Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 03, Issue: 06 (NOV-DEC, 2023)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Economies of Agroforestry Systems

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Agroforestry is a collective name for a land-use system and technology whereby woody perennials are deliberately used on the same land management unit as agricultural crops and/or animals in some form of spatial arrangement or temporal sequence.

- Agroforestry is a collective name for land-use systems involving trees combined with crops and/or animals on the same unit of land

ECONOMIES OF AGROFORESTRY

- The economies of agroforestry systems discussed here are
  i. Agri silviculture
  ii. Agri horticulture

Agri-silviculture: Agri-silviculture is a production scheme that supplies wood, foodstuffs and/or animal products from a single management unit where good agricultural practices are complemented by the judicious use of trees.

Ex: Teak + Pulses

Agri-horticulture: Agro horticultural means the [cultivation]utilization of land for the production of food, fiber, animals, and related activities customary to agricultural and horticultural production and operations.

Ex: Teak + Vegetables

Per hectare costs of cultivation of Gram: The per hectare costs of gram in study area is presented in Table a. it is revealed from the table that the total overall average per hectare cost of cultivation of gram is accounted for Rs. 33431.35. The maximum per cent share of the costs is constituted by seed i.e.23.70 per cent followed by human labour, machinery charges, and fertilizer corresponding to 23.34, 13.37, and 7.26 per cent, respectively on overall farms.

The average costs of cultivation of gram on different categories of farms are also mentioned in the table which was maximum of Rs. 34016.20 on small farm followed by marginal and medium size of farm corresponding to Rs. 33657.33 and 32470.80 respectively. Average cost of production per quintal was recorded as Rs. 1497.94The higher per hectare cost of cultivation on marginal farm was found due to heavy expenditure on human labour and fertilizer as compared to other categories of farms. It may be concluded that costs of cultivation per hectare had the indirect association with the size of farms.

Per hectare income measures of gram: The per hectare income measures of gram are presented in Table b. It is depicted from the table that the per hectare gross income on overall farms was found to 75843.67. It was maximum of Rs. 81678.00 small size of farms followed by medium and marginal categories of farms corresponding to Rs. 73980.50 and Rs.72253.50 respectively.

The overall net income per hectare was found to 42412.00. It was maximum of Rs. 47661.85 on small size of farms followed by medium and marginal categories of farms corresponding to Rs. 41509.66 and 38596.17 respectively. The overall family labour and

farm business income accounted for 51025.12 and 57659.77 respectively. The output-input ratio came to 1:2.26 on overall farm which was highest on small farms i.e. 1:2.40 followed by medium and marginal farms corresponding to 1:2.27 and 1:2.14 respectively. It may be calculated that gram cultivation was more profitable an small farms of the study area due to high cost and higher yield per hectare. It may be concluded that Gram cultivation had the scope to increase the additional input to receive the additional income.

Per hectare costs of Pea: Per hectare costs of Pea (matar) in the study area is presented in Table c. It is revealed from table that per hectare overall average costs came to Rs. 36115.08. The per cent share of different components of the costs shows that the maximum expenditure occurred on human labour 28.98 per cent followed by, machinery charges, seed, fertilizer, and Irrigation which accounted for corresponding per cent share of 15.48, 11.31, 7.91 and 4.98 respectively. The average total cost of cultivation per hectare of pea on various categories of farms were also analysed and it were accounted for Rs.37584.30 on marginal size of farms followed by medium and small size group of farms corresponding to Rs.32606.24 and 31798.45 respectively. The highest cost of cultivation per hectare on marginal farm was occurred due to heavy expenditure on human labour.

Per hectare income measures of pea: Details of per hectare income measures of pea are presented in table d. It is depicted from the table that a hectare of pea yielded 17.88 quintals of grain which offered the gross income of Rs. 52098.96 at the rate of sale Rs.2913.81 per quintal. The per hectare net income, family labour income and farm business income are also presented in the table which corresponded the amount of Rs. 15983.88, Rs. 27028.76, and Rs. 33811.82 respectively. The cost of production per quintal was recorded as Rs. 1607.76 and input-output ratio was found to 1:1.44 on overall farm. The net income measures per hectare were maximum on medium Rs. 18225.76 followed by small and marginal size of farms corresponded to Rs. 16535.55 and Rs.15507.70 respectively. It is concluded from the table that costs of cultivation per hectare did not have any definite relation with size of farms and the income measures were also found to have the same trend.

Per hectare costs of Pegionpea: The per hectare costs of pigeonpea (Arhar) in the study area is presented in Table e. It is depicted from the table that the per hectare total costs of Pigeonpea on an overall farms came to Rs. 28794.27. Comparison of different items of cost revealed maximum for human labour 18.04 per cent followed, fertilizer costs 10.84 per cent, machinery charge 6.76 per cent and seed cost 2.36 per cent. The average total costs per hectare on various categories of farms were found to highest small size of farms Rs. 29184.45 followed by marginal Rs.28688.92 and medium Rs. 26453.20 respectively. Higher per hectare costs of cultivation occurred on small size of farms due to comparatively more expenditure on machinery charges.

It may be concluded that the per hectare costs of Pigeonpea (Arhar) did not have any definite association with size of farms.

Per hectare income measures of Pigeonpoea: Per hectare income measures of Pigeonpea is presented Table f. It is depicted from the table that a hectare of Pigeonpea yielded 17.66 quintals of main product and 49.12 quintals of by product with correspond grass income Rs. 87499.68 with the average sale rate of Rs. 4398.39 main product and Rs. 200 by product per quintal.

The net return per hectare was found to Rs. 58525.01 and cost of production was Rs. 1439.13 per quintal on overall farms. The family labour income, and farm business income were recorded as Rs. 64280.56, and Rs. 76612.95 on overall farms. The inputoutput ratio on overall farms came to 1:3.01 which was maximum 1:3.38 on small farms followed by medium and marginal (1:3.02 and 1:2.75) size of farms respectively. It is concluded from the table that per hectare yield output input ratio on small farms were maximum, followed by

medium and marginal farms than the medium and marginal farms because of costs of cultivation per hectare on these farm groups.

Per hectare costs of different inputs used in Gram production (Rs.)

Table.1 Per hectare costs of different inputs used in Gram production (Rs.)

S. No	Particulars	Size group of farms			
		Marginal	Small	Medium	Overall average
1.	Human Labour	10342.87 (30.72)	6400.01 (18.81)	6037.74 (18.59)	7803.29 (23.34)
2.	Machinery Charges	3771.44 (11.20)	5100.01 (14.99)	4679.26 (14.41)	4469.96 (13.37)
3.	Seed	6205.72 (18.44)	9166.67 (26.95)	8784.91 (27.05)	7923.50 (23.70)
4.	Fertilizer	2603.42 (7.74)	2364.58 (6.96)	2273.20 (7.00)	2429.47 (7.26)
5.	Total working capital	22923.45 (68.10)	23031.27 (67.70)	21775.11 (67.06)	22626.22 (67.68)
6.	Interest on working capital	1146.17 (3.40)	1151.57 (3.38)	1088.75 (3.35)	1131.31 (3.38)
7.	Rental value of land	6000.00 (17.83)	6000.00 (17.63)	6000.00 (18.48)	6000.00 (17.94)
8.	Interest on fixed capital	528.01 (1.57)	714.01 (2.09)	655.09 (2.01)	625.79 (1.87)
9.	Sub total	30597.63 (90.90)	30923.90 (90.90)	29518.95 (90.90)	30392.19 (90.90)
10.	Managerial Cost @10% of sub-total	3059.76 (9.09)	3092.30 (9.09)	2951.89 (9.09)	3039.18 (9.09)
Grand total		**33657.33 (100)**	**34016.2 (100)**	**32470.80 (100)**	**33431.35 (100)**

(Figures in parentheses indicate the percentage to total)

Table.3 Per hectare costs of different inputs used in Pea production (Rs.)

S. No	Particulars	Size group of farms			
		Marginal	Small	Medium	Overall average
1.	**Human Labour**	11682.40 (31.08)	7123.29 (22.40)	7285.72 (22.34)	10468.71 (28.98)
2.	**Machinery Charges**	5642.48 (15.01)	5265.75 (16.55)	5714.28 (17.52)	5593.11 (15.48)
3.	**Seed**	3857.57 (10.26)	4471.00 (14.06)	5000.00 (15.33)	4085.35 (11.31)
4.	**Fertilizer**	2996.09 (7.97)	2545.12 (8.01)	2425.72 (7.43)	2860.09 (7.91)
5.	Irrigation	1895.36 (5.04)	1709.58 (5.37)	1328.58 (4.07)	1800.38 (4.98)
6.	Total working capital	26073.90 (69.37)	21114.74 (66.40)	21754.30 (66.71)	24819.75 (68.72)
7.	Interest on working capital	1303.70 (3.46)	1055.74 (3.32)	1087.72 (3.33)	1240.99 (3.43)
8.	Rental value of land	6000.00 (15.96)	6000.00 (18.86)	6000.00 (18.40)	6000.00 (16.61)
9.	Interest on fixed capital	789.95 (2.10)	737.21 (2.31)	799.99 (2.45)	783.42 (2.16)
10.	Sub total	34167.55 (90.90)	28907.69 (90.90)	29642.04 (90.90)	32831.90 (90.90)
11.	Managerial Cost @10% of sub-total	3416.75 (9.09)	2890.76 (9.09)	2964.20 (9.09)	3283.18 (9.09)
Grand total		**37584.30 (100)**	**31798.45 (100)**	**32606.24 (100)**	**36115.08 (100)**

(Figures in parentheses indicate the percentage to total)

Table.5 Per hectare costs of different inputs used in Pigeonpea production (Rs.)

S. No	Particulars	Size group of farms			
		Marginal	Small	Medium	Overall average
1.	**Human Labour**	**6456.82 (15.59)**	**6129.88 (11.75)**	**6266.67 (23.96)**	**6332.39 (18.04)**
a.	Family Labour	3552.36 (8.58)	2805.20 (5.37)	2400.00 (9.17)	3121.50 (8.89)
b.	Hired Labour	2904.46 (7.01)	3324.68 (6.37)	3866.67 (14.78)	3210.89 (9.15)
2.	**Machinery Charges**	1949.05 (4.70)	2909.10 (5.57)	2800.01 (10.70)	2374.16 (6.76)
3.	**Seed**	772.49 (1.87)	831.17 (1.59)	973.34 (3.72)	828.85 (2.36)
4.	**Fertilizer**	3972.08 (9.59)	3581.31 (6.86)	3658.67 (13.98)	3805.75 (10.84)
5.	Total working capital	13150.44 (31.76)	13451.46 (25.79)	13698.69 (52.37)	13341.17 (38.02)
6.	Interest on working capital	657.53 (1.58)	672.58 (1.29)	684.94 (2.61)	667.07 (1.90)
7.	Rental value of land	12000.00 (28.98)	12000.00 (23.01)	12000.00 (45.88)	12000.00 (34.20)
8.	Interest on fixed capital	272.87 (0.65)	407.28 (0.78)	392.01 (1.49)	332.39 (0.94)
9.	Sub total	26080.84 (90.00)	26531.32 (90.90)	26775.64 (90.00)	26340 (90.00)
10.	Managerial Cost @10% of sub-total	2608.08 (9.09)	2653.13 (9.09)	2677.56 (9.09)	2634.05 (9.09)
Grand total		**28688.92 (100)**	**29184.45 (100)**	**26453.20 (100)**	**28794.27 (100)**

(Figures in parentheses indicate the percentage to total)

Inter crop comparison of costs of cultivation per hectare of different pulses under study area

Table.7 Inter Compression of Per hectare costs of different inputs used in Major pulses production (Rs.)

S. No	Particulars	Measure pulses		
		Gram	Pea	Pigeonpea
1.	Human Labour	7803.29 (23.34)	10468.71 (28.98)	6332.39 (18.04)
2.	Machinery Charges	4469.96 (13.37)	5593.11 (15.48)	2374.16 (6.76)
3.	Seed	7923.50 (23.70)	4085.35 (11.31)	828.85 (2.36)
4.	Fertilizer	2429.47 (7.26)	2860.09 (7.91)	3805.75 (10.84)
5.	Total working capital	22626.22 (67.68)	24819.75 (68.72)	13341.17 (38.02)
6.	Interest on working capital	1131.31 (3.38)	1240.99 (3.33)	667.07 (1.90)
7.	Rental value of land	6000.00 (17.94)	6000.00 (16.61)	12000.00 (34.20)
8.	Interest on fixed capital	625.79 (1.87)	783.42 (2.16)	332.39 (0.94)
9.	Sub total	30392.19 (90.90)	32831.90 (90.90)	26340 (90.00)
10.	Managerial Cost @10% of sub-total	3039.18 (9.09)	3283.18 (9.09)	2634.05 (9.09)
	Grand total	33431.35 (100)	36115.08 (100)	28794.27 (100)

(Figures in parentheses indicate the percentage to total)

Source: Rajeev singh et al. (2018). A Study the Cost and Returns of Major Pulse (Gram, Pea and Pegion pea) Production on Different Size Group of Farms in Azamgarh District of Eastern Uttar Pradesh, India. International Journal of Current Microbiology and Applied Sciences ISSN: 2319-7692 Special Issue-7 pp. 307-318

Comparative values of different cost per hectare occupied in cultivation of various pulses is presented in table. g. It is revealed that the per hectare total cost was maximum of Pea Rs. 36115.08 followed by Gram Rs. 33431.35 and Pigeonpea Rs. 28794.27.used show that cost of human labour was maximum in pea production followed by Gram and Pigeonpea corresponded to 28.98, 23.34 and 18.04 per cent respectively. Amount pad for per hectare machinery charges and costs of seeds were also found of same trend per hectare cost of fertilizer was highest on Arhar followed by pea and gram which account for 10.84, 7.50 and 7.26 percent of total cost respectively.

Ratio of input-output was found highest in respect of pigeonpea (1:3.01) followed by Gram 1:2.26 and pea (1:1.44). It is revealed from the table that per hectare gross income received from Arhar was highest i.e. Rs. 87499.68 followed by Gram (Rs.75843.67) and Pea (Rs. 52098.96) Net returns were also found of same trend

It is concluded from the table that cultivation of pigeonpea was more economic as compared to gram and pea due to comparatively low cost of production and higher level of income per hectare.

The importance of pulses can be judges from the fact that majority of Indian population is vegetarian. Pulses are the main source of cheap protein and an important ingredient of vegetarian diet of Indian population. Since both food and nutritional security are important requirement, thus special efforts on intensification of production and supply of pulses are necessary. Pulse crop provide the sustainability to crop production system by enriching the soil through biological nitrogen fixation and their varied uses as feed and fodder. These crops also fit in the various cropping system without disturbing the main cereals crops.

India is the largest producer, importer and consumers of pulses in the world accounting for 25 per cent of the global production, 15 per cent trade, and 27 per cent of consumption during the present economic days farmers are interested to esquire maximum profit from minimum costs which can be managed by increasing the area under pulses

Tabular and function analysis were applied to draw the inferences and presentation of the results. Similar trend was also recorded in case of per hectare investment. Per hectare total cost of cultivation and gross income of gram were Rs. 33431.35 and Rs. 75843.67 and Rs. 36115.08 and Rs. 52098.96 in pea, likewise it was Rs. 28794.27 and 87499.68 in case of arhar respectively.

Output input ratio were found to 1:2.26, 1:1.44 and 1:3.01 in case of gram, pea and arhar respectively. It may be concluded that among three pulses under study arhar was most profitable followed by gram and pea. Finally it is concluded that pulse is an unavailable important ingredient of human diet with the points of view of food and nutritional security of poor vegetarian population of the country. Along with the time population increases and availability of per capita land is decreases which ultimately created the situation of increasing the cultivated area under food grain and reduction in the area of pulses.

S.NO	PARTICULARS	COST (Rs/ha)
1	Young teak plants (@15/-)	37,500
2	Plant replacement (20 percent mortality)	1,875
3	Labour cost (Land preparation, planting, weeding, pitting, soil working etc)	80,600
4	Manures and fertilizers	18,400
5	Herbicides and pesticides	15,200
6	Irrigation	18,000
7	Contingency	14,800
	TOTAL COST	1,86,375

S.NO	AGE (Yrs)	PARTICULARS	INCOME (Rs.)
1	7-8	Trees felled for poles @Rs.250	2,50,000
2	13-14	Trees felled for poles @Rs.475	2,96,875
3	20	Trees felled for heartwood @Rs.4000	12,00,000
4	30	Trees felled for heartwood @Rs.12,000	18,00,000

Cost of cultivation of Tomato

PARTICULARS	COST (Rs.)
Crop	Tomato
Field preparation	6000
Nursery and planting	7000
Weeding	10000
Plant protection	12000
Fertilizers	8000
Wages	13000
Transport and other expenses	5000
Total	61,000

Cost and Benefits

PARTICULARS	COST (Rs.)
Crop	Tomato
Cost of cultivation	61,000
Yield (MT/ha)	50
Net income (Rs.) at the lowest price	39,000 @Rs.2/kg
Market price range	2-30/kg

Source: tnauagritechportal
NPV is positive
BCR is more than 1
IRR is greater than the bankable interest rate
All these criteria meet out the economic needs for the implementation of the project. Hence the Agroforestry Project is feasible.

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