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ORIGINAL ARTICLE **OPEN ACCESS**

Analysis of the Financial Returns of Different Spices Grown Under Teak Based Agri-Silviculture System

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ABSTRACT
The Present study was conducted to estimate the economic return cultivation of spices under teak based agri-silviculture system. Experiment was conducted in 17 years old existing teak based agri-silviculture system using Randomized Block Design (RBD) with three replications and 8 treatments. The treatments used under experimentation are (C_1) Fennel, (C_2) Ajowain, (C_3) Coriander, (C_4) Fenugreek, (C_5) Mentha, (C_6) Kalonji, (C_7) Chilli, (C_8) Cumin As far as economic concern, maximum C:B ratio Chilli (1: 3.08) and Net Return C_7 (Rs. 1,66,501.82/-) was found. Therefore, a systematic Spices cropping with sufficient management practices will be more beneficial for livelihood on a sustainable basis.
Key words: *Spices Crop, economics, Cost of cultivation, Net Return, Teak, Yield & Agri-silviculture.*

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INTRODUCTION

The current trend of production strategy is simply to grow more than one crop including a perennial wood species simultaneously in order to maximize the productivity and income of a unit area. Therefore, it is necessary to evaluate the performance of an annual agricultural crop before going to undertake a joint production system, which is commonly known as agroforestry [13].

Agroforestry is an approach that integrates trees into farming systems, and allows for the production of trees and crops or livestock from the same piece of land in order to obtain economic, environmental, ecological, and cultural benefits [11]. Diversification of existing farming systems by developing suitable agroforestry models seems to be the need of the day to supply ever increasing demand for diversified products.

Agroforestry offers a viable option for large scale agricultural diversification and environmental amelioration. The increasing population and rapid industrialization has more pressure on the natural forests for timber and other related wood products. Therefore, to save forests and meet the growing demands of wood, there is urgent need for large scale plantations of fast growing tree species outside the natural forests to make country self-sufficient in its timber requirements. Fast growing tree species like poplar, eucalypts, leucaena, casuarina, willow, etc. have gained popularity due to their higher productivity and suitability. On-farm tree plantations can also benefit farmers along with the global environmental facilities like carbon trading [9]; [2].

Traditional agro-forestry system had its origins in developing nations where high population densities coupled with scarce land resources have required that concurrent food and wood production may be produced on the same land base with little compromise on principal of sustainability. Tree- based inter-cropping systems can result in more diversified economies for both short- and long-term products and provide a market for both agriculture and forest crops. Inter-cropping systems can also play a vital role in sequestering carbon below- and above-ground plant components and critical societal concerns about global climate change [11]; [5]. These potential benefits of tree based inter-cropping systems will minimize competitive interactions between non-woody (annual agricultural crop) and woody (tree) components while exploiting beneficial interactions between these components. These interactions will provide a scientific basis for both improvement and adoption of tree- based inter-cropping systems.

Agroforestry helps in improving the economy of the farmers, besides taking care of the natural resources (soil, water and air). All components in agroforestry system depends on the same reserve of growth resources such as light, water and nutrients and hence there will be influence of one component of a system on the performance of the other components as well as of the system as a whole [3]. Agroforestry provides a way to remove the unsuitable land from crop production over extended period as the trees mature. It also provides social benefits by functioning as a protective system that ensures resource conservation, though, some of these are not directly measurable [8].

Agroforestry offers not only a sustained productivity, but also its sustainability over the longer period. It buffers against the climate change through its unique way of amelioration of microclimate and reshapes the agro-ecosystem with enhanced stability and resilience. Global warming and associated problems of climate change have pressed the need for land use system that are more dependable in production and more sustainable in terms of resource conservation to ensure food security [6]; [10]. The theme of agroforestry oriented around sustainability in terms of economics, environmental and resource conservation and social issues like food security, health and safety [9]. The current interest in agroforestry in India has transformed the land-use system in terms of economic sustainability.

Spices are integral part of human daily life, especially in Indian society; in tradition, food, aroma, health and economy and every positive development in spices improves the quality of life world over. India is the largest producer of spices with an annual production of 6.1 million MT during 2014-15 from an area of 3.3 million hectares. Black pepper, ginger, turmeric, cardamom and tree spices such as nutmeg, cinnamon, garcinia and tamarind are the tropical spices of importance in Indian context. Coriander, cumin, fennel and fenugreek are important seed spices and mint is an herbal spice of importance. Garcinia, black cumin, ajowain, saffron, mint, oregano, lavender, star anise are considered as future crops among the spices. India has been a traditional producer, consumer and exporter of spices in the world and almost all states in the country produce one or the other spices. After a domestic consumption of more than 70% of the spices produced, India still remains as the largest exporter of spices in all its forms; raw, ground and processed and as active ingredient isolates. India contributes 48% of the total world trade in quantity and 43% of the value.

Spices are mainly used as stomachic and good source of vitamins, minerals, amino acids and alkaloids. A major cause of dietary deficiency and food insecurity is the decreasing diversity of diets which results in increasing incidence of diseases, poor health and reduction in life span. However, there is a growing awareness by the public to use spices to control disease. Spices also have a prominent place in ensuring rural development, self-sufficiency, food security and ultimately human development.

The spices constitute an important group of agricultural commodities and play a significant role in our national economy. The seed spices possess industrial importance and are used in cosmetics, perfumery and pharmaceutical preparations. The export of seed spices annually is to the tune of about 83550 tonnes against requirement of 1, 55, 000 tonnes in the world market. The export can be increased if in addition to major seed spices crops (coriander, fennel, cumin, and fenugreek), the minor seed spices crops (Ajowain, dill, celery, nigella, anise) are also given importance [7].

MATEREALS AND METHODS

Present investigation is carried out for analyzing the economic return of different spices crop under poplar based Agri-silviculture system in Prayagraj district Uttar Pradesh. Research conducted atForest research Nursery of College of Forestry, SHUATS,during Rabi season. Experimental area(Fig 1) is situated at an elevation of 78 meters above mean sea level at 28.87^{o}N latitude and 81.15^{o}E Longitude and has tropical to sub-tropical climate with extremes of summer and winter. During the winter months especially December and January, temperature drops down to as low as 5^{o}C while in the summer temperature reaches above 45^{o}C, hot scorching winds are a regular feature during the summer whereas there may be an occasional spell of frost during the winter. The annual rainfall is 1100mm mostly during July to September, with a few occasional showers during the winter months. Eight different spices crops viz. Fennal, Ajowian, Coriander, Fenugreek, Mentha, Kalonji, Chilli and Cumin were selected as study material because of their medicinal and commercial value.

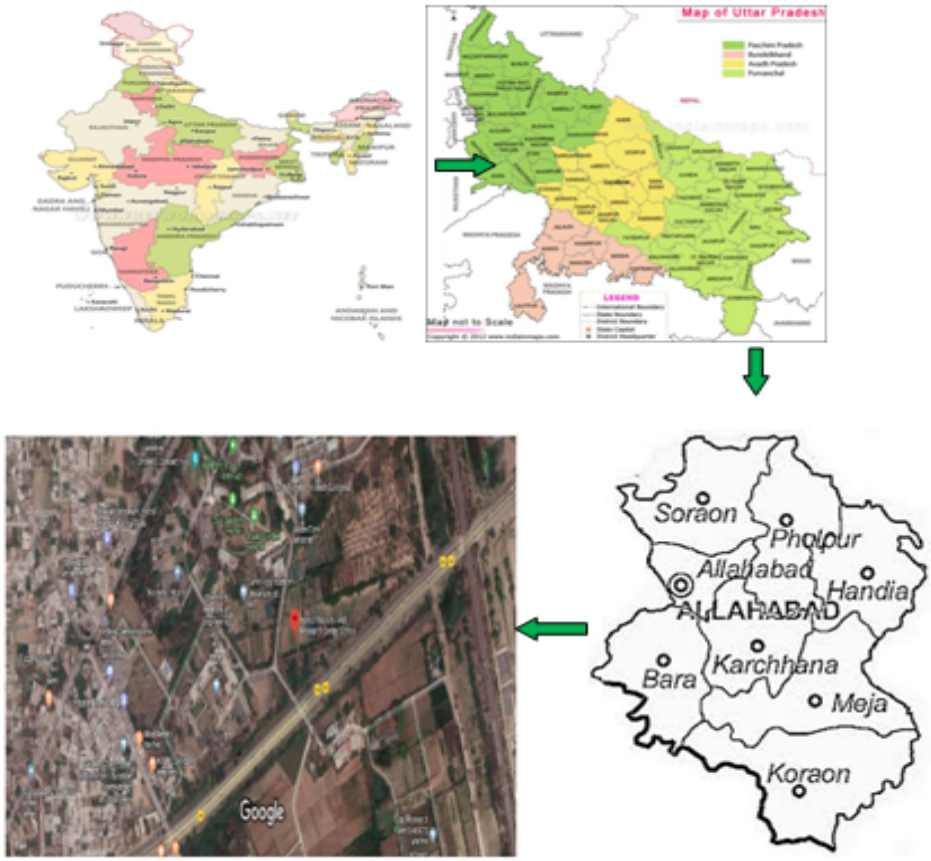

Fig1: Location map of the research site

RESULTS AND DISCUSSION

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 of different spices was also calculated for determine the cost of cultivation under teak. The financial return of different treatment and cost benefit ratio was calculated and is showed in tables, 1 and 2 respectively and discussed in the light of the findings reported by the earlier researchers.

Cost of cultivation (Rs.ha-1)

It was recorded that the highest cost of cultivation was noticed in Kalonji with Rs.55,410.43/- and Cumin 55,410.43/- followed by Mentha with 54,389.37/- and lowest cost of cultivation is noticed in Fenugreek with Rs.51,622.67.

Data presented in Table2 on the economic analysis of different spices under Teak based agri-silviculture system shows that both net returns and benefit cost ratio were higher with Chilli. The higher net returns and benefit cost ratio realized due to higher returns. The lowest net returns and benefit cost ratio was found for Cumin.

Gross return (Rs.ha-1)

It was recorded that the highest gross return wasnoticed in Chilli withRs.2,20,640/- followed by Fennel with1,10,200/- and lowest gross return is noticed in Cumin with Rs.53,500/-.

Net returns (Rs.ha-1)

It was recorded that the highest net return wasnoticed in Chilli withRs.1,66,501.82/- followed by Fennel with57,487.53/- and lowest net return is noticed in Cumin with Rs.-1,910.43.

Cost Benefit ratio

It was recorded that the highest cost benefit ratiowas noticed in Chilli with 1:3.08 followed by Fennel with1:1.09and lowest cost benefit ratio is noticed in Cumin with.1:-0.03.

Table 1: Variable cost and total cost of cultivation for different spices crop under Teak based Agri - Silviculture System.

C*2		Rs ha^{-1}	52,712.47	51,931.84	52,002.72	51,622.67	54,389.37	55,410.43	54,138.18	55,410.43
Total cost (C)		Rs ha^{-1}	47,920.43	47,210.76	47,275.20	46,929.70	49,444.88	50,373.12	49,216.53	50,373.12
Cost (A)		Rs ha^{-1}	44950	44950	44950	44950	44950	44950	44950	44950
Interest (Rs.) on var. cost for 4 months @ 11.2%			919.03	699.46	719.40	612.50	1390.68	1677.87	1320.03	1677.87
Total var. cost (B)		Rs ha^{-1}	2051.40	1561.30	1605.80	1367.20	3104.20	3745.25	2946.50	3745.25
K	Amt.	Rs.	309.90	103.30	361.55	413.20	413.20	516.50	516.50	516.50
	Rate	Rs kg^{-1}	10.33	10.33	10.33	10.33	10.33	10.33	10.33	10.33
	Qty.	kg ha^{-1}	30	10	35	40	40	50	50	50
P	Amt.	Rs.	1350	675	787.50	562.50	1125	2250	1125	2250
	Rate	Rs kg^{-1}	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
	Qty.	kg ha^{-1}	60	30	35	25	50	100	50	100
N	Amt.	Rs.	391.5	783	456.7	391.5	1566	978.7	1305	978.7
	Rate	Rs kg^{-1}	13.05	13.05	13.05	13.05	13.05	13.05	13.05	13.05
	Qty.	kg ha^{-1}	30	60	35	30	120	75	100	75
Treatment			**Fennel**	**Ajowain**	**Coriander**	**Fenugreek**	**Mentha**	**Kalonji**	**Chilli**	**Cumin**

Table 2: Economics of different treatments and benefit cost ratio of (Pooled - Teak based agroforestry system).

Crop	Yield	Selling Rate	Cost of cultivation	Gross return	Net return	Cost benefit ratio
	q/ ha	Rs./ q	Rs. /ha	Rs. /ha	Rs. /ha	
Fennel	5.80	19,000	52,712.47	1,10,200	57,487.53	1:1.09
Ajowain	5.16	20,000	51,931.84	1,03,200	51,268.16	1:0.99
Coriander	4.46	13,000	52,002.72	57,980	5,977.28	1:0.11
Fenugreek	5.22	20,000	51,622.67	1,04,400	52,777.33	1:1.02
Mentha	50.48	2,000	54,389.37	1,00,960	46,570.63	1:0.86
Kalonji	2.42	23,500	55,410.43	55,660	249.57	1:0.03
Chilli	31.52	7,000	54,138.18	2,20,640	1,66,501.82	1:3.08
Cumin	2.14	25,000	55,410.43	53,500	-1,910.43	1:-0.03

DISCUSSION

The purpose of present study is to analyse result of the spices in agri-silviculture systems, most with roots deep in the past, in order to try and find the economic considerations that have produced farmers to implement them. This is advocated by analysing the limited number of conditions covered under the above studies. Nevertheless, the information outlined above, the main basics 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 a major 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 situations in which the study was conducted, It was recorded that the highest cost of cultivation was noticed in Kalonji with Rs.55,410.43 and Cumin 55,410.43/- followed by Mentha with 54,389.37/- and lowest cost of cultivation is noticed in Fenugreek with Rs. 51,622.67. The benefit of spices crop combinations was further depicted by higher C:B ratio of 3.08. Similar results were reported by [12] in coriander; [4]; [1].

CONCLUSION

Finding of the above experiment concluded that, among eight crop combination, Menthawas found to be the most suitable in terms of seed yield (50.48q per ha), cost benefit ration and other aspects. Therefore combination in the above will be emerged best in terms of higher return as well as other benefits and recommended for cultivation of spices in Prayagraj climatic condition.

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