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Economic analysis of various cherry (*Prunus avium* L.) fertigation treatments under high-density plantation system

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Abstract
Fertigation is a method of fertilizer application in which an optimum dose of fertilizer is supplied to the plant along with irrigation water through the drip irrigation system thereby reducing leaching losses, groundwater pollution, labor and input cost and ensuring integrated nutrient management besides bringing down the cost of production. This study was conducted with an aim of working out the economics of different doses of fertigation applied to cherry cv. Regina thus, to find the most economically feasible dosage of fertigation treatment for high density plantation system under temperate climatic conditions. The present investigation was conducted in the Experimental fields of Division of Fruit Science, SKUAST, Kashmir during the year 2021 and 2022. 8 year old trees of cherry cv. Regina grafted on Gisela-5 rootstock, were selected for experimentation. The fifteen treatments used were replicated thrice in Randomized Complete Block Design. The benefit cost ratio (BCR)/per rupee return (PRR) for different fertigation treatments was worked out by considering the rates of fertilizers, quantity used etc. The maximum net returns of ₹ 8,79,470.5 and ₹ 9,05,816.90 were obtained from treatment T_6 (125% of reference dose of NPK at weekly interval) with benefit cost ratio of 3.52 and 3.57 during the year 2021 and 2022 respectively. Lowest benefit- cost ratio (1.88 and 1.97) was recorded in T_{15} during both the years. Higher benefit-cost ratio may be attributed to the fact that T_6 offered the most optimum dose to the plants which resulted in highest yield thereby contributing to the overall BC ratio.

Keywords: Urea, fertigation, mono-ammonium phosphate, potassium sulphate, per-rupee return

Introduction
Sweet cherry (*Prunus avium* L.) is one of the most important temperate fruit all over the world. It is commonly cultivated in colder areas with prolonged winter period. 90% of the entire production of India is contributed alone by Kashmir division of union territory of J&K due to its strictly temperate climatic condition which provide congenial environmental conditions for cherry cultivation. Cherry fruit is of high market value and it has a huge demand owing to its distinctive taste and aroma. However, it is a short-duration crop and almost all the varieties produce fruits by the month of June as a result there is a glut in market. Cherry is a self-incompatible crop and hence needs pollinizers for optimum fruit set. Excessive use of fertilizers has been found hazardous for the plant growth besides causing environmental pollution (Raina *et al*. 2005) [5]. Research on fertigation of N, P, and K nutrients for sweet cherry has been scarce, but it has been shown that several fruit crops used N, P, and K more effectively when applied using trickle emitters than when applied broadcastly. Many apple producers see sweet cherries as a high-value crop for possible crop diversification, which is why at SKUAST-K, many cultivars were introduced to span a wide ripening period. The cultivar Regina is well-liked for it's later than average ripening date and resilience to cracking, although it is a shy bearer. Fruit set remains subpar despite improvements in orchard management practices. HDP is one of the most crucial techniques for achieving high yield per unit area in horticulture crops, both short-term and permanent. Over the past 30 years, there has been a substantial change in the world's cherry output. New technologies and varieties are replacing the older ones, and new essential inputs are being added to the production of cherry as a consequence of numerous research and development initiatives. New rootstocks are being introduced to limit vegetative development, to enable high-density planting and early fruiting, and new kinds have been created that self-pollinate to produce tougher and bigger fruit. In India, the North-Western states of Jammu and Kashmir (J&K), Himachal Pradesh (H.P), and

Uttarakhand are where cherry is mostly farmed (Bhat *et al*., 2018) [1]. However, cherry cultivation is a long term investment considering its establishment, maturation period etc. for which careful planning is required to ensure financial success. Hence, benefit-cost ratio provides a better insight in terms of economic feasibility under high density plantation system. This study was conducted with the objective of analyzing the economic suitability of different doses of fertilizers in cherry cv. Regina on Gisela 5 via drip irrigation in high density plantation system under temperate climatic conditions.

Material and Methods

This study was conducted at experimental fields of Division of Fruit Science SKUAST-K during year 2021-22. In this study, cherry cultivar Regina on Giesela-5 (8 year old plants) was laid in randomized complete block design at a spacing of 4 × 2 m (1250 plants ha^{-1}) to study the effect of different doses and timings of fertigation treatments. Fertilizers used i.e. urea (@₹ 5.4 kg^{-1}), mono-ammonium phosphate (@₹180 kg^{-1}) and sulphate of potash (@₹120 kg^{-1}) were all water soluble. Reference dose of 125g N, 50g P, 100g K / plant was taken as the base line for deriving all other treatments (Koumanova *et al*. 2016) [2]. Fertigation was started from 15th of March and was stopped 10 days before harvest. A total of fifteen treatment were replicated thrice in this study. Details of treatments a given in Table 1. Besides all the physico-chemical analysis, economic analysis was done to see which dose of fertigation would give highest returns with least input cost. In order to analyse the data and establish the costs and returns of perennial crops, generic statistical and mathematical calculations were made, and a cost of cultivation process for orchards was devised in order to fulfil the needs of the objectives. Several cost-benefit theories and economic measures, including fixed cost, variable cost, treatment cost, total added cost, total variable cost, total cost of cultivation, gross returns, net returns etc. were estimated as mentioned below.

Fixed cost: As the name itself suggests is fixed and doesn't change, regardless of production output. Fixed cost is the sum of rental value of land, cost of planting material, cost of establishment of the drip system, depreciation on farm structures and implements and interest on fixed capital.

Variable cost: Variable costs are any expanses that change based on the production. Cost of inputs used, labour cost, plant protection application, interest on working capital together account for total variable cost estimates.

Treatment cost: It includes the actual cost incurred for application of each treatment. It may also be referred to as total added cost.

Total variable cost: It is the sum of variable cost and total added cost/ treatment cost.

Total cost of production: It is the sum of fixed cost, variable cost and treatment cost.

Gross returns: It is the sum of all receipts from main product and by-product produced per acre. It was estimated as under:

Gross returns (₹ /ha^{-1}) = Yield × cost of cherry per kg

{Selling price of cherry = ₹150 per Kg for grade A, ₹100 per Kg for grade B and ₹50 for remaining (considering 70% of cherries produced where of grade A, 20% grade B and 10% remaining)}

Net returns

Is obtained by subtracting total cost of production from gross returns.

i.e., Net returns (₹/ha^{-1}) = Gross returns – total cost of production

Benefit cost ratio/ per rupee return: Is obtained by dividing gross returns from total cost of production.

$$\text{i.e., BC ratio} = \frac{\text{Gross returns}}{\text{Total cost of production}}$$

Results and Discussion

Establishment of an orchard is a cost intensive investment hence proper planning including economic analysis is a critical pre-requisite for success of the planting system. Keeping in view this point, analysis of economics of cherry production under high density plantation was carried out. Perusal of table 2 shows the cost beakdown into fixed and variable cost components during year 2021 and 2022. Rental value of the land remained same during the two year i.e., ₹ 5000 per kanal. Cost of planting material which at the time of establishment was ₹ 4,37,500 (i.e., ₹ 350 per plant) which was divided over 18 years of average life of plants. Similarly, the cost of trellis, drip establishment etc. was also divided over 20 years of expected life of the system i.e. ₹ 7,00,000 (since it was desi-type drip system) over 20 years including yearly depreciation of ₹ 1500. Interest on fixed capital was taken as the 12% of the total fixed cost involved. The total fixed cost remained same during the two years of experiment i.e. ₹ 1,80,102.1. The variable cost in terms of labour cost was ₹43,636 and ₹ 45,600 during the two consecutive years. Plant protection measures accounted for ₹ 14,000 and 15,633 during the two years while farm yard manure costed ₹ 37,500 during both the years (i.e. 1 cubic feet per plant @ ₹ 30). Interest on working capital was computed in a similar manner like before. The total variable cost came out to be ₹ 1,06,552.32 while the total cost of production was ₹ 2,86,654.42 and ₹ 2,90,683.1 respectively during the year 2021 and 2022. Perusal of Table 3 explains total added treatment cost which ranges from ₹ 50,000 to ₹87,687.50 based on calculations of fertilizers as per each treatment separately during the two years. Table 4 reveals the values of total cost of production during 2021 which was highest in T_2 and T_3 (₹ 3,74,341.92) while the lowest values was recorded in T_{14} and T_{15} (₹ 2,99,141.92). Similar such trend was observed in Table 5. Table 6 Table 7 gives a brief idea about the yield, gross returns, net returns and per rupee returns during year 2021. Highest yield was obtained in case of T_6 (9,100 kg ha^{-1}) while the lowest was obtained in case of T_{15} (5,637.50 kg ha^{-1}). The values of gross returns and net returns were calculated which ultimately gave us the benefit cost ratio. Highest BC ratio of 3.52 was obtained in case of T_6 followed by T_7 (3.45) while the lowest value was obtained in case of T_{15} (1.88).

Similar results were obtained during 2022 where highest BC ratio was obtained in case of T_6 (3.57) while the lowest value was obtained in case of T15. The results obtained are in close conformity with the results obtained by Mahadevan *et al.* (2019) [3] who reported highest value of BC ratio with 125% of RDF through fertigation along with moderate pruning in guava cv. Sardar. The results obtained by Maneesha *et al.* (2019) [4] who studied cost benefit analysis of drip fertigation and flower induction in pineapple (*Ananas comosus* L. Merr.) and found highest B: C ratio of 3.34 in fertigation with 100% RDN (12:4:12 g NPK/plant/cycle) followed by fertigation with 125% RDN (15: 5:15 g NPK/plant/cycle (3.32), respectively are also in line with the present studies. Besides, Ramniwas *et al.* (2012) [6] in their study recorded highest BC ratio of 2.49 with fertigation treatment F_2 (45, 20, 20 g NPK/plant/year) and lowest with F_3 (60, 30, 30 g NPK/plant/year) respectively.

Table 1: Experimental details (Reference dose (125g N, 50g P, 100g K / plant))

Treatment code	Treatment details
T1	Soil application of NPK (100% of reference dose)
T2	175% of reference dose of NPK at weekly interval
T3	175% of reference dose of NPK at 15 days interval
T4	150% of reference dose of NPK at weekly interval
T5	150% of reference dose of NPK at 15 days interval
T6	125% of reference dose of NPK at weekly interval
T7	125% of reference dose of NPK at 15 days interval
T8	100% of reference dose of NPK at weekly interval
T9	100% of reference dose of NPK at 15 days interval
T10	75% of reference dose of NPK at weekly interval
T11	75% of reference dose of NPK at 15 days interval
T12	50% of reference dose of NPK at weekly interval
T13	50% of reference dose of NPK at 15 days interval
T14	25% of reference dose of NPK at weekly interval
T15	25% of reference dose of NPK at 15 days interval

Table 2: Cost incurred in production of cherry cv. Regina under high density cherry orchard system (1250 trees ha^{-1})

(A). Fixed cost (₹)		
Year	**2021**	**2022**
Rental value of the land (5000/kanal)	1,00,000	1,00,000
Cost of planting material	24,305.5	24,305.5
Cost of trellis system, drip establishment including yearly depreciation on farm structures/ implements etc.	36,500	36,500
Interest on fixed capital @ 12%	19,296.6	19,296.6
Total fixed cost	1,80,102.1	1,80,102.1
(B). Variable cost (₹)		
Labour cost (pruning, training, harvesting, watch and ward)	43,636	45,600
Plant protection application	14,000	15,633
FYM (Farm yard manure)	37,500	37,500
Interest on working capital @12%	11,416.32	11,847.96
Total variable cost	1,06,552.32	1,10,581
Total cost of cultivation	2,86,654.42	2,90,683.1

Table 3: Treatment –wise added cost (fertilizers)

Treatment code	Treatment cost (Rs ha^{-1})/Total added cost (2021)	Treatment cost (Rs ha^{-1}) /Total added cost (2022)
T1	50,000	50,000
T2	87,687.50	87,687.50
T3	87,687.50	87,687.50
T4	74,900	74,900
T5	74,900	74,900
T6	62,375	62,375
T7	62,375	62,375
T8	50,000	50,000
T9	50,000	50,000
T10	37,375	37,375
T11	37,375	37,375
T12	24,875	24,875
T13	24,875	24,875
T14	12,487.5	12,487.5
T15	12,487.5	12,487.5

Table 4: Treatment-wise comparative economics of cost of production of cherry cv. Regina under high density orchard system during year 2021 (1250 trees ha^{-1})

Treatment code	Fixed Cost (Rs Ha^{-1})	Variable Cost (Rs Ha^{-1})	Total Added Cost (Rs Ha^{-1})	Total Variable Cost (Rs Ha^{-1})	Total Cost of Cultivation (Rs Ha^{-1})
T_1	1,80,102.1	1,06,552.32	50,000	1,56,552.3	3,36,654.42
T_2	1,80,102.1	1,06,552.32	87,687.50	1,94,239.8	3,74,341.92
T_3	1,80,102.1	1,06,552.32	87,687.50	1,94,239.8	3,74,341.92
T_4	1,80,102.1	1,06,552.32	74,900	1,81,452.3	3,61,554.42
T_5	1,80,102.1	1,06,552.32	74,900	1,81,452.3	3,61,554.42
T_6	1,80,102.1	1,06,552.32	62,375	1,68,927.3	3,49,029.42
T_7	1,80,102.1	1,06,552.32	62,375	1,68,927.3	3,49,029.42
T_8	1,80,102.1	1,06,552.32	50,000	1,56,552.3	3,36,654.42

T_9	1,80,102.1	1,06,552.32	50,000	1,56,552.3	3,36,654.42
T_{10}	1,80,102.1	1,06,552.32	37,375	1,43,927.3	3,24,029.42
T_{11}	1,80,102.1	1,06,552.32	37,375	1,43,927.3	3,24,029.42
T_{12}	1,80,102.1	1,06,552.32	24,875	1,31,427.3	3,11,529.42
T_{13}	1,80,102.1	1,06,552.32	24,875	1,31,427.3	3,11,529.42
T_{14}	1,80,102.1	1,06,552.32	12,487.5	1,19,039.8	2,99,141.92
T_{15}	1,80,102.1	1,06,552.32	12,487.5	1,19,039.8	2,99,141.92

Table 5: Treatment-wise comparative economics of cost of production of cherry cv. Regina under high density orchard system during year 2022 (1250 trees ha^{-1})

Treatment Code	Fixed Cost (Rs Ha^{-1})	Variable Cost (Rs Ha^{-1})	Total Added Cost (Rs Ha^{-1})	Total Variable Cost (Rs Ha^{-1})	Total Cost of Cultivation (Rs Ha^{-1})
T_1	1,80,102.1	1,10,581	50,000	1,60,581.0	3,40,683.10
T_2	1,80,102.1	1,10,581	87,687.50	1,98,268.5	3,78,370.60
T_3	1,80,102.1	1,10,581	87,687.50	1,98,268.5	3,78,370.60
T_4	1,80,102.1	1,10,581	74,900	1,85,481.0	3,65,583.10
T_5	1,80,102.1	1,10,581	74,900	1,85,481.0	3,65,583.10
T_6	1,80,102.1	1,10,581	62,375	1,72,956.0	3,53,058.10
T_7	1,80,102.1	1,10,581	62,375	1,72,956.0	3,53,058.10
T_8	1,80,102.1	1,10,581	50,000	1,60,581.0	3,40,683.10
T_9	1,80,102.1	1,10,581	50,000	1,60,581.0	3,40,683.10
T_{10}	1,80,102.1	1,10,581	37,375	1,47,956.0	3,28,058.10
T_{11}	1,80,102.1	1,10,581	37,375	1,47,956.0	3,28,058.10
T_{12}	1,80,102.1	1,10,581	24,875	1,35,456.0	3,15,558.10
T_{13}	1,80,102.1	1,10,581	24,875	1,35,456.0	3,15,558.10
T_{14}	1,80,102.1	1,10,581	12,487.5	1,23,068.5	3,03,170.60
T_{15}	1,80,102.1	1,10,581	12,487.5	1,23,068.5	3,03,170.60

Table 6: Benefit-Cost ratio of different fertigation treatments in cherry cv. 'Regina' under high density orcharding system during year 2021 (1250 trees ha^{-1})

Treatment Code	Total Cost of cultivation (Rs Ha^{-1})	Yield (kg Ha^{-1})	Gross Returns (Rs ha^{-1})	Net Return (Rs Ha^{-1})	B:C Ratio
T_1	3,36,654.42	7,237.50	9,77,063	6,40,408.08	2.9
T_2	3,74,341.92	6,962.50	9,39,938	5,65,595.58	2.51
T_3	3,74,341.92	6,525.00	8,80,875	5,06,533.08	2.35
T_4	3,61,554.42	8,237.50	11,12,063	7,50,508.08	3.08
T_5	3,61,554.42	8,025.00	10,83,375	7,21,820.58	3
T_6	3,49,029.42	9,100.00	12,28,500	8,79,470.58	3.52
T_7	3,49,029.42	8,925.00	12,04,875	8,55,845.58	3.45
T_8	3,36,654.42	8,350.00	11,27,250	7,90,595.58	3.35
T_9	3,36,654.42	8,000.00	10,80,000	7,43,345.58	3.21
T_{10}	3,24,029.42	6,925.00	9,34,875	6,10,845.58	2.89
T_{11}	3,24,029.42	6,625.00	8,94,375	5,70,345.58	2.76
T_{12}	3,11,529.42	6,525.00	6,52,500	3,40,970.58	2.09
T_{13}	3,11,529.42	6,462.50	6,46,250	3,34,720.58	2.07
T_{14}	2,99,141.92	6,237.50	6,23,750	3,24,608.08	2.09
T_{15}	2,99,141.92	5,637.50	5,63,750	2,64,608.08	1.88

Table 7: Benefit-Cost ratio of different fertigation treatments in cherry cv. 'Regina' under high density orcharding system during year 2022 (1250 trees ha^{-1})

Treatment Code	Total cost of production (Rs Ha^{-1})	Yield (Kg Ha^{-1})	Gross Returns (Rs Ha^{-1})	Net Return (Rs Ha^{-1})	B:C Ratio
T_1	3,40,683.10	7,487.50	10,10,812.50	6,70,129.40	2.97
T_2	3,78,370.60	7,250.00	9,78,750.00	6,00,379.40	2.59
T_3	3,78,370.60	6,812.50	9,19,687.50	5,41,316.90	2.43
T_4	3,65,583.10	8,512.50	11,49,187.50	7,83,604.40	3.14
T_5	3,65,583.10	8,262.50	11,15,437.50	7,49,854.40	3.05
T_6	3,53,058.10	9,325.00	12,58,875.00	9,05,816.90	3.57
T_7	3,53,058.10	9,100.00	12,28,500.00	8,75,441.90	3.48
T_8	3,40,683.10	8,650.00	11,67,750.00	8,27,066.90	3.43
T_9	3,40,683.10	8,212.50	11,08,687.50	7,68,004.40	3.25
T_{10}	3,28,058.10	7,262.50	9,80,437.50	6,52,379.40	2.99
T_{11}	3,28,058.10	6,862.50	9,26,437.50	5,98,379.40	2.82
T_{12}	3,15,558.10	6,787.50	6,78,750.00	3,63,191.90	2.15
T_{13}	3,15,558.10	6,725.00	6,72,500.00	3,56,941.90	2.13
T_{14}	3,03,170.60	6,562.50	6,56,250.00	3,53,079.40	2.16
T_{15}	3,03,170.60	5,962.50	5,96,250.00	2,93,079.40	1.97

Conclusion

Cherry is a crop of high commercial value. This study helped us to set a baseline for fertigation in cherry. It can be concluded that cherry cultivation is economically feasible with 125% reference dose of fertigation that accounts for 312.8g urea, 102.4g MAP and 250g SOP/plant as the BC ratio was greater than 1 and varied between 3.52 and 3.57 during the two years. Hence cherry production has proved to be a highly remunerative farm activity with adaptation of fertigation technology.

References

1. Bhat KM, Wani WM, Jan A, Kirmani SN, Mir MA, Pandith AH. Evaluation of traditional and exotic sweet cherry cultivars for horticultural and physico-chemical traits under North Western Himalayas. Journal of Pharmacognosy and Phytochemistry. 2018;**7**(1):1968-1971.
2. Koumanova KS, Staneva IN, Kornov GD, Germanova DR. Sweet cherry fruit quality under fertigation. Acta Horticulturae. 2016;1139:551-58.
3. Mahadevan A, Kumar S, Swaminathan V, Gurusamy A, Sivakumar T. Benefit cost ratio (BCR) as influenced by different pruning and fertigation treatments on guava cv. Sardar during rainy season. Journal of Pharmacognosy and Phytochemistry. 2019;8(6):1324-1325.
4. Maneesha SR, Devi SP, Vijayakumar RM, Soorianathasundaram K. Cost benefit analysis of drip fertigation and flower induction in pineapple (*Ananas comosus* L. Merr.) variety 'Giant Kew' in Goa, India. International Journal of Current Microbiology and Applied Sciences. 2019;8(4):2010-2019.
5. Raina JN, Thakur BC, Suman S, Spehia RS. Effect of fertigation through drip irrigation system on nitrogen dynamics, growth, yield and quality of apricot. Acta Horticulture. 2005;696:227-9.
6. Ramniwas A, Kaushik RA, Sarolia DK, Pareek S, Singh V. Effect of irrigation and fertigation scheduling on growth and yield of guava (*Psidium guajava* L.) under meadow orcharding. African Journal of Agricultural Research. 2012;7(47):6350-6356.