Agroforestry

Agroforestry is a land-use system that integrates agriculture, trees, people and animals in the same space, resulting in improved soil quality, higher yields, and improved standards of living. Agroforestry techniques are tailored to the needs of the community.

Though, the origin of agroforestry practices, i.e. growing trees with food crops and grasses, is believed to have been during Vedic era (1000 BC), the agroforestry as a science is introduced only recently. The systematic research in agroforestry got impetus after the establishment of the International Council for Research in Agroforestry (ICRAF) in 1977, which was renamed in 1991 as the International Centre for Research in Agroforestry. During 2001-02, ICRAF adopted a new brand name “World Agroforestry Centre”. In India, organized research in agroforestry was initiated in 1983 with the establishment of All India Coordinated Research Project on Agroforestry by ICAR at 20 centres and later establishment of the National Research Centre for Agroforestry at Jhansi in 1988. At present 39 centres of agroforestry are working in the country. The process of system evolution can be still observed in the natural forests through settled agriculture, animal husbandry and organized forestry with the adoption of variety of land use practices, where tree is one of the components.

Forest cover of India has been estimated to be 690,899 sq km, which amount to 21.02% of the total geographical area of the country. Out of this, 8.77% forest cover is in the form of open forests and another 1.26% is scrub forests. According to National Forest Policy- 1988, one-third (33.33%) of the land area should be under the forest cover for sound ecological balance. It means that we have to bring another 12.31% areas under forest cover and at the same time improve quality of the degraded forests. The National Forest Policy also says that the natural forests serve as a gene pool resource and help in maintaining ecological balance, therefore, such forests will not be made available to industries. Forest based industries should raise the raw material needed for meeting its own requirements, preferably by establishment of a direct relationship between the factory and the individual who can grow the raw material by supporting the individual with inputs including credit, constant technical advice and transport services. Farmers, particularly small and marginal farmers should be encouraged to grow wood species required for the industries [Jha, 1994]. Raising of poplar plantations for wood production began in tarai region of Uttar Pradesh, India, to meet the needs of industries that manufacture match splints and wood panel products [Chaturvedi and Rawat, 1994].

In order to increase the tree cover and fulfill the requirements of the people and industries, social forestry programmes were launched. As the country has a net sown area of 46.84% it is one of the most important potential areas for tree growing along with the agriculture crop. In order to attract farmers toward agroforestry, we should have viable agroforestry models, which can provide attractive financial returns in the form of additional income to address the livelihood issues to the farmers.

Popular agroforestry practices

The type of agroforestry techniques that are adopted, depends on factors, such as the region, type of crops, soil, climatic
conditions etc. A wide selection of tree species and woody shrubs can be used for agroforestry systems. Some of these trees are suited for acidic soil conditions and others for erosion control and some are more appropriate as forage trees. The choice of appropriate species is critical to the success of agroforestry system. In addition to the intended use, the choice of tree and associated crop species also depends on cultural and ethnic factors, which is of social importance. Some of the most popular agroforestry practices adopted worldwide are outlined below:-

1. Alley Cropping
2. Forest Farming
3. Riparian Buffer Strips
4. Windbreaks or Shelterbelts

The agroforestry has considerable potential, not as the only way to improve agricultural production, but also as an important way to enhance and maintain overall productivity of the small upland farm. Agroforestry practices have been intertwined in the various development programmes/schemes like watershed development. Therefore, it has been realized that agroforestry is the only alternative to meet the target of increasing forest cover to 33% from the present level of 21.02% by 2012. However, it will require appropriate research interventions, adequate investments, suitable extension strategies, post harvest process technology, development of new products and market infrastructure. With these inputs, the area under agroforestry is likely to be increased from the current 7.45 million ha to 25.36 million ha by 2025.

ICFRE, through its eight research institutes and four advanced research centers in different bio-geographical regions, is striving to carry out need based research in the field of agroforestry.

Some popular agroforestry models in Punjab, Haryana, Uttar Pradesh and Uttarakhand

Poplar (Populus deltoides) based agroforestry is being practiced on a big scale in the state of Punjab, Haryana and Uttar Pradesh. This is because of various beneficial characteristics of poplar viz. fast growth, soil enriching properties, leaflessness during winters, compatibility with various agricultural crops and high economic returns. Poplars can be clonally reproduced, thus give uniform sized trees and high yield of timber. Lops and tops of the poplar trees are used as fuel. Unlike Eucalyptus, it is easy to remove roots of poplar from the field, which are used for manufacturing charcoal. Under poplar selective shade loving or shade tolerant crops can be grown for optimum utilization of land and maximizing economic returns. Poplar wood is light in weight, odourless, suitable for peeling, therefore, largely used in manufacture of plywood. Freshly felled logs, which are best for peeling, fetch best price. Small quantity of wood is used in making wood boards, match sticks, packing cases etc. Populus deltoides with high productivity (up to 50 m$^3$ ha$^{-1}$ yr$^{-1}$), in 6-12 years rotation is being preferred for various agroforestry systems in different parts of India [Tewari, 1993].

G-48 clone of poplar was chosen by most of the farmers for planting. Plantations in the fields were done in the first week of February by using one-year-old ETPs (Entire Transplants) of superior clones of poplar, which were 3.5 to 4.0 m in height. Plantations were maintained for six years. Under proper management, a poplar tree attains a height of about 23 m, diameter about 25 cm and average volume of 0.369 m$^3$, which gives an average gross return of ₹ 994 per tree. Gross income
from the block plantation of poplar after six years comes to ₹ 447300 ha⁻¹ (Box-1).

Agricultural crops grown under the poplar are turmeric (Curcuma longa), sugarcane (Saccharum officinarum), wheat (Triticum aestivum), paddy (Oryza sativa), potato (Solanum tuberosum), bajra/pearl millet (Pennisetum typhoides), chari (Sorghum vulgare) fodder, maize (Zataria mays) fodder and barseem (Trifolium species) fodder. Details of cost, production, sale, and net income for these agricultural crops are given in a sequential manner in Boxes-2 to 10.

Turmeric is sown in the month of April and harvested in next March. It is a shade loving crop, therefore, preferred in block plantation of poplar. Studies have shown that average green biomass production of turmeric under poplar is 10298 kg ha⁻¹. Raw turmeric when processed (boiled and dried) gives the dried biomass of 2252 kg ha⁻¹. Net return from turmeric cultivation comes to ₹ 40000 ha⁻¹ (Box-2).

Sugarcane, in a block plantation of poplar, is grown in first and second year, when poplar plants are small and do not obstruct much sunlight. Sugarcane cuttings with four nodes are sown horizontally in the month of February and harvested in the month of December for the first crop and November in case of second crop. After harvesting the first crop of sugarcane, more numbers of new culms come up naturally. Therefore, there is no expenditure in the second year on account of sugarcane cuttings, field preparation and sowing of crop. However, crop production in the second year remains the same due to cumulative effect of decreasing sunlight and more number of culms, which balance each other. In the third year, it is not economical to grow sugarcane in block plantation of poplar due to heavy shade. Sugarcane production under block plantation was observed to be 50000 kg ha⁻¹, while in case of boundary plantation, it was 66500 kg ha⁻¹. Net return from sugarcane under block and boundary plantations of poplar comes to ₹ 47500 ha⁻¹ and ₹ 66500 ha⁻¹ respectively (Box-3).

Wheat is normally sown in the month of November. But in the case of block plantation of poplar, wheat sowing is done in the month of December when the leaf fall is complete. Fallen leaves add to the productivity of the soil. Harvesting of wheat is done in the second half of April. New leaves in poplar come in the month of March and the wheat crop under poplar comes under shade. On account of late sowing and effect of shade, average yield of wheat comes to 3000 kg ha⁻¹, while in a boundary plantation of poplar; average yield of wheat was observed to be 4000 kg ha⁻¹. Net return from wheat cultivation under block and boundary plantations of poplar comes to ₹ 12250 ha⁻¹ and ₹ 20350 ha⁻¹ respectively (Box-4).

Paddy can be grown only with the boundary plantation of poplar, as it requires water logging conditions, which poplar cannot tolerate. It is sown in the month of July and harvested in November. Paddy production comes to 3500 kg ha⁻¹ with a net income of ₹ 11100 ha⁻¹ (Box-5).

Potato is sown in the month of November and harvested in February. Under block plantation of poplar, potato production comes to 18000 kg ha⁻¹ with a net income of ₹ 19000 ha⁻¹ (Box-6).

Bajra (Pearl millet) is sown in the month of July and harvested in October. Under block plantation of poplar, bajra production comes to 2000 kg ha⁻¹ with a net income of ₹ 2000 ha⁻¹ (Box-7).

Chari fodder crop is sown in the month of May and harvested in August-
September. Under block plantation of poplar, chari fodder production comes to 25000 kg ha\(^{-1}\) and yields a net income of ₹ 4000 ha\(^{-1}\) (Box-8).

Maize fodder crop is sown in the month of March and harvested in June. Under block plantation of poplar, maize fodder production comes to 24000 kg ha\(^{-1}\) with a net income of ₹ 6000 ha\(^{-1}\) (Box-9).

Barseem fodder crop is sown in the month of October and harvested four times from January to April. Under block plantation of poplar, barseem fodder production comes to 76000 kg ha\(^{-1}\) with a net income of ₹ 20300 ha\(^{-1}\) (Box-10).

Agroforestry models adopted by farmers belong to Agri-silvi-pastoral and Agri- Silvicultural systems. Poplar plantings in the fields were seen in blocks and on the boundaries. Block Plantation Models are mostly established by big landlords who are financially so rich that they can wait for six years to get return from poplar plantation. In block plantation models, 500 trees ha\(^{-1}\) are planted at a spacing of 5m x 4m with rotation period of six years and land under the trees is used for agricultural purposes. This spacing allows movement of tractor in the field for undertaking various agricultural operations. As the rotation of poplar adopted by the farmers is six years, all the agroforestry models are of six years duration.

While presenting details of costs and benefits for various agroforestry models (Tables 1-6), each year was reckoned from February to January. Benefits have been shown against the year, in which they are received. Depending on the geometry of poplar plantation and utilization of the land under poplar for agriculture, various viable agroforestry models as seen in the study areas are as follows:

Model-1  Poplar-sugarcane-turmeric block plantation model

In the first year, one-year-old ETPs of poplar and cuttings of sugarcane are planted in the field in the first week of February. Sugarcane is harvested in December. From the left over clump, new culms of sugarcane come up which are harvested in the second year in November. After this potato is sown in November itself and harvested in April of the third year. Then turmeric is sown in April and harvested in March of the fourth year. Similarly two more crops of turmeric are harvested. In the sixth year after harvesting turmeric, Chari fodder crop is sown in May and harvested during August-September. Poplar is harvested at the end of sixth year. For this model, Net Present Value (NPV) at 12 %, 9 %, 6 % discount rates come to ₹ 53685, 62349, 72705 ha\(^{-1}\) yr\(^{-1}\) with Benefit- Cost (B: C) ratio as 2.87, 3.06, 3.27 respectively and Internal Rate of Return (IRR) as 97% (Tables 1 & 7).

Model-2  Poplar-sugarcane-wheat-chari block plantation model

As described in the model-1, poplar and sugarcane are planted in the first year and for the first two years two, crops of sugarcane are harvested. In the second year wheat is sown in December, which is harvested in April of the third year. Then in May, chari fodder is sown, which is harvested during August-September. Similarly chari and wheat crops are taken in alternation till sixth year. Poplar crop is harvested after six year of age. For this model, NPV at 12 %, 9 %, 6 % discount rates come to ₹ 46126, 53733, 62856 ha yr with Benefit- Cost (B: C) ratio as 3.23, 3.47, 3.73 respectively and IRR as 94% (Tables 2 & 7).
Model-3 Poplar-Sugarcane-wheat-charipotato- maize-bajra block plantation model

In this model also, operations in the first two years are same as model-1. In the third year after harvesting of wheat, chari fodder is sown in May and harvested during August- September. Then potato is sown in November and harvested in February of the fourth year. Then maize fodder crop is sown in March and harvested in June. Bajra crop is sown in July and harvested in October. Similarly, potato, maize fodder and bajra crops are taken in a sequence till sixth year. At the six years of age, poplar trees are also harvested. For this model, NPV at 12 %, 9 %, 6 % discount rates come to 49280, 57317, 66942 ha. yr with Benefit- Cost (B: C) ratio as 2.46, 2.58, 2.71 respectively and IRR as 96% (Tables 3 & 7).

Model-4 Poplar-Sugarcane-potato-barseem chari block plantation model

In this model also, operations in the first two years are same as model-1 as far as poplar and sugarcane are concerned. However, in the second year, immediately after the harvesting of sugarcane in November, potato crop is sown in the field, which is harvested in February of the third year. Then chari crop is sown in the month of May and harvested during August-September. Then barseem fodder is sown in October and harvested four times from January to April in the fourth year. Similar operation is repeated till sixth year for taking chari and barseem fodder crops. At the end of sixth year, poplar crop is also harvested. For this model, NPV at 12 %, 9 %, 6 % discount rates come to ₹ 49348, 57338, 66902 ha. yr with Benefit- Cost (B: C) ratio as 2.83, 3.01, 3.22 respectively and IRR as 97% (Tables 4 & 7).

Farmers with marginal and small land holdings have adopted Boundary Plantation Models. In general, these farmers are financially weak and unable to sacrifice nominal agricultural production in lieu of much higher return from block plantation of poplar at the end of six years. For boundary plantations, poplar is now getting popularized with the farmers [Sharma and Dadhwal, 1996]. In order to minimize shade on the agricultural crop, planting of poplar has been done in East-West direction. In general, in one ha field area, poplar plantation has been taken along two boundaries and one field bund in the middle, at 3m spacing from plant to plant. Thus, total 102 numbers of plants have been planted in one ha area. For boundary plantation, cost of raising and gross income is proportionately reduced as compared to the block plantation in view of reduced number of trees. Gross income from the boundary plantation comes to ₹ 91448 ha.1.

Model-5 Poplar-paddy-wheat boundary plantation model

Under this model, poplar is planted on the raised bunds along the field boundary in the first week of February. In March, maize fodder crop is sown and harvested in June. Then paddy is sown in July and harvested in November. In the November itself wheat crop is sown, which is harvested in April of the second year. Then paddy and wheat crops are taken alternately till sixth year. At the end of sixth year poplar crop is also harvested. For this model, NPV at 12 %, 9 %, 6 % discount rates come to ₹ 26626, 29738, 33392 ha. yr with Benefit- Cost (B: C) ratio as 2.35, 2.42, 2.49 respectively and IRR as 389% (Tables 5 & 7). IRR is high due to short rotation of agricultural crops and relatively less return from the poplars (as compared to return from
the block plantation) after six years of rotation.

Model-6 Poplar-sugarcane-wheat-paddy boundary plantation model

Under this model also, poplar is planted on the raised bunds along the field boundary and sugarcane is sown in the field in the first week of February. Sugarcane is harvested in December. Next sugarcane crop is harvested in the November month of second year. Then wheat crop sown in November itself and harvested in April month of the third year. Then in July paddy is sown in the field and harvested in November. Like this, crops of wheat and paddy are taken alternately till sixth year. At the end of sixth year, poplar trees are also harvested. For this model, NPV at 12 %, 9 %, 6 % discount rates come to ₹ 31519, 34946, 38937 ha⁻¹ yr⁻¹ with Benefit- Cost (B: C) ratio as 2.67, 2.73, 2.81 respectively and IRR as 216% (Tables-6 & 7). In this model, IRR is lesser as compared to model-5 because relatively longer rotation agricultural crop of sugarcane was taken in the first two years. Rankings of the agroforestry models based on NPV, B: C ratio and IRR have been shown in Table 7. Among the block plantation models, models- 1 and 2 rank first and fourth respectively, while models- 3 and 4 have almost same NPV. Although model 2 ranks fourth based on NPV but has the highest B: C ratio. IRR of the models vary from 94% to 97%. Among the boundary plantation models, model-6 was found better based on NPV and B: C ratio but model-5 has a much higher IRR as compared to model-6. According to a study, conducted by Forest Research Institute, Dehradun during 1983, on economics of poplar plantation with agricultural crops, maximum NPV and B: C ratio at 12% interest rate and 8 years rotation were found to be ₹ 11046 ha⁻¹ yr⁻¹ and 3.22 respectively, while IRR was found to be 79%[Karnataka, 2000]. Gross return of ₹ 85308 ha⁻¹ yr⁻¹ from the block plantation of poplar on eight years rotation has been reported [Singh and Jhajaria, 2001]. It can be noted that now rotation period of poplar has come down to 6 years with better economic returns.

Farmers have adopted agroforestry due to much higher economic returns from it, as compared to income from agriculture alone. Poplar based agroforestry has left a profound impact on the upliftment of the socioeconomic status of the people in the region. It has also contributed towards improving the local environment by increasing tree cover over a large area and reducing biotic pressure on the natural forests. Agroforestry was started in the region in early 1980s and today, over 200 small-scale plywood peeling/manufacturing industries have been established in Yamunanagar District of Haryana alone. Poplar based agroforestry has benefited farmers by increasing their income manifolds, created wood based industries, generated employment opportunities and developed ancillary units like transport, fertilizers, insecticides, pesticides, wood processing machineries etc. It has saved valuable foreign exchange by way of reduction in import of timber. Agroforestry has brought the overall development in the region.
Box-1

Economics of growing 500 Poplar trees as block plantation in one ha area

(A) Details of cost

Total cost: `44000.00

(B) Details of production and sale

1. Average height of trees in a six years old plantation: 23 m
2. Average DBH of a tree in a six years old plantation: 25 cm
3. Volume (under bark) of a tree: 0.369 m³ [Singh & Upadhyay, 2001]
4. Weight of a freshly felled tree: 0.369 * 12 = 4.428 Quintal
   (1m³ = 12 Quintal and 1 Quintal = 100 kg)
5. Selling rate of Poplar wood:
   (a) Logs with > 60 cm mid girth: `250 per Quintal (account for 75% of the total
       - weight of a tree)
   (b) Logs with 60-30 cm mid girth: `180 per Quintal (account for 15% of the total
       - weight of a tree)
   (c) Remaining wood: `100 per Quintal (account for 10% of the total weight of a tree)
6. Average selling price of a tree: 4.428 * 224.50 = `994
(C) Gross income @ 90% survival = `447300.00 ha⁻¹
   1 US $ = Rupees (India) 48.60 (December, 2002)

Box-2

Economics of growing Turmeric under block plantation of Poplar in one ha area

(A) Details of cost: `27560.00

(B) Details of production and sale

a) Green biomass production: 10298 kg ha⁻¹
b) Weight after processing and drying: 2252 kg ha⁻¹
   c) Total sale amount @ `30 kg⁻¹ dry weight = 2252 * 30 = `67560.00
(C) Net return = `67560 -27560 = `40000.00 ha⁻¹
Box 3
Economics of growing Sugarcane under block plantation of Poplar in one ha area

(A) Details of cost:

a) Expenditure on growing sugarcane in the first year: ` 25000.00
b) Expenditure on growing sugarcane in the second year: ` 15000.00

(B) Details of production and sale

a) Total production of sugarcane under block plantation of poplar: 50000 kg ha\(^{-1}\)
b) Total sale amount @ ` 0.95 kg\(^{-1}\) = 50000 × 0.95 = ` 47500.00
c) Total production of sugarcane under boundary plantation of poplar: 66500 kg ha\(^{-1}\)
d) Total sale amount @ ` 0.95 kg\(^{-1}\) = 66500 × 0.95 = ` 63175.00

(C) Net return

a) From sugarcane crop in the first year under block plantation of Poplar:
   ` 22500.00 ha\(^{-1}\)

b) From sugarcane crop in the second year under block plantation of Poplar:
   ` 32500.00 ha\(^{-1}\)

c) From sugarcane crop in the first year under boundary plantation of Poplar:
   ` 38175.00 ha\(^{-1}\)

d) From sugarcane crop in the second year under boundary plantation of Poplar:
   ` 48175.00 ha\(^{-1}\)

Box 4
Economics of growing one crop of Wheat under block plantation of Poplar in one ha area

(A) Details of cost: ` 12050.00

(B) Details of production and sale

a) Under block plantation of Poplar, production of
   (i) Wheat: 3000 kg ha\(^{-1}\)
   (ii) Plants residue and Husk: 3000 kg ha\(^{-1}\)

b) Under boundary plantation of Poplar, production of
   (i) Wheat: 4000 kg ha\(^{-1}\)
   (ii) Plants residue and Husk: 4000 kg ha\(^{-1}\)

a) Under block plantation of poplar sale amount of
   (i) Wheat @ ` 6.10 kg\(^{-1}\) = 3000 × 6.10 = ` 18300
   (ii) Plants residue and Husk @ ` 2.00 kg\(^{-1}\) = 3000 × 2.00 = ` 6000.00

b) Under boundary plantation of poplar sale amount of
   (i) Wheat @ ` 6.10 kg\(^{-1}\) = 4000 × 6.10 = ` 24400.00
   (ii) Plants residue and Husk @ ` 2.00 kg\(^{-1}\) = 4000 × 2.00 = ` 8000.00

(C) Net return

   (i) From wheat under block plantation of poplar = ` 12250.00 ha\(^{-1}\)
   (ii) From wheat under boundary plantation of poplar = ` 20350.00 ha\(^{-1}\)
Box 5

Economics of growing one crop of Paddy with Poplar on the field boundary in one ha area

(A) Details of cost: ` 13150.00

(B) Details of production and sale

(a) Production of

(i) Paddy: 3500 kg ha⁻¹
(ii) Plants residue and Husk: 2000 kg ha⁻¹

(b) Sale proceed of

(I) Paddy @ ` 6.50 kg⁻¹ = ` 22750.00
(ii) Plants residue and Husk @ ` 0.75 kg⁻¹ = ` 1500.00

(C) Net income = ` 11100.00 ha⁻¹

Box 6

Economics of growing Ponta under block plantation of Poplar in one ha area

(A) Details of cost: ` 44000.00

(B) Details of production and sale

(a) Production: 18000 kg ha⁻¹
(b) Sale proceed of @ ` 3.50 kg⁻¹ = ` 53000.00

(C) Net income = ` 19000.00 ha⁻¹

Box 7

Economics of growing Bajra (Pearl millet) under block plantation of Poplar in one ha area

(A) Details of cost: ` 6000.00

(B) Details of production and sale

(a) Production: 2000 kg ha⁻¹
(b) Sale proceed @ ` 4.00 kg⁻¹ = ` 8000.00

(C) Net return = ` 2000 ha⁻¹

Box 8

Economics of growing Chani fodder (Sorghum vulgare) under block plantation of Poplar in one ha area

(A) Details of cost

(B) Details of production and sale

(a) Production: 25000 kg ha⁻¹
(b) Sale proceed @ ` 0.40 kg⁻¹ = ` 10000.00

(C) Net return = ` 4000.00 ha⁻¹

Box 9

Economics of growing Maize fodder under block plantation of Poplar in one ha area

(A) Details of cost: ` 8400.00

(B) Details of production and sale

(a) Production: 34000 kg ha⁻¹
(b) Sale proceed @ ` 0.60 kg⁻¹ = ` 20400.00

(C) Net return = ` 6000.00 ha⁻¹

Box 10

Economics of growing Barseem fodder (Trifolium sp) under block plantation of Poplar in one ha area

(A) Details of cost: ` 17700.00

(B) Details of production and sale

(a) Production: 19000 × 4 = 76000 kg ha⁻¹
(b) Sale proceed @ ` 0.50 kg⁻¹ = ` 38000.00

(C) Net return = ` 20300.00 ha⁻¹
### Table 1 Peoplar-sugarcane-turmeric block plantation model

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### Table 2 Peoplar-sugarcane-wheat- charti block plantation model

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### Table 3: Poplar-sugarcane-wheat-chili-potato-maize-bajra block plantation model

<table>
<thead>
<tr>
<th>Year</th>
<th>Forestry and Agricultural crop</th>
<th>Actual cost</th>
<th>Present value of cost at 12% discount rate</th>
<th>Present value of benefit at 12% discount rate</th>
<th>Present value of benefit at 6% discount rate</th>
<th>Present value of benefit at 2% discount rate</th>
<th>Actual benefit</th>
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<th>Present value of benefit at 6% discount rate</th>
<th>Present value of benefit at 2% discount rate</th>
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### Table 4: Poplar-sugarcane-potato-bajsa-chili block plantation model

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<th>Present value of cost at 12% discount rate</th>
<th>Present value of benefit at 12% discount rate</th>
<th>Present value of benefit at 6% discount rate</th>
<th>Present value of benefit at 2% discount rate</th>
<th>Actual benefit</th>
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<th>Present value of benefit at 6% discount rate</th>
<th>Present value of benefit at 2% discount rate</th>
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</tr>
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<td>0</td>
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### Table 5: Poplar-paddy-wheat boundary plantation model

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<th>Present value of benefit at 12% discount rate</th>
<th>Present value of benefit at 6% discount rate</th>
<th>Present value of benefit at 2% discount rate</th>
<th>Actual benefit</th>
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<th>Present value of benefit at 2% discount rate</th>
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### Table 6: Poplar-sugarcane-wheat-paddy boundary plantation model

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<th>Actual cost (rupees)</th>
<th>Present value of cost at 12% discount rate (rupees)</th>
<th>Present value of cost at 6% discount rate (rupees)</th>
<th>Actual benefit (rupees)</th>
<th>Present value of benefit at 12% discount rate (rupees)</th>
<th>Present value of benefit at 6% discount rate (rupees)</th>
<th>Present value of cost at 9% discount rate (rupees)</th>
<th>Present value of benefit at 9% discount rate (rupees)</th>
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### Table 7: Agroforestry models at a glance

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<th>Model No.</th>
<th>Forestry and Agricultural crop</th>
<th>Present value of cost at 12% and 6% discount rate respectively (in rupees)</th>
<th>Present value of cost at 12% and 6% discount rate respectively (in rupees)</th>
<th>NPV &amp; Ranking</th>
<th>B.C. ratio &amp; Ranking</th>
<th>IRR (%) &amp; Ranking</th>
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