Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 9[11] October 2020 : 23-27

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.876
Universal Impact Factor 0.9804
NAAS Rating 4.95

ORIGINAL ARTICLE **OPEN ACCESS**

Analysis of the Economic Returns of Different Spices Grown Under Poplar Based Agri-Silviculture System

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ABSTRACT
The Present study was conducted to estimate the economic return cultivation of spices under poplar based alley cropping system. Experiment was conducted under 15 years old existing poplar based agri-silviculture system using Randomized BlockDesign (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, and (C_8) Cumin As far as economic concern, maximum C:B ratio Chilli (1:4.28) and Net Return Chilli (Rs. 2,31,601.82/-) was found. Therefore, a systematic spices cropping with sufficient management practices will be more beneficial for livelihood on a sustainable basis.
Key words: *Spices, Economics, Cost of cultivation, Poplar, Net return, Yield &Agri-silviculture.*

Received 22.07.2020 Revised 11.09.2020 Accepted 03.10.2020

INTRODUCTION

Over the past two decades, a number of studies have been carried out analyzing the viability of agroforestry. The combined research has highlighted that agroforestry can reap substantial benefits both economically and environmentally, producing more output and proving to be more sustainable than forestry or agricultural monocultures. Agroforestry systems have already been adopted in many parts of the world.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 [10]; [14]; [15]; [7]; [16]. 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 [17]. This diversification of the farming system initiates an agro ecological succession, like that in natural ecosystems, and so starts a chain of events that enhance the functionality and sustainability of the farming system. Trees also produce a wide range of useful and marketable products from fruits/nuts, medicines, wood products, etc.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 [13]; [3].With shade applications, crops are purposely raised under tree canopies within the shady environment. The understory crops are shade tolerant or the overstory trees have fairly open canopies. A conspicuous example is shade-grown coffee. This practice reduces weeding costs and improves coffee quality and taste.

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 [17]; [6]. 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.The aim of agroforestry oriented around sustainability in terms of economics, environmental and resource conservation and social issues like food security, health and safety [13]. The current interest in agroforestry in India has transformed the land-use system in terms of economic sustainability. Agroforestry helps in improving the economy of the farmers, besides taking care of the natural resources (soil, water and air). All component 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 [4]. 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 [11].

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. 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. 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 export of seed spices annually is to the tune of about 83550 tons against requirement of 1, 55, 000 tons 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 [8].

MATEREAL 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 at Forest 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. Fennel,Ajowain, Coriander, Fenugreek, Mentha, Kalonji, Chilli and Cumin were selected as study material because of their medicinal and commercial value.

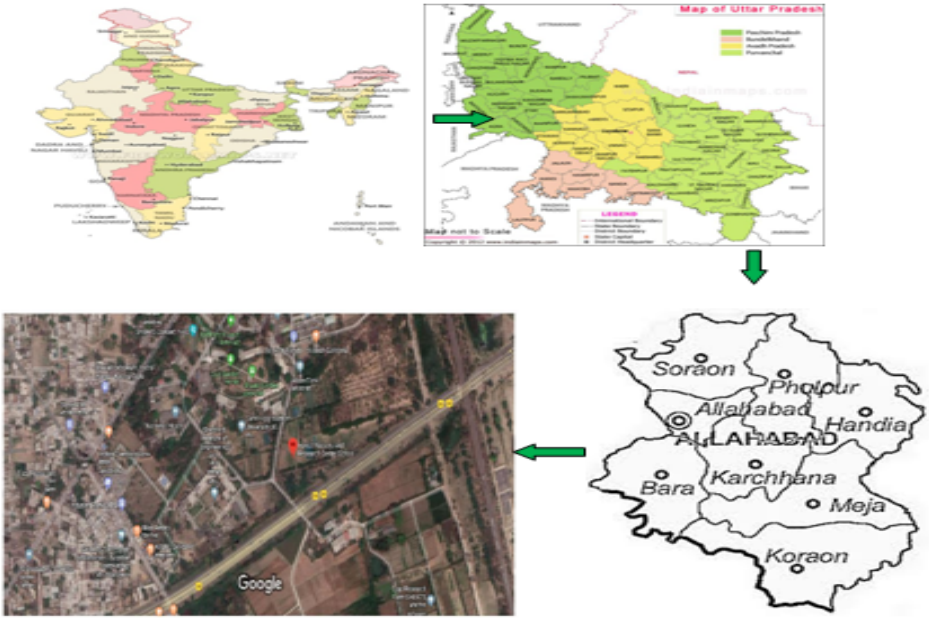

Fig1: Location map of the research site

RESULTS AND DISCUSSION

The economics regarding the cultivation of the crop calculated separately for different treatment on perhectare 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 poplar.The financial return of different treatment and cost benefit ratio was calculated and is showed intables, 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.

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

Treatment	N			P			K			Total var. cost (B)	Interest (Rs.) on var. cost for 4 months @ 11.2%	Cost (A)	Total cost (C)	C^{x2}
	Qty.	Rate	Amt.	Qty.	Rate	Amt.	Qty.	Rate	Amt.					
	kg ha^{-1}	Rs kg^{-1}	Rs.	kg ha^{-1}	Rs kg^{-1}	Rs.	kg ha^{-1}	Rs kg^{-1}	Rs.	Rs ha^{-1}	Rs ha^{-1}	Rs ha^{-1}	Rs ha^{-1}	Rs ha^{-1}
Fennel	30	13.05	391.5	60	22.5	1350	30	10.33	309.90	2051.40	919.03	44950	47,920.43	52,712.47
Ajowain	60	13.05	783	30	22.5	675	10	10.33	103.30	1561.30	699.46	44950	47,210.76	51,931.84

Coriander	35	13.05	456.7	35	22.5	787.50	35	10.33	361.55	1605.80	719.40	44950	47,275.20	52,002.72
Fenugreek	30	13.05	391.5	25	22.5	562.50	40	10.33	413.20	1367.20	612.50	44950	46,929.70	51,622.67
Mentha	120	13.05	1566	50	22.5	1125	40	10.33	413.20	3104.20	1390.68	44950	49,444.88	54,389.37
Kalonji	75	13.05	978.7	100	22.5	2250	50	10.33	516.50	3745.25	1677.87	44950	50,373.12	55,410.43
Chilli	100	13.05	1305	50	22.5	1125	50	10.33	516.50	2946.50	1320.03	44950	49,216.53	54,138.18
Cumin	75	13.05	978.7	100	22.5	2250	50	10.33	516.50	3745.25	1677.87	44950	50,373.12	55,410.43

Cost benefit ratio of different spices crops (Pooled- Poplar based Agri-silviculture system)

Data presented in Table2 on the economic analysis of different spices under Poplar based agri-silviculture system; it was observed that both net returns and cost benefit ratio were higher with Chilli during both years. The higher net returns and benefit cost ratio realized were due to higher returns viz., different spices with the crop combination. The lowest net returns and benefit cost ratio was found with Cumin. Among all other crop combinations maximum net returns of Rs. 2,31,601.82/-ha^{-1} in both years was observed in Chilli. The same crop combination also gave the maximum Cost benefit ratio of 4.28 pooled. Therefore, the benefit from rupee per unit invested was maximum and hence economically feasible.

Table 2: Economics of different treatments and benefit cost ratio of (Pooled- Poplar based Agri-silviculture system).

Treatment	Yield	Selling Rate	Cost of cultivation	Gross return	Net return	Cost Benefit ratio
	q/ ha	Rs./ q	Rs. /ha	Rs. /ha	Rs. /ha	
Fennel	7.55	19,000	52,712.47	1,43,450	90,737.53	1:1.72
Ajowain	6.77	20,000	51,931.84	1,35,400	83,468.16	1:1.61
Coriander	5.95	13,000	52,002.72	77,350	25,347.28	1:0.49
Fenugreek	8.56	20,000	51,622.67	1,71,200	1,19,577.33	1:2.32
Mentha	58.93	2,000	54,389.37	1,17,860	63,470.63	1:1.17
Kalonji	3.16	23,500	55,410.43	72,680	17,269.57	1:0.34
Chilli	40.82	7,000	54,138.18	2,85,740	2,31,601.82	1:4.28
Cumin	2.26	25,000	55,410.43	56,500	1,089.57	1:0.02

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 [18] in coriander; [5]; [1].

CONCLUSION

Finding of the above experiment concluded that, among eight crop combination, Mentha was found to be the most suitable in terms of seed yield (58.93q 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.

ACKNOWLEDGEMENT

The author is highly thankful to College of Forestry, SHUATS, Prayagraj, ICAR- Indian Agricultural Statistics Research Institute, Pusa, New Delhi and FRC-ER, Prayagraj for providing basic facilities and technical support during course of investigation as well as anonymous reviewer to improve the quality of this manuscript.

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CITATION OF THIS ARTICLE

Y K Agarwal and Ramchnadra. Analysis of the Economic Returns of Different Spices Grown Under Poplar Based Agri-Silviculture System. Bull. Env. Pharmacol. Life Sci., Vol 9[11] October 2020 : 23-27