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COMPARATIVE ECONOMICS OF TRADITIONAL SEED PRODUCTION VIS-À-VIS MULCH CROPPING GEOMETRY-BASED SEED PRODUCTION IN HILLY AREAS : A REVIEW

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Introduction

Seed is a critical, essential, and fundamental component for continued growth in crop production and productivity. Quality seed production is a skillful practice. General crop produce saved for seed can't be substituted by higher seed, as farm-saved seed typically sacrifices genetic vigor and poor germination (Pal *et al*., 2016). A sustainable boost in crop production and productivity depends on both the introduction of new, improved variety, adequate and satisfactory availability of quality seed to farmers. It reported that perhaps the positive contribution of quality seed to global production alone is around 15-20 percent depending on the seed and can be boosted up to 40 percent with efficient allocation of other inputs. A top-quality seed not only increases productivity per unit area but also helps to achieve predictable crops without any admixtures required for reasonable market prices (Pal *et al*., 2019). For farmers creating an economic incentive is a leading factor in decisions to introduce or refuse a new technology.

Furthermore, production data costs will provide relevant information to growers, governments, and policymakers. It can advise on a broad spectrum of agricultural resource utilization concerns, manufacturing processes and materials, farming costs and financial conditions, and farm household well-being. Besides, an efficient production cost plan may advise the management tools and equipment used throughout the production process. It will also comment on the cost of producing agricultural commodities and farm household income status (Elias *et al*., 2017).

Radish (*Raphanus sativus* L.) is one of Cruciferae's most important root crops rises in tropical and temperate regions of the world and is presumably from Europe and Asia (Perveen, 2012).Based on environmental conditions, the radish categorized into two groups, ' Asian ' or ' Tropical ' and ' European ' or ' Temperate. Asian type produces roots and seeds in tropical and temperate climates. European forms grow roots under both climatic conditions, but only hills or temperate environment may develop their seeds. In India, radish is grown in one and other parts of the country, covering an area of 1,77,000 hectares and generating 25,40,000 MT of roots (Malik, 2016).Many researchers have produced substantial evidence that most of the mulches used in agricultural production, including organic or synthetic, are effective in reducing disease occurrence, reducing weed species, mitigate the effects of falling rainfall, maintaining soil temperature, and sustaining soil moisture (Rasal *et al*., 2017). The goal of this study was an economic analysis of radish seed production using various mulching and cropping geometry systems in India's Himachal Pradesh province.In this analysis, also important economic indicators total cost production gross return, net profit, cost-benefit ratio, and profitability were measured for productive management.

Material and Methods

The experiment conducted in the Khaltoo Experimental Farm, Seed Science Department, Dr. Y S Parmar Horticultural and Forestry University, Nauni, Himachal Pradesh at 1250 m (1250 m) above sea-level and Latitude 35, 50N (77, 80E) of the Himachal Pradesh Hill. The area has a semi-humid weather and is generally sub temperate with cold winters. The average yearly temperature is 23.5°C and 9.8°C. The average yearly rainfall is 213.6 mm. The soil structure of the experimental horizon is from loam to clay with a pH of 6.85-7.05. The crop bunch of radish was Japanese white. FYM and fertilizers used as per the vegetable crops practice package. Only true-to-type roots have been selected and also utilized as stecklings. Stecklings with crown intact have been replanted on leveled beds at an appropriate spacing in such a manner that top surface area of the shoulder of stecklings was in the level of soil surface. The plots irrigated without delay after the replanting of stecklings. The treatments included four separate mulches (M), M_1- no mulch, M_2- black plastic mulch, M_3- silver-black plastic mulch and M_4-Crop Residue mulch in the main compartment, three-column configurations with the same population (L) *viz*., The suggested one line (L_1) is 60 X 30 cm, two-line (75+ 45) X 30 cm (L_2) and a two-line (90+30) X 30 cm (L_3). In Split-Split Plot Model, the experiment has performed in 24 treatments (4x3x2). These treatments have been repeated three times in a 2.40 m x 1.5 m plot holding scale, 3.6 m^2. Observations recorded are seed yield per ha (q),

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Gross income, the total cost of cultivation, net returns, and cost-benefit ratio. The statistical analysis was carried out according to(Gomez and Gomez, 1984) and(Kaur & Mahal, 2017), respectively, for split-split plot design and complete completely randomized designs (factorial), according to the design of the experiment.

Results and Discussion

Economic comparison is essential to test the profitability and viability of any activity. Therefore, the economics of traditional seed production vis-à-vis mulching and cropping geometry-based seed production has calculated and compared to analyze the feasibility of mulching and cropping geometry-based seed production over traditional seed production. The present analysis on cost of cultivation was worked out on per hectare basis separately for mulching and cropping geometry-based seed production over traditional seed production of radish in hilly areas. The item-wise cost of cultivation of mulching and cropping geometry-based seed production over traditional seed production of radish has presented in Table-1.

Conclusion

The analysis showed that the total cost of cultivation in radish mulching and cropping geometry-based seed production was around 129992/- lower than traditional seed production 133992/-. Further, the gross return was about 512000/- in mulching and cropping geometry-based seed production than traditional seed production 211000/-. Net return estimated from $M_2L_2P_2$ seed production of radish was Rs. 382008/- per hectare while in case of $M_1L_1P_1$ seed production, it was Rs. 77008/-. The net return from radish seed production found encouraging; therefore, the area under seed production may increase for higher profitability and timely supply of quality seed to the farmers with a cost-benefit ratio of 1:2.94 in hilly areas using mulching and cropping geometry.

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Table:-1 Cost of cultivation of seed crop of radish as affected by different treatments.

A	**FIXED COSTS**	
A	***Cost of cultivation of 1 ha mother root production***	
1	Preparatory Tillage	
a	Two ploughing @Rs. 2000/ploughing	4000
b	Two planking @Rs. 400/planking	800
c	Preparation of beds/ridges and channels, 30 mandays@Rs. 160/day	4800
2	Seed and Sowing	
a	*Cost of 10Kg seed @Rs500/Kg	5000
b	Sowing cost, sixmandays@Rs. 160/day	960
C	FYM only(10t/ha) @Rs.100/q	10000
D	Carriage and application of FYM, 25mandays@Rs. 160/day	4000
3	Weeding followed by earthing up, 30 mandays@Rs. 160/day	4800
4	Three irrigations, i ncluding operational and labor charges@ Rs. 1000/irrigation	3000
5	Harvesting, selection, and preparation of steckling, 30 worker days @ 160/day	4800
	Total	42160
	One ha produces stecklings for 5 ha. Therefore, the cost of stecking for one hectare	8432
B	***Cost of cultivation of 1 -hectare seed crop***	
1	Preparatory Tillage	
a	Two ploughing @Rs. 2000/ploughing	4000
b	Two planking @Rs. 400/planking	800
c	Preparation of beds and channels, 25 mandays@Rs. 160/day	4000
2	Transplanting, 30 Mandays@ Rs. 160/day	4800
3	Three irrigations, including operational and labor charges@ Rs. 1000/irrigation	3000
4	Interculture operation/ Gap filling, 30 mandays@ Rs. 160/day	4800
5	Plant Protection	
	3 Pesticide spray	1200
	3 Sprays, six worker days @ Rs. 160/day	960
6	Harvesting, threshing and cleaning, 50 worker days @ Rs. 160/day	8000
7	Rental charges of land@ Rs. 30000/year	30000
8	Total	61560
	Total *(A + B)*	69992

Total variable cost for:

No mulch	=	64000
Black plastic mulch	=	60000
Silver-black plastic mulch	=	60000
Crop residue mulch	=	24000

***Cost of radish seeds - Rs.500/Kg**

B. Variable cost

	Inputs	
a)	**Cost of mulches**	
i)	No mulch	0.00
ii)	Black or Silver – Black plastic mulch (80 % coverage) @ Rs 6.5/m^2	52000.00
iii)	Layout and replanting of mulch 50 worker days @ Rs 160/manday	80000
vi)	Crop residue mulch (laying and lifting) 50 mandays @ Rs 160/manday	8000
b)	**Cultural operations**	
i)	No mulch replanting+ hoeing + earthing up + 3 weedings 400 mandays @ Rs 160/manday	64000
ii)	Black plastic mulch	0.00
iii)	Silver – Black plastic mulch	0.00
iv)	Crop residue mulch 2 weeding 150 mandays @ Rs 160/manday	24000

Cost cultivation of seed production for treatment combinations

Treatment combinations	Fixed cost (Rs/ha)	Variable cost (Rs/ha)	Total cost of cultivation (Rs/ha)
$M_1L_1P_1$	69992	64000	133992
$M_1L_1P_2$	69992	64000	133992
$M_1L_2P_1$	69992	64000	133992
$M_1L_2P_2$	69992	64000	133992
$M_1L_3P_1$	69992	64000	133992
$M_1L_3P_2$	69992	64000	133992
$M_2L_1P_1$	69992	60000	129992
$M_2L_1P_2$	69992	60000	129992
$M_2L_2P_1$	69992	60000	129992
$M_2L_2P_2$	69992	60000	129992
$M_2L_3P_1$	69992	60000	129992
$M_2L_3P_2$	69992	60000	129992
$M_3L_1P_1$	69992	60000	129992
$M_3L_1P_2$	69992	60000	129992
$M_3L_2P_1$	69992	60000	129992
$M_3L_2P_2$	69992	60000	129992
$M_3L_3P_1$	69992	60000	129992
$M_3L_3P_2$	69992	60000	129992
$M_4L_1P_1$	69992	24000	93992
$M_4L_1P_2$	69992	24000	93992
$M_4L_2P_1$	69992	24000	93992
$M_4L_2P_2$	69992	24000	93992
$M_4L_3P_1$	69992	24000	93992
$M_4L_3P_2$	69992	24000	93992

Effect of mulching, row layout, and plant layout (MxLxP) on benefit: cost ratio of Radish cv. Japanese White

Effect of mulching, row layout, and plant layout (MxLxP) on benefit: cost ratio of Radish cv. Japanese White

Particulars		Characters			
	Seed yield/ha (q)	Gross income	Total cost of cultivation (Rs/ha)	Net returns (Rs/ha)	Benefit: Cost Ratio
	Mulching x Row layout x Plant layout (M x L x P)				
$M_1L_1P_1$	4.22	211000	133992	77008	0.57:1
$M_1L_1P_2$	4.28	214000	133992	80008	0.60:1
$M_1L_2P_1$	4.70	235000	133992	101008	0.75:1
$M_1L_2P_2$	4.87	243500	133992	109508	0.82:1
$M_1L_3P_1$	4.45	222500	133992	88508	0.66:1
$M_1L_3P_2$	4.54	227000	133992	93008	0.69:1
$M_2L_1P_1$	8.42	421000	129992	291008	2.24:1
$M_2L_1P_2$	8.88	444000	129992	314008	2.42:1
$M_2L_2P_1$	9.95	497500	129992	367508	2.83:1
$M_2L_2P_2$	10.24	512000	129992	382008	2.94:1
$M_2L_3P_1$	9.23	461500	129992	331508	2.55:1
$M_2L_3P_2$	9.62	481000	129992	351008	2.70:1
$M_3L_1P_1$	6.25	312500	129992	182508	1.40:1
$M_3L_1P_2$	6.64	332000	129992	202008	1.55:1
$M_3L_2P_1$	7.82	391000	129992	261008	2.01:1
$M_3L_2P_2$	8.20	410000	129992	280008	2.15:1
$M_3L_3P_1$	7.12	356000	129992	226008	1.74:1
$M_3L_3P_2$	7.49	374500	129992	244508	1.88:1
$M_4L_1P_1$	5.11	255500	93992	161508	1.72:1
$M_4L_1P_2$	5.34	267000	93992	173008	1.84:1
$M_4L_2P_1$	5.95	297500	93992	203508	2.16:1
$M_4L_2P_2$	6.13	306500	93992	212508	2.26:1
$M_4L_3P_1$	5.49	274500	93992	180508	1.92:1
$M_4L_3P_2$	5.79	289500	93992	195508	2.08:1

M1 = No mulch, M2 = Black plastic mulch

M3 = Silver-black plastic mulch, M4 = Crop residue mulch

L1 = Single row 60 x 30 cm spacing, L2 = Double row (75+45) x30 cm spacing,

L3=Double row (90+30) x30 cm spacing

P1 = Square plant layout, P2 = Triangle plant layout