Economic Evaluation of Sal based Agro Forestry System Technology

Gokul Benode Roy

Dept. of Soil and Water Conservation Bidhan Chandra Krishi Viswavidyalaya, Mohanpur-741252, Nadia, West Bengal

Abstract—*In the present day Agro forestry is an advanced technology in which arable crops can be grown in association with trees. It is well established that Agro forestry system is an advanced technology for better socio economic status of an area and ecological balance. The growth of plants and tree crops is dependent on many variables like nature and type of soil, availability of surface and groundwater and other environmental factors. The present research work carried out in during 2007-08 with a view to assess the growth and productivity of Shorea robusta, (Sal) in association with rice, cowpea, ground nut and black gram. The results revealed that yield of groundnut in association with Shorea robusta gave the highest economic yields and monetary return.*

1. INTRODUCTION

Land and water, the most important natural resources, is essential for the growth and development of various types of plants including tree crops. With the escalating population pressure, these natural entities are going to be limiting factors. Hence, the proper land use system should be evolved for better soil and water management practices. Agroforestry is such a type of modern advanced technology in which both arable crops and tree crops can be cultivated simultaneously in a single piece of land for more economic return per unit land and time. The information on the profitability of planting Shorea *robusta*, (sal) intercropping with several field crops in arid, semi-arid and humid regions is well documented (Chaturvedi *et.al*., 1982). However, these aspects are still lacking in the red and laterite zone of West Bengal. With this background in view, the present research work on agroforestry based intercropping was carried out in the red and laterite zone of West Bengal to (i) study the growth and productivity of *Shorea robusta*, (sal) in association with field crops and (ii) to find out the acceptability and economic viability of the present technology.

Role of forestry:

Acceleration in human and livestock population growth necessitated acquisition of more and more land under cultivation continued to meet the ever-increasing demand for food, fodder, vegetables, fuel wood, timber, medicines etc. This exerts a great pressure on the forest world wise loss of forest cover, by releasing vast stock pile of carbon in to the atmosphere as CO_2 creates the green house effect with various adverse effects. This pressure has forced people to seek unconventional method of agriculture to utilize land to the maximum extent.

Present scenario:

Under 10^{th} five year plan, the Government of India has set a target to increasing the countries forest cover up to 25%. According to the 2001 report of forest survey of India, the forest covers in the country is 675,538 Km^2.constituing 20.55% of its total geographical area. The state of West Bengal has 11,879Km^2 under recorded forest which constitutes 13.38% of the total geographical area of the state. So a multifaceted programme of forestry development in the state for a durable ecosystem is needed very much.

It is sufficiently clear today that any increase in food production has to come primarily from raising the productivity of existing agricultural land rather than by bringing more area under agriculture. Therefore, in the quest of optimizing productivity the multi-tire system came into existence.

Concept of agroforestry:

Agroforestry has been recognized as a land use system which is capable to increase the productivity and at the same time maintain nutrient balance and rehabilitate the ecosystem. Trees have the dominant role to play in all agroforestry system for sustainable agriculture and environmental production. Agroforestry is the science of designing and developing integrated self sustainable land management system which involves introduction or retention of woody components along with agricultural crops simultaneously or sequentially, on the same unit of land and at the same time to meet the ecological balance as well as socio-economic needs of the people. Agroforestry also is an important land use system to meet not only food, fodder and wood requirement but also to protect the earth from degradation.

2. MATERIALS AND METHODS:

An experiment was conducted in the Regional Research Station (red and laterite zone), Jhargram to study the growth and productivity of Sal plantation under agroforestry system. Rice cowpea, ground and black gram were grown as

intercrops to determine their effects on the Sal plants during the *kharif* season of 2007. The station is situated at 22.5° N Latitude and 87.0° E latitude and at an elevation of 78.77 m above mean sea level.

The climate is sub-humid to humid, subtropical in nature. The mean annual rainfall of this zone for 50 years is 1307 mm received in normally 70 – 80 rainy days.

The maximum and minimum temperature fluctuated during a year from 26.7°C to 38.4° C and 13.1 C to 26.5° C respectively. The relative humidity ranges from 42.82 to 91.1.

The soil of the experimental site are red and Lateritic with pH 5.5 and sandy clay loam in texture with 0.32% organic carbon, 7.2me/100g of CEC, 65 kg/ha total nitrogen, 13 Kg/ha of available P2O5 and 100 kg/ha of available K2O obtained.

Soil depth varies from 0.9 to 3 meter. The bulk density of the soil is 1.56 g/cc, particle density is 2.66 g/cc, pore space is 40.6%, infiltration capacity 1.21cm/hr and hydraulic conductivity is 0.31 cm/hr.

The size of the experimental plot was 20m x 20m

The spacing maintained between row to row 5m while that of plant to plant was 5m.

All the intercrops were sown in the 2nd week of July 2007 another plot was provided fro sole tree.

Experimental design : Randomized block design

No. of replication : 4

No. of treatment : 5

Treatment combination

1. Sal + rice
2. Sal + cowpea
3. Sal+ ground nut
4. Sal + black gram
5. sole tree
6. gross are 1.5 ha
7. Gross plot size 20m x 20 m = 400 m $^{2.}$

The data obtained were statistically analyzed by the variance method as suggested by Sukhatne, 1978 and Chandal 1969.

The volume of the tree was determined by measuring the area of the tree or log at the thin end at the middle and the thick end (in square unit) by employing Newton formula as describe by Chaturbedi and Khanna, 1982.

3. RESULTS AND DISCUSSION:

Organic matter is most dynamic constituent of soil influences physical and biological properties and are presented in Fig.1.

Results of pH of soil samples after harvesting of intercrops under Sal plantation are presented in Fig.2

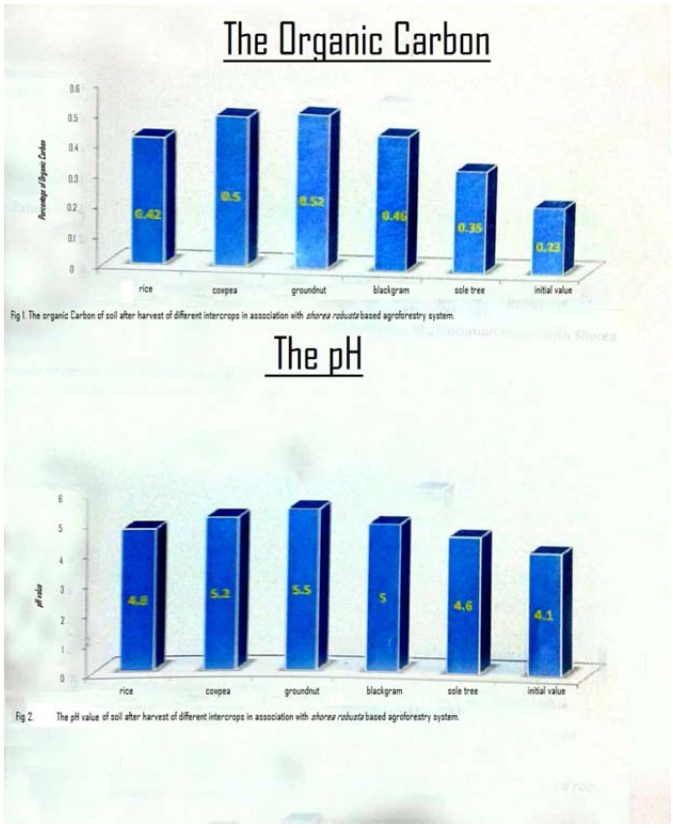

Fig 1. The organic Carbon of soil after harvest of different intercrops in association with *shorea robusta* based agroforestry system.

Fig 2. The pH value of soil after harvest of different intercrops in association with *shorea robusta* based agroforestry system.

The plant height (m), bole height (m), diameter in breast height (cm) and volume yield (m^3/ha/year) in different intercropping systems are recorded and presented in the Table 1. It is evident from the table that plant height showed distinct variation among themselves in different plots. Maximum plant height (4.70m) was recorded on sal plant when ground nut was used as intercrop and minimum plat height (3.55m) was recorded under the sole tree without intercrop.

Table 1. Plant height, bole height, diameter in breast height and volume yield of *Shorea robusta*

Intercrop	height,	bole height (m)	diameter in breast height (cm	volume yield (m^3/ha/year)
Rice	4.45	3.70	6.92	1.01
Cowpea	4.15	3.50	6.75	0.91
Groundnut	4.70	3.90	7.99	1.42
Black gram	3.90	3.40	7.80	1.18
Sole tree	3.55	3.00	6.20	0.66
SEm (±)	0.123	0.120	0.092	0.014
C.D. (at 5%)	0.268	0.261	0.201	0.031

Significant difference among growth of sal was noticed with regard to bole height per plot (Table 1). Maximum bole height was recorded in ground nut (3.90m) plot, which ws also statistically at per with rice (3.70 m), cow pea (3.50m) and

black gram (3.40m). While the minimum bole height was recorded in sole tree (3.00m)

Among the different intercrops, maximum trees dbh was recorded in ground nut (7.99cm) plot followed by black gram (7.80cm), rice (6.82cm) cow pea (6.75cm) and minimum dbh was recorded from sole tree plot (6.20cm).

The projected volume yield m^3/ha/year or other words the potentiality was recorded on ground nut plot (1.42m3) closely followed by black gram (1.18 m^3/ha/year), rice (1.01 m^3/ha/year), sole tree (0.66 m^3/ha/year) and the minimum volume yield per ha per year has been projected with cowpea plot.

Table 2: Economics of *Shorea robusta* based agroforestry system

Intercrop	Yield of Cr (t/ha)	Volume yield of tree (m3/ha/yr)	Return from crop/ha (Rs)	Return from tree ha/yr (Rs)	Total return /ha (Rs)
Rice	2.32	1.01	13,920	17,834	31,750
Cowpea	1.71	0.91	10,260	16,067	26,327
Groundnut	0.78	1.42	15,600	25,073	40,673
Black gram	0.59	1.18	17,700	20,835	38,535
Sole tree	-	0.66		11,653	11,653

The productivity of the different intercrops under *Shorea robusta* plantation with the different intercrops, the maximum yield was recorded with rice (2.32t/ha) followed by cow pea (1.71 t/ha) and ground nut (0.78 t/ha). The lowest yield was obtained with black gram (0.59 t/ha). However, the return from the crop per hectare in monitary value was highest with groundnut and black gram. Lowest return from the crop/ha was recorded with cowpea followed by rice. This is due to the fact that black gram and ground nut fetches more market prices (Rs 30/kg and Rs 20/kg, respectively) than cow pea and rice (Rs 6/kg each).

A difference in the volume yield of tree (m^3/ha/yr) was also observed when it is grown in association with different intercrops. Maximum volume yield was observed when Sal is grown with ground nut (1.42) and least with cowpea (0.91) except for the sole tree (0.66). at a market price of Rs. 500 (approximately) per cubic feet for Sal , maximum return from the tree was obtained from *Shorea robusta* + groundnut plot.

4. CONCLUDING REMARKS

1. In the present study it may be concluded that out of the four intercrops the most suitable intercrop under *Shorea robusta* (sal) plantation with ground nut shown maximum return.
2. In this system people of this area can earn by making plate (*thali*) and bowl (*bati*) by the young leaves of the Sal tree.

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