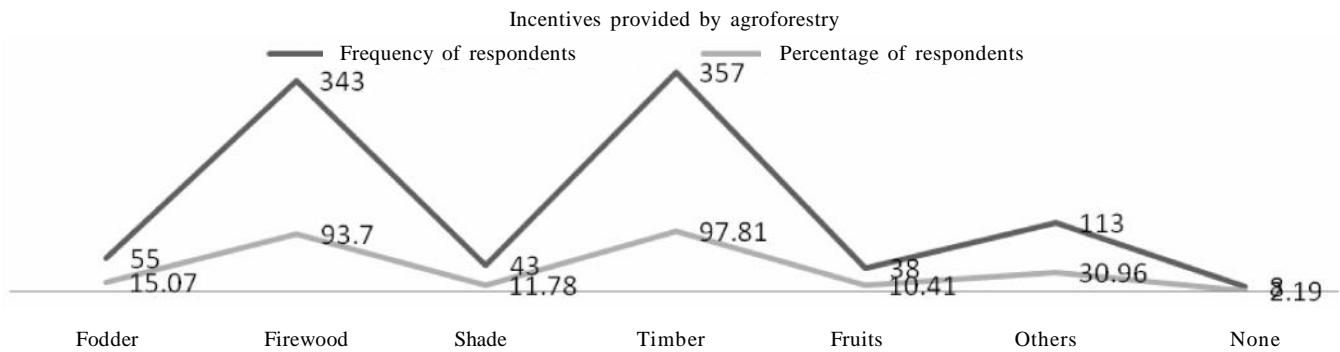


Fig. 5 : Incentives from agroforestry practices

(97%) and very less (3%) responded negatively on importance of income from agroforestry. Similar to it, 24.93% respondent mentioned it as important and 23.56% stated that this income was good enough to them and this additional income is meaningful in their livelihood as earlier reported by (Wijaya *et al.*, 2007). These are the farmers which are having other source of income also. Rest 3 % farmers accounted it as not so good (2.47%) or very bad (0.27%). Though this ratio is very low but should be solved so that it could not increase in future because these farmers may lose their interest in agroforestry adoption (Fig. 6).

The study demonstrated certain criteria that

determine expansion and trailing of agroforestry by the farmers. Focus was given to soil fertility enhancements methods, fertilizer sources, fuelwood collection and quantity, incentives and income supports provided by agroforestry.

**Trailing of agroforestry by soil fertility enhancement methods (Application of fertilizers and manures):**

Types of fertilizers studied were also mentioned earlier by Mafongoya *et al.* (2006). Manure applied to crops is a substantial source of nutrient input to the whole farming system (Umarani and Jain, 2010) and hence tend to trail agroforestry in some other way. Sampled

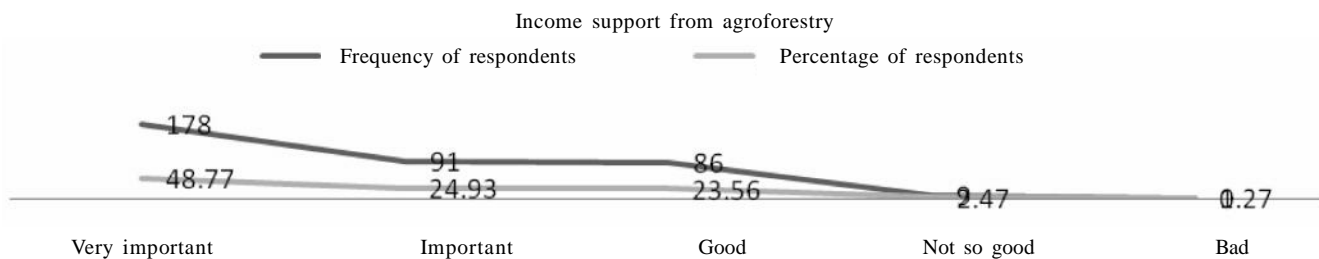


Fig. 6 : Frequency and percentage of provided income support from agroforestry practices

agroforestry farmers considered use of fertilizers helpful in increase the production of agroforestry in their field. From survey, it was observed that some farmers that used chemical fertilizers to improve soil fertility usually applied it at levels far more than recommended rates. It goes with the findings of (Damisa and Igonoh, 2007) that in order to meet crop needs; farmers require adding higher quantities of inorganic fertilizers in the fields. However in surveyed villages, the application rate and quantity fertilizers and manures in every land holding varied according to owners' ability to access, purchase and pattern of land use in farming plots reflecting the influence of these matters on soil fertility enhancement methods and trailing of agroforestry.

#### **Trailing of agroforestry and fertilizer/manure source:**

It was reported that farmers were more interested in chemical fertilizer, their purchase and application. They found it best to meet the soil nutritional demand which increases due to tree-crop interaction and competition. In some cases, the quality of organic/animal manure has also been said to be lower in mineral contents and therefore not sufficient to meet the levels required by crops as mentioned by the respondents. Also, the lower amount of available animal manure has been attributed to the agroforestry component management and hence, these farmers felt that use of chemical fertilizers and animal manure/FYM together fulfill the nutritional demand of crops and soils to improve and promote status of agroforestry in their field. Home was reported second most available source of manure/fertilizers. It shows that farmers use domestic manure and commercially available chemical fertilizers from markets application to raise farm plantation.

#### **Trailing of agroforestry and fuel sources used in farmers' households :**

A tradition of utilizing different types of fuels (mixed or separated) was found among the families in study area. Because they get subsidies on kerosene and LPG, while for timber and firewood and dung, these materials were available easily from agroforestry components. Hence, adoption of agroforestry reduces their investment on consumption of other kinds of fuels. This may be counted another reason why farmers trailing agroforestry in the region.

#### **Trailing of agroforestry and fuelwood collection:**

Wood is an important source of fuel in most of the rural communities and this fact cannot be overemphasized (Erakhrumen *et al.*, 2010). On study area, nearly all of the farmers (98.36%) collected and used the lopped-pruned branches of planted tree species as fuelwood used either domestically or sold and thus earned additional income from it. Most of the farmers, who had collected medium and small quantities of fuelwood, used it for domestic consumptions only, while farmers who collected large quantities had also sold it locally. It shows that the not only major agroforestry produces like timber, grains supports farmers economically, but also the lopped-pruned material or left wood residue are also used by farmers for domestic or commercial purpose thus supports livelihood economically.

#### **Trailing of agroforestry by provided incentives to farmers:**

The main incentives for agroforestry adoption in surveyed villages are timber and Firewood (Fig. 5). They are also the main criteria and purpose behind species selection and planting them in agroforestry. From results, it is clear that incentives can be enhanced by agroforestry through provision of basic needs such as fodder, timber, fuel/fire wood, fruits and other attributes. Incentives might have motivated towards agroforestry practices in the study area. As mentioned earlier by Meijer *et al.* (2015) that farmers recognize the benefits of planting tree species in their fields, this finding shows that farmers use agroforestry on their land, not only for timber, but also for fuel/ fire wood, fodder, fruits, shades and other. Here also, the aim of agroforestry is also to meet the needs of farmers by getting multiple outputs from agroforestry. This finding gives an idea that adoption of an agroforestry brings incentives that are increase house hold income and security.

#### **Trailing of agroforestry by provided income support:**

The participants during focus group discussion agreed that tree species provide income support to their livelihoods. From living standard point of view, sampled agroforestry farmer in the study area confirmed that agroforestry serves as income support by providing diverse products and benefits. It is quite evident from Fig. 6 that, to half of total agroforestry farmers, income

coming from agroforestry was very important. It may be due to the fact that they utilized it in family and farming expenditures which further helps them in continuing farming activities or they may do not have any source of income to substitute income coming from agroforestry. It favored Rahman *et al.* (2008) that agroforestry helps in increasing the output and farm household earnings. In this regards, “important” means this income is highest monetary support to them. This finding coincide with Dwivedi *et al.* (2007) that additional income was the major reason behind adoption of agroforestry.

### Recommendations:

As this study shows that availability and sources of fertilizers are important to maintain production from agroforestry, their ample availability would encourage farmers to maintain farm production level. However at the same time, other sources of organic as well as green manures are needed to develop so that farmers could be less dependent upon chemical fertilizer application. Farmers plant tree species in agroforestry mainly for timber and fire/fuelwood (which is usually lopped branch material). Market channels of these two agroforestry produce can be improved in the region to facilitate more utilization of the lopped residue to markets. It would certainly increase income support for which farmers practice agroforestry. Even with the improvements described above, there is a limit to what can be absorbed as well extracted from agroforestry as enhancement to the types, sources and uses of fertilizers and manures or the incentives provided by trees in agroforestry. So further steps should be continuously taken which increase adoption and promotion of agroforestry.

### Conclusion:

From this study it is concluded that farmers are well aware of usefulness of tree species and benefits associated with them. The incentives provided by these tree species may be a reason why farmers are practicing agroforestry. It means that the benefits and incentives provided by tree species are associated with promotion of agroforestry in the region. The subjective studied norms were mostly resulted in positive, meaning that these norms encourage farmers to practice and promote agroforestry and all above studied points such as fuelwood collection, incentives, income supports are some reasons behind trailing of agroforestry and farmers are actively involving

themselves to adopt methods like soil fertility enhancements to raise production and widespread promotion of agroforestry. The recommendation must be heard and put in to action for further promotion of agroforestry.

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