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Economic Analysis of Carrot (*Daucus carota* L.) Under Seed Priming and Pelleting in Combination with Different Crop Geometry

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Abstract

The present study was conducted at experimental farm of Department of Seed Science and Technology, Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.) during the years 2017-18 and 2018-19 under priming and pelleting in combination with different crop geometry to improve carrot production for maximizing economic returns. The economics of carrot under different treatment combinations was worked out to find the most economical treatment combination. It was concluded that the treatment combination seed primed for 4 days in PEG 6000 solution having osmotic potential of -1.2 MPa and pelleted with *Melia azedarach* leaf powder sown at paired row 30 +15 x 10 cm (T_1G_2) was more profitable as compare to other treatment combinations as net returns as well as BC ratio (2.31) was higher under this combination as compare to other treatment combinations.

Keywords: Carrot, economics, production

1. Introduction

Carrot is one of the most popular and versatile root crop in the world. Carrot production can be a profitable market for small-scale farmers and resource-poor growers, as carrots are short-duration crops and higher produce can be obtained per unit area (Ahmad et al., 2005). In terms of area, production and market value, carrot is among the top ten most economically important vegetable crops in the world (Fontes and Vilela, 2003). Most of the world's carrot production occurs in temperate countries. The leading carrot producing countries are China, USA, Russian Federation and European countries. In India, carrot is grown in an area of 97000 hectares with an annual production of 1648000 MT in the year 2017-18 (NHB, 2018), this indicates the economic importance of carrot. The main carrot growing states are Uttar Pradesh, Assam, Karnataka, Andhra Pradesh, Punjab and Haryana. The carrot has the most economic importance among root vegetables due to high content of vitamin A, a smooth texture and a good taste (Filgueira, 2008). European carrot is rich in bioactive compounds like carotenoids and good source of vitamin A, thiamin, protein, calcium, riboflavin and vitamin C. Its root is valued as food mainly for high carotene content, Beta carotene, having high vitamin A activity (Biesalski, 1997) which constitute 60 to 90% of carrot carotenoids (Simon and Wolff, 1987). Nutrient composition of carrot root includes moisture 86 g, protein 0.9 g, carbohydrate 10.6 g, fat 0.2 g, fiber 1.2 g, energy 48 kilo calorie, mineral 1.1 g, iron 2.2 mg, carotene 1890 mg, thiamine 0.04 mg, riboflavin 0.02 mg, niacin 0.5 mg, vitamin C 3 mg, folic acid 15 mg, calcium 80 mg and phosphorus 30 mg per 100 g of edible portion (Bose and Som, 2000). Carrot roots contain sucrose 10 times higher than that of glucose or fructose. Good quality seed not only raise productivity per unit area but also contribute to achieve predictable crops without any admixtures required for reasonable or fair market prices (Pal et al., 2019). However, the key problem faced by carrot growers is that the necessary quantity of good quality seed is not sufficient, which requires standardization of production technology in order to produce a high yield of quality carrot roots (Kumar et al., 2017). Seed priming and seed pelleting found more appropriate to overcome these problem related to seed quality to improve productivity of carrot. Also, finding the most suitable spacing or crop geometry is therefore very

important in order to achieve higher productivity with good quality roots that lead to higher economic benefits. Keeping in a view, present study was taken to analyze economics of carrot under priming and pelleting in combination with different crop geometry.

2. Materials and Methods

The present investigation was conducted at experimental farm of Department of Seed Science and Technology, Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.) during the years 2017-18 and 2018-19. This experiment comprised of four different crop geometry viz. 30 x 10 cm (Recommended), paired row 30 +15 x 10 cm, paired row 45+15 x 10 cm and paired row 75 +15 x 10 cm and best four selected treatments from priming and pelleting treatment combination viz. seeds primed for 4 days with PEG 6000 solution having osmotic potential of -1.2 MPa and pelleted with *Melia azedarach* leaf powder, seed primed for 2 days with PEG 6000 solution having osmotic potential of -1.2 MPa and pelleted with *Vitex negundu* leaf powder, seed primed for 4 days with PEG 6000 solution having osmotic potential of -1.2 MPa, seed primed for 4 days with PEG 6000 solution having osmotic potential of -1.0 MPa and pelleted with *Melia azedarach* leaf powder along with control. So as to have 20 treatment combinations which were planned and executed under field experiment. Economics of carrot crop under different treatment combinations was worked out using following formulae:

Gross returns = Output of crop x Price

Net returns = Gross returns – Total Cost of Cultivation

BC ratio=(Gross return/ Total cost of cultivation)

3. Results and Discussion

Economic analysis is essential to test the profitability and viability of any activity. Therefore, the economics of traditional carrot (without plant protection chemicals) vis-à-vis different treatment combinations (priming and pelleting in combination with different crop geometry) was worked out and have been presented in Table 1 and 2. The data in Table 1 revealed that per hectare cost of cultivation of carrot was Rs. 105930 with total variable cost of Rs. 74680 and total fixed cost of Rs. 31249.

The results in Table 2 pointed out maximum yield was obtained under treatment combination seed primed for 4 days in PEG 6000 solution having osmotic potential of -1.2 MPa and pelleted with *Melia azedarach* leaf powder sown at paired row 30 +15 x 10 cm (T_1G_2) (177.11 quintal ha^{-1}) treatment combination and minimum (71.63 quintal ha^{-1}) was under control sown at paired row 75 +15 x 10 cm (T_5G_4). Among different treatment combinations, highest net returns (Rs. 150541 ha^{-1}) was obtained from T_1G_2 treatment combination i.e. seed primed for 4 days in PEG 6000 solution having osmotic potential of -1.2 MPa and pelleted with *Melia azedarach* leaf

Table 1: Cost of cultivation of carrot (₹ ha^{-1})

Sr. No.	Cost Items	Rs.
A.	Variable Cost	
	Human Labour	36500
	Machinery cost	8400
	Seed	12000
	FYM	13500
	Miscelleneous	1408
	Interest on working capital	2872
	Total Variable cost	74680
B.	Fixed Cost	
	Land revenue	31
	Rental value of land	30000
	Depreciation	543
	Interest on fixed capital	675
	Total fixed cost	31249
C.	Total cost of cultivation	105929

Table 2: Economics of carrot for different treatment combination

Treatment combinations	Total cost of cultivation (₹ ha^{-1})	Yield (q ha^{-1})	Gross returns (₹)	Net returns (₹)	B:C Ratio
T_1G_1	113362	94.56	141840	28478	1.25
T_1G_2	115124	177.11	265665	150541	2.31
T_1G_3	113362	143.56	215340	101978	1.90
T_1G_4	106985	106.85	160275	53290	1.50
T_2G_1	113362	98.11	147165	33803	1.30
T_2G_2	115124	138.78	208170	93046	1.81
T_2G_3	113362	111.56	167340	53978	1.48
T_2G_4	106985	92.15	138225	31240	1.29
T_3G_1	110236	119.56	179340	69104	1.63
T_3G_2	113563	169.44	254160	140597	2.24
T_3G_3	109631	120.48	180720	71089	1.65
T_3G_4	106253	98.22	147330	41077	1.39
T_4G_1	111642	105.85	158775	47133	1.42
T_4G_2	113625	149.09	223635	110010	1.97
T_4G_3	111253	126.52	189780	78527	1.71
T_4G_4	106854	97.7	146550	39696	1.37
T_5G_1	105929	82.89	124335	18406	1.17
T_5G_2	108542	136.93	205395	96853	1.89
T_5G_3	105929	91.04	136560	30631	1.29
T_5G_4	105634	71.63	107445	1811	1.02

Table 2: Continue...

Treatments: T_1= PEG 6000-1.2 MPa 4days+*Melia azedarach*+clay; T_2 = PEG 6000 -1.2 MPa 2 days+*Vitex negundu* + clay; T_3 = PEG 6000 -1.2 MPa 4 days + unpelleted; T_4 = PEG 6000 -1.0 MPa 4 days + *Melia azedarach*+clay; T_5 = Control; Crop Geometry: G_1 = 30 x 10 cm (Recommended); G_2= Paired row 30 +15×10 cm; G_3= Paired row 45+15×10 cm; G_4= Paired row 75 +15×10 cm

powder sown at paired row 30 +15 x 10 cm and minimum (Rs. 1811 ha^{-1}) was from T_5G_4 treatment combination i.e. control sown at paired row 75 +15 x 10 cm. It was observed that all the treatments with crop geometry G2 provided higher net returns as compared to treatment combination with other crop geometry. The benefit cost ratio was found highest (2.31) under treatment combination seed primed for 4 days in PEG 6000 solution having osmotic potential of -1.2 MPa and pelleted with *Melia azedarach* leaf powder sown at paired row 30 +15 x 10 cm (T_1G_2) indicated that one rupee spent on carrot under this treatment combination will give 2.31 rupees in return. The benefit cost ratio was minimum (1.02) under control sown at paired row 75 +15 x 10 cm (T_5G_4) treatment combination.

4. Conclusion

The analysis showed that total cost of cultivation under T_1G_2 was around Rs. 115124 ha^{-1} with net returns of Rs. 150541. Based on the results, it was concluded that treatment combination seed primed for 4 days in PEG 6000 solution having osmotic potential of -1.2 MPa and pelleted with *Melia azedarach* leaf powder sown at paired row 30 +15 x 10 cm (T_1G_2) was more profitable as compare to other treatment combinations as net returns as well as BC ratio (2.31) was higher under this combination as compared to others.

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