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PERFORMANCE ANALYSIS AND ECONOMICS OF CORIANDER (*CORIANDRUM SATIVUM* L.) CULTIVATION UNDER SUBABUL (*LEUCAENA LEUCOCEPHALA*) BASED ALLEY CROPPING SYSTEM

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Abstract

Present study was conducted to estimate the effect of different organic manure level on yield and cultivation of coriander (*Coriandrum sativum* L.) under subabul (*Leucaena leucocephala*) based alley cropping system. Experiment was conducted under four to five years old existing alley cropping system of Subabul (*Leucaena leucocephala*) using Randomized Block Design (RBD) with three replications and 8 treatments. The treatments used under experimentation are (T_1) 100% RDF through Vermicompost (5t ha^{-1}), (T_2) 100% RDF throw Neem Cake (2.5t ha^{-1}), (T_3) 100% RDF throw FYM (12t ha^{-1}), (T_4) 50% RDF through Vermicompost + 50% RDF Neem cake, (T_5) 50% RDF through Neem cake + 50% RDF FYM, (T_6) 50% RDF through Vermicompost + 50% RDF FYM, (T_7) 50% RDF through Vermicompost + 25% RDF Neem cake +25% RDF FYM and (T_0) control. Findings revealed that the treatment (T_7) 50% RDF through Vermicompost + 25% RDF Neem cake +25% RDF FYM emerged superior in respected of growth attributes as well as yield of coriander and gave maximum seed yield (19.76 q ha^{-1}) followed by treatment (T_4) 50% RDF through Vermicompost + 50% RDF Neem cake, with seed yield (16.06 q ha^{-1}) while minimum was recorded in control. As far as economic concern, maximum C:B ratio T_7 (1: 2.38) and Net Return T_7 (Rs. 45,802/-) was found. Therefore, asystematic coriander cropping with sufficient management practices will be more beneficial for livelihood on a sustainable basis.

Key words : *Coriander, economics, Cost of cultivation, Neem cake, Vermicompost, FYM, Subabul, Yield & Alley cropping.*

Introduction

In agroforestry system, there are different components and interaction between ecological and economic factors. In other words, agroforestry is combination of agricultural technology and foresting in order to complete, variety, productivity, health and sustainability of land (Shamekhi, 2007). In all agroforestry systems only exist three main groups *viz.* woody cover (trees and shrubs), Herbaceous plants (crops) and livestock which are managed by human, There are some reasons that justify agroforestry system are: reduction of forests in the country, increase of population and need to foods, reduction of pastures and increase of cattle grazing, need to crops and forest product, prevent from destruction of forest and also optimum usage of the land (Swinkels *et al.*, 1996). Alley cropping is also known as hedgerow intercropping, it involves managing rows of closely planted (within row) woody plants with annual crops planted in alleys in between hedges. The primary purpose of alley cropping is to increase crop yields by improvement of the soils, micro climate and weed control. The Subabul leaves are highly nutritious for ruminants and excellent animal production data have been published confirming the fodder value of leucaena (Agarwal *et al.*, 2016). Leucaena can be used in cropping systems, parquet flooring and small furniture as well as for paper pulp. Leucaena poles are useful for posts, props and frames for various climbing crops (Brewbaker *et al.*, 1985). Leucaena is not tolerant of even light frosts which cause leaf to be shed (Isarasenee *et al.*, 1984).

Coriander (*Coriandrum sativum* L.) fruit is an annual herb and originating from the Mediterranean countries.

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Nowadays, it is mostly grown in Italy, India, Morocco and Eastern Europe and is commonly known as coriander, Cilantro, or Chinese parsley. India is the largest producer, consumer and exporter of coriander in the world. Area, production and productivity of coriander in India are 5.30 lac ha 4.82 lac million tones and 0.9 million tones ha^{-1} respectively *(*Anonymous, 2011*)*. Rajasthan (54%) and Madhya Pradesh (17%) are the two largest producing states in the country contributing over two-thirds to the 3 country's total production. In Chhattisgarh coriander covers an area of 4090 ha and production of coriander is about 1010 ton *(*Anonymous, 2011*)*. The demand of various medicinal, aromatic and spice crops is increasing in the national and international markets. The large deficit in the availability of quality material of these crops can be met only through their organized and scientific cultivation. The globular coriander fruit is brownish-yellow in colour with straight and curving ridges. The flavour resembles a mixture of caraway, cumin, sage and lemon peel. The aroma and taste are due to essential oil content which is used for flavouring baked goods, condiments, confectionaries, ice-cream mixes, chewing gums, alcoholic and non-alcoholic beverages (Rathee *et al.*, 2017)

In India, about 528,171 hectare area is under organic farming (certified and area under organic conversion) with 44,926 number of certified organic farms. This accounts for about 0.3% of total agricultural land (Ramesh *et al.*, 2010). The local existing resources are used mostly by the majority of small farmers in India. As such, in many marginal areas of India, organic farming is present not by choice but by the default. Vermicompost is the process of composting using various worms, are usually red wigglers, white worms and other earthworms to create a heterogeneous mixture of decomposing vegetable and food waste, bedding materials and vermicast. Neem cake is organic manure. It is the by-product obtained in the process of cold pressing of neem tree fruits or kernels, the solvent extraction process for neem oil cake also reduces alkalinity in soil. It produces organic acids on decomposition. Farm yard manure is prepared basically using cow dung, cow urine, waste straw and other dairy wastes. It is highly useful and rich in nutrients. A small portion of N is directly available to the plants while a larger portion is made available when the FYM decomposes. The mixture of cow dung and urine, a balanced nutrition is made available to the plants. Application of FYM also improves soil fertility up to great extent. The main objective of present study was to work out economics of coriander (*Coriandrum sativum* L.) on different Organic fertilizer doses under Subabul (*Leucaena leucocephala*) alley cropping system.

Materials and Methods

The field experiment was conducted at experimental field of forestry nursery College of Forestry, Department of Silviculture and Agroforestry, SHUATS, Prayagraj, India during the growing Rabi season of 2015- 2016. The soil characteristic of the experiment is shown in (Table 1). The experiment was conducted in fixed plot under Randomized Block Design (RBD) with 8 treatments and 3 replications. Treatments selected for study were (T_1) 100% RDF through VC (5t ha^{-1}), (T_2) 100% RDF throw NC (2.5t ha^{-1}), (T_3) 100% RDF throw FYM (12t ha^{-1}), (T_4) 50% RDF through VC + 50% RDF NC, (T_5) 50% RDF through NC + 50% RDF FYM, (T_6) 50% RDF through VC + 50% RDF FYM, (T_7) 50% RDF through VC + 25% RDF NC +25% RDF FYM and (T_0) control. The coriander were shown with spacing of 15 x 10 cm. Observations on different growth and yield parameters were recorded by randomly selected 5 plants and workout on hectare basis. The data obtained were analyzed statistically using ANOVA table. The means differences among the treatments were compared by least significant difference test (RBD) at 0.05 levels. Site Characteristics are depicted in table 1.

Results and Discussion

Economic

The economics regarding the cultivation of the crop calculated separately for different treatment on per hectare basis. The fixed cost of cultivation of crops, fertilizers used in different treatments, cost of seeds, cost of oil extraction, etc. were calculated separately for determine the economics of cultivation. The revenue generated from seed yield was also calculated for determine the cost of cultivation was Rs 43,863 under different organic fertilizers influence in term of cost of cultivation of crops (Rs 26,901) per hectare, cost of seeds, fertilizers used in different treatment and cost benefit ratio of each treatment was calculated and is showed in tables, 2a, 2b and 2c respectively.

Cost of cultivation (Rs.ha^{-1})

It was recorded that the highest cost of cultivation was noticed in T_1 (VC) with Rs.34, 905 followed by T_6 (50% VC + 50% FYM) with 34, 253 and lowest cost of cultivation is noticed in T_0 (control) with Rs.26, 901.

Gross return (Rs.ha^{-1})

It was recorded that the highest gross return was noticed in T_7(50% VM + 25% NM + 25% FYM) with Rs.79, 040 followed by T_4 (50% VC + 50% NM) with

Table 1: Soil characteristics of the Experimental site.

Sand(%)	Silt(%)	Clay(%)	Textural Class	Organic carbon (%)	Nitrogen N) kg ha^{-1}	Phosphorus (P) kg ha^{-1}	Potassium (K) kg ha^{-1}	Soil pH	EC (dSm^{-1})
58	24	18	Sandy Loam	0.45	221	22.5	358	7.8	0.48

Table 2 (a): Growth and yield.
Cost of cultivation (fixed cost Rs. ha^{-1}) for Coriander (*Coriandrum sativum* L.) under Subabul (*Leucaena leucocephala*) based alley cropping system.

Sl. No.	Particulars	Unit	Qty.	Rate/Unit (Rs.)	Cost (Rs. / ha)
A.	**Land Preparation**				
1	Ploughing	Hours	3	400	1,200
2	Layout of the field	Labour	4	250	1,000
B.	**Seed**				
1	Cost of seeds	kg	20	100	2,000
C.	**Fertilizer application**				
1	Labour for seed sowing and fertilizer application	Labour	6	250	1,500
D.	**Irrigation**				
1	Tubewell Charges	Irrigation	4	300	1,200
2	2 Labours per irrigation	Labour	8	250	2,000
E.	**Inter-culture**				
1	Thinning and Gap Filling	Labour	2	200	400
2	2 Hand Weeding (2 labours/weeding)	Labour	4	250	1,000
F.	**Harvesting and Threshing**				
	Labour for harvesting and threshing	Labour	10	250	2,500
G	**Rental value of land**	Months	4	600	2,400
H.	**Interest on Fixed Capital @ 8.4% p.a.**	Months	4		426
	Sub - cost (A)				15,626
I.	**Supervision charges**	Months	4	2500	10,000
J.	**Land Revenue**				275
K.	**Family Labour Charges - 4 Labours**		4	250	1,000
	Total sub- cost (Rs. ha^{-1}) (B)				26,901

Table 2 (b): Variable cost and total cost of cultivation Variable cost and total cost of cultivation for different treatments for Coriander (*Coranndram sativum* L.) under Subabul (*Leucaena leucocephala*) based alley cropping system.

Treatment No.	Treatment	Vermicompost			Neem Cake			Farmyard Manure			Total variable cost	Interest on variable cost for 4 months	Cost* (B)	Total cost* (C)
		Qty. t ha^{-1}	Rate Rs t^{-1}	Amt. Rs.	Qty. t ha^{-1}	Rate Rs t^{-1}	Amt. Rs.	Qty. t ha^{-1}	Rate Rs t^{-1}	Amt. Rs.	Rs.	Rs ha^{-1}	Rs/ ha	Rs/ ha
T_0	Control										0	0	26,901	26,901
T_1	Vermicompost (VC)	5.00	1500	7500							7500	504	26,901	34,905
T_2	Neem Cake (NC)				2.50	1000	2500				2500	140	26,901	29,541
T_3	Farmyard Manure (FYM)							12.00	500	6000	6000	700	26,901	33,601
T_4	50% VC + 50% NC	2.50	1500	3750	1.25	1000	1250				5000	322	26,901	32,223
T_5	50% NC + 50% FYM				1.25	1000	1250	6.00	500	3000	4250	420	26,901	31,571
T_6	50% VC + 50% FYM	2.50	1500	3750				6.00	500	3000	6750	602	26,901	34,253
T_7	50% VC + 25% NC + 25% FYM	2.50	1500	3750	0.63	1000	625	3.00	500	1500	875	462	26,901	33,238

Table 2 (c): Economics Economics of different treatments for cultivation of Coriander (*Coriandrum sativum* L.) under Subabul (*Leucaena leucocephala*) based alley cropping system.

Treatment No.	Treatments	Cost of cultivation	Seed Yield	Sale Rate	Gross Return	Net Return	Cost : Benefit
		Rs. ha^{-1}	q ha^{-1}	Rs. q^{-1}	Rs. ha^{-1}	Rs. ha^{-1}	Ratio
T_0	Control	26,901	5.76	4,000	23,053	-3,847	1 :0.86
T_1	Vermicompost (VC)	34,905	9.26	4,000	37,050	2,145	1 :1.07
T_2	Neem Cake (NC)	29,541	10.09	4,000	40,343	10,802	1 :1.37
T_3	Farmyard Manure (FYM)	33,601	8.85	4,000	35,403	1,802	1 :1.06
T_4	50% VC + 50% NC	32,223	16.06	4,000	64,220	31,997	1 :1.99
T_5	50% NC + 50% FYM	31,571	13.17	4,000	52,693	21,122	1 :1.67
T_6	50% VC + 50% FYM	34,253	10.60	4,000	42,402	8,149	1 :1.24
T_7	50% VC + 25% NC + 25% FYM	33,238	19.76	4,000	79,040	45,802	1 :2.38

64, 220 and lowest gross return is noticed in T_0 (control) with Rs.23, 053.

Net returns (Rs.ha^{-1})

It was recorded that the highest net return was noticed in T_7(50% VM + 25% NM + 25% FYM) with Rs.45, 802 followed by T_4 (50% VC + 50% NM) with 31, 997 and lowest net return is noticed in T_0 (control) with Rs.-3, 847.

Cost benefit ratio

It was recorded that the highest cost benefit ratio was noticed in T_7(50% VM + 25% NM + 25% FYM) with 1: 2.38 followed by T_4 (50% VC + 50% NM) with 1: 1.99 and lowest cost benefit ratio is noticed in T_1 (VC) with.1: 0.86.

Discussion

The purpose of present study is to analyse result of the coriander in agroforestry systems, most with roots deep in the past, in order to try and identify the economic considerations that have caused farmers to adopt them. This is advocated by analysing the limited number of situations covered under the above studies. Nevertheless, the information outlined above, the main elements of which are summarized in above tables does suggest some of the main economic factors which encourage farmers to adopt tree/crop/livestock management as amajor component of their overall farming system. In most of the situations, farmers lacked access to capital and consequently were unable to increase their land or labour resources by renting or purchasing. In many instances, farmer decisions were clearly also influenced by considerations of risk management.

Therefore under the local environmental conditions in which the study was conducted, It was recorded that the highest cost of cultivation was noticed in T_1 (VC) with Rs.34, 905 followed by T_6 (50% VC + 50% FYM) with Rs. 34, 253 and lowest cost of cultivation is noticed in T_0 (control) with Rs.26, 901. The benefit of FYM application was further depicted by higher B:C ratio of 1.83. Similar results were reported by Verma *et al.*, (2015) in coriander; Khiriya & Singh (2003) in fenugreek.

Moreover, this might be due to addition of nutrients which improved the physical, chemical and biological properties of soil and this leads to improve the root growth and development. So, Subabul hereby uptake all the nutrients and water from soil volume, in contrast the result of coriander shows good yield. Subabul based alley cropping system is much more beneficial than other. Owing to very little risks and high economical profits in Subabul cultivation, 1arge farmers and absentee land-lords prefer to put their lands under Subabul based agroforestry rather than other agroforestry options.

Conclusion

Finding of the above experiment concluded that, among eight treatment combination, treatment T_7 (50% RDF VC + 25% RDF NC + 25% RDF FYM)was found to be the most suitable in terms of seed yield (19.76 q per ha), cost benefit ration and other aspects. Therefore application of VC, NC and FYM in the above recommended dose will be emerged best in terms of higher return as well as other benefits and recommended for cultivation of coriander in Prayagraj climatic condition.

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