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Socio-economic study of poplar (*Populus deltoides*) based agroforestry model in Vaishali district of Bihar

Arpana Pandey, Prem Ranjan Sinha and VK Dhawan

Abstract
A questionnaire survey was conducted during April- May 2016 on poplar based agroforestry model in Vaishali district of Bihar for analysis of its acceptability, profitability, and constraints prominent for the popular beyond its favourable condition. Result released that the growth of popular not much affected but on comparison of production and income obtained from with and without cultivation of poplar trees, with crops shows slightly decrease in production of crops but overall income of farmer's increases due to addition of poplar selling price. The yield of potato and onion found better as compared to the other crops while the yield of maize was lower with Poplar. Based on the respondent opinion, 46.14% of the respondents believe that trees reduce yield of agriculture crop. Other reasons behind less popularity of agroforestry include lack of market (38.57%), small land holding (31.71%), lack of awareness (25.71%), late returns (26.57%) and restrictions on felling and transport of trees (8.85%).

Keywords: Agroforestry, poplar, production, income, constraints

Introduction
Poplar (*Populus deltoides*) based agroforestry systems, adopted extensively by the farmers on a commercial scale play a significant role to meet the economic, social and environmental concerns of the people. Poplar has become the most preferred cash crop in north-western states (Chandra, 1986) [3]. Poplar has become the preferred cash crop can be grown with cereals, pulses, vegetables, forage, fruit/vegetable crops etc. (Sharma, 1996; Chauhan and Mangat, 2006) [8, 4]. Poplars provide huge cash returns to individuals and communities engaged in their cultivation and management, contribute considerably to government exchequer, reduce pressure on forests and entail massive ecological and environmental benefits besides providing a wide range of other wood products and employment opportunities to various subsidiary sectors.

Indian Council of Forestry Research and Education has taken up major initiative to introduce *P. deltoids* in Vaishali district of Northern Bihar, with signing the agreement among Govt. of Bihar, Ministry of Environment, Forests and Climate Change through Indian Forest Product Institute, Ranchi on March 2006 with the project name Samuday Aadharit Samanvit Prabandhan Evam Sanrakshan Yojana (SASPYA). The project envisaged planting of 76 lakh seedlings on farmlands spread over 1,398 villages covering approximately 6,100 farmers in all the 16 blocks of Vaishali district. Establishment of Model Nursery, Demonstration Plots, Clonal Garden and Hedge Garden were also some of the key activities of the project (Anon. (2014) [2]. Poplar for prosperity).

Materials and Methods
Study site
The data collected from Vaishali district of Bihar. It is located between $25^0$41' N to $25^0$68' N latitudes and 85°13'E to $85^0$22' E longitudes. Its geographical area is 2,036 sq. km. having a population of 34, 95,021 as per 2011 census. Muzaffarpur in the North, Samastipur in the East, with rivers Ganga and Gandak making the Southern and Western boundaries surround it. The soil of experimental site is fertile loamy soil.

Methodology
All the necessary data for the study gathered through household questionnaire survey conducted from April to May 2016. The data used for this study obtained from both primary and secondary sources. About, 75 percent of sites were randomly selected distributed throughout the district where plantation had been done. In each block, 5 to 6 villages were

taken up for detailed study. In each village, minimum five families were selected at random and the number of respondents was increased in proportion of population and area of village.

At the stage of survey, informal group contacts and personal i.e. door-to-door contacts and transect walks across each village were undertaken to understand the general agricultural and socio-economic situation of the population of study area. The village-wise data was compiled. Data analysis was carried out with the help of using MS Excel software.

Results and Discussions

The result showed that the average land holding per family for a household was 1.89 acre, which ranged from 0 to 22.08 acre and land per capita of Vaishali district was 0.26 acre that ranges from 0.040 to 3.68 acre. The agriculture is the main source of income; farmers follow conventional system of agriculture. Popular clone like Lalkuan series, L-3, Kranti, G-3 were introduced in Vaishali district.

The growth data recorded from various poplar plantations in Vaishali indicated the compatible growth of the poplar (Table 1). Going by this rate of growth, it can safely attained 105-120cm girth and 17-18m height after period of 4 years. Farmers are planting poplar on bunds or block depending on their resources with combination with wheat, potato, maize, rice and mustard. The percent yield of mustard reduced 3.75% and onion 16% found less in comparision to the other crops while the maize yield reduced 33% was lowest with Poplar. Based on agro-climatic zone Popular, Shisham, Melia, Eucalyptus, Mango, Litchi, Bamboo, Kathal and others trees can be practice with local agricultural crops (Agroforestry Policy, Govt. of Bihar, 2018).

On comparison of production and income obtained from with and without cultivation of popular trees, with crops shows slightly decrease in production of crops (Table 2) but overall income of farmer's increases due to addition of popular selling price according to their girth (Table 3). Based on the respondent opinion, 46.14% of the respondents believe that trees reduce yield of agriculture crop. Other reasons behind less popularity of agroforestry include lack of market (38.57%), small land holding (31.71%), lack of awareness (25.71%), late returns (26.57%) and restrictions on felling and transport of trees (8.85%). The farmers holding major land farmers will more benefited by agroforestry in comparison to small and marginal farmers (Verma *et al*. 2012) and in India 2/3 rd farmers are small and marginal (Kumar *et al.* 2017) [6]. There is costly and complicated legislation in respect of tree felling, wood transportation, processing and marketing (Planning Commission, 2001) which plays significant role to the farmer for adoption of agroforestry (*Chavan et al.* 2014).

1 2

Fig 1: Row wise popular plantation in village & **2):** ETPs in poplar nursery in the village

Table 1: Growth statistics of Poplar at Vaishali

Year	Average girth(cm)	Average Height (m)
1	14.75	5.18
2	25.15	6.66
3	36.83	8.35
4	45.47	10.97
5	60.96	14.90
6	69.72	18.21

Table 2: The production of crops under Poplar and open field

S. No.	Crop variety grown along with Poplar	Yield of crop without Poplar (In Kg.)	Yield of crop with Poplar (In Kg.)	% decrease in production
1	*Triticum aestivum L.* (Wheat)	100	80	20
2	*Oryza sativa L.* (Rice)	95	75	21
3	*Brassica* juncea (Mustard)	80	77	3.75
4	*Solanum tuberosum* (Potato)	400	300	25
5	*Allium cepa (Onion)*	350	300	16
6	*Zea mays L.* (Maize)	90	60	33

(**Note:** Area of the field was taken as 1 Kattha (in Bihar) =1361.25 sq ft. In Bihar-1 Bigha has 20 Kathas.)

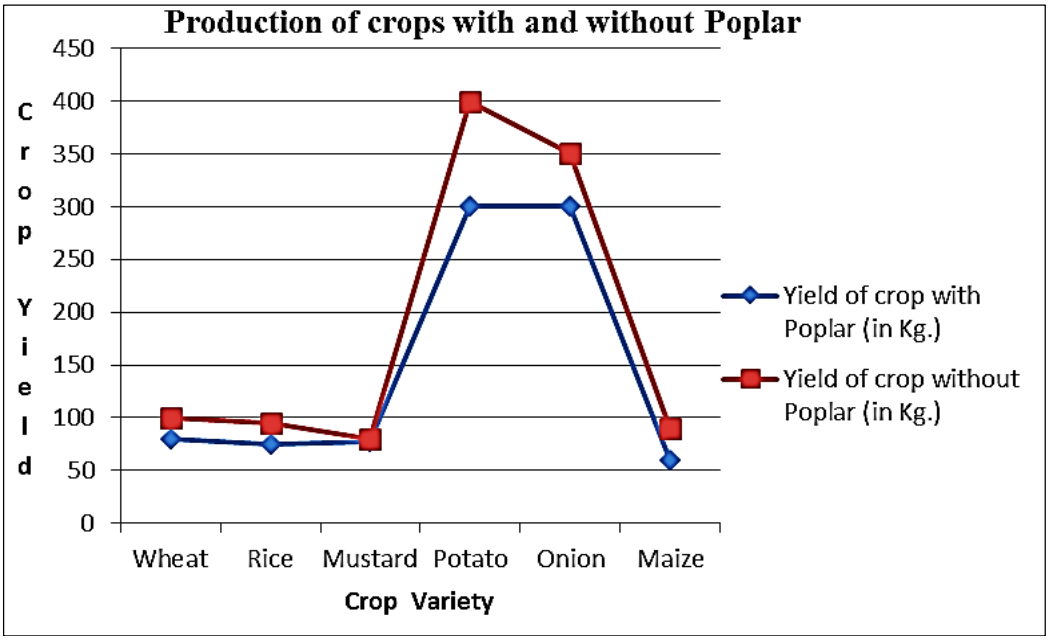

Fig 3: Shows the production of crops in open and crops with Poplar

Table 3: Girth wise market price of Poplar logs

S. No.	Girth (Cm)	Market Price (Rs/Qtls.)
1	>60.96	600-650
2	45.72-60.96	500-450
3	30.48-60.96	450- 400
4	20.32-30.48	300-250

Conclusion

Agroforestry is sustainable land use system as it plays pivotal role for enhancing the socioeconomic condition of farmer's and rural peoples, provide employment from generation to generation, food security and meet their day-to-day needs other than that it also helpful in maintaining ecological and environmental balance. Thus, agroforestry becomes need of the world so that research of different models with combination of other crops should be analysed and suitable model follows by farmers.

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