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# Study of Cost-Benefit Ratio Analysis of Rooftop Farming Vegetables Cultivated Plants.

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## ABSTRACT

Fast growing urban population need to be rapid production of vegetables on rooftop farming. Urban agriculture is meeting to daily needs for urban people. Vegetable cultivation technique on rooftop is the passion of urbanize. Vegetable cultivation is closely related with rooftop farming. Almost all variety of vegetables plants are grown on the rooftop farming in seasonal basis. Proper planning and management give more profited .it is more essential for the urban people because the organic vegetable grown in the Rooftop farming by utilization of compost vermin-compost coco peats and organic fertilizers. The method of study carried out by experimental as well as survey methods. I chosen site of study is Bhubaneswar because of large numbers of farmer cultivate vegetables on rooftop in India. Study of cost-benefit ratio analysis of rooftop farming is essential for the vegetable cultivation. The objectives of study entitled analysis economical benefits of vegetables cultivation on rooftop farming. These benefits are saves to expenses of urban people. It has profit making self managing cultivation of vegetable on rooftop needful for urban people. They obtain fresh organic vegetables on their own rooftop in marginal expenses. The percentage of profit is enhancing the perception of rooftop farming among urban people.

**Keywords:** Rooftop Farming, Vegetable Cultivation, Cost-benefit Ratio, Percentage of Profit, Economic Value.

## INTRODUCTION

Vegetable cultivation on rooftop farming increases as per the market demand of vegetables and high cost urban land. Fruits and vegetables intake among urban community gardeners has essential and demands. Astee, L. and Kishnani, N. (2010). Vegetables are easily cultivated on rooftop farms because of different opportunity and benefits technique of vegetables cultivation involved water management, Alaima, K, et al., (2008) Bio-waste management and environmental benefits and controlled.

Other benefits are associated with the rooftop farming. It is effective of cost benefit ratio. Benefits are more than cost. Boardman, A. E., et al.,(2020). Almost all vegetables are cultivated on rooftop farming such as Materials and methods.

The material required for the vegetable on rooftop farms were basically suitable well roof conditioned cultivation, Buhler, D. et al.,(2016), global trend and global status of commercial urban rooftop farming proper irrigation facility, Grow Bags, soil, Manure, investment for cultivation, instrument, containers, seeds and seedling and labour. The methods of cultivation are same as land field cultivation but here grow bags and container garden are used .Due to the water scarcity less amount of water is need for container garden and reduce expenses.

The observation carried out on the spots and gather the data of expenses/investment for 10 species and pots (Table -1) cost etc estimate the different material that are used for cultivation from the rooftop farms. Give sampling methods and gather the data. Calculate and analyzed the data and put the value of benefits cost, ratio of different aspect % of profits, Tamboli, M. A., et al., (2025). It is proof that calculation of vegetable is highly profit making crop being cultivated at rooftop farm.

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# MATERIALS AND METHODS

The study is carried out by survey of primary raw data from rooftop farmers of the Bhubaneswar city of India. Data are collected and record by semi-structured survey and semi-experimental methods through farmer's gardens. Further questioner methods used to from the rooftop farms.

Formulate the statistical data analysis of cost benefit ratio. The data collect during a complete cultivation of a specific species of the plant. Technique of cultivation has been followed the methods of study.

# RESULTS

Data had collected and documented by dominant respondent's opinion has been completed the vegetable crops and compare to market value with RTF in Tabulated and figures format. Here calculation of expenses of selected common vegetable in terms of market value. Income and the Cost-profit, Cost-Benefit and percentage (%) of profit has calculated. The tables present data on various vegetables grown on rooftop farming along with their corresponding costs, benefits, and cost-benefit ratios. Each row represents a different plant species. The "Sum of Cost" column indicates the total expenses incurred for cultivating and production of each vegetable plant, while the "Sum of Benefit" column shows the total returns or benefits obtained from cultivating them.

The "Sum of Cost-Benefit Ratio" column calculates the ratio of benefits to costs, indicating the efficiency of each cultivation effort. Higher ratios suggest more profitable crops relative to their cultivation costs.

**Ratio analysis of cultivated vegetable plants on rooftop farming.**

**Table 3. 1 Calculation of expenses of plants cultivate on rooftop farms in (Indian rupees).**

| | Name of the plant | Expenses For Cultivation( Indian rupees and US dollar)Rupees 82.96=1 Dollar | | | | | |
|---|---|---|---|---|---|---|---|
| | | Particulars | | | | | |
| VP | Vegetables (VP) | Grow Bag | Loam Soil | Manures | WaterSuply | Seedling/seeds | Labour |
| VP1 | Solanum lycopersicum | 40(0.48) | 200(2.41) | 50(0.60) | 100,(1.21) | 150(1.81) | 200(2.41) |
| VP2 | Cucurbita maxima | 50(0.60) | 200(2.41) | 100,(1.21) | 100,(1.21) | 50(0.60) | 200(2.41) |
| VP3 | Capsicum annuum | 50(0.60) | 200(2.41) | 100 (1.21) | 80 (0.96) | 100,(1.21) | 200(2.41) |
| VP4 | Brassica oleracea | 40(0.48) | 200(2.41) | 50(0.60) | 50(0.60) | 50(0.60) | 200(2.41) |
| VP5 | Brassica oleracea | 50(0.60) | 150(1.81) | 50(0.60) | 100,(1.21) | 50(0.60) | 200(2.41) |
| VP6 | Abelmoschus esculentus | 16(0.19) | 100(1.21) | 100(1.21) | 50(0.60) | 200(2.41) | 100(1.41) |
| VP7 | Cucumis sativus | 50(0.60) | 300(3.62) | 100(1.21) | 100(1.21) | 150(1.81) | 200(2.41) |
| VP8 | Solanum melongena | 60(0.72) | 250(3.01) | 150(1.81) | 100(1.21) | 150(1.81) | 200(2.41) |
| VP9 | Lagenaria siceraria | 50(0.60) | 200(2.41) | 100(1.21) | 100(1.21) | 150(1.81) | 200(2.41) |
| VP10 | Momordica charantia | 50(0.60) | 200(2.41) | 100(1.21) | 80(0.96) | 150(1.81) | 200(2.41) |
| VP11 | Raphanus sativus | 16(0.19) | 200(2.41) | 110(1.33) | 80(0.96) | 20(0.24) | 100(1.41) |

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**Grow bag=Poly bag, plastic pots, Siol pots,Gunny Bag**

**Manure =Mixture of compost, cocopeat, organic fertilizers, Vermi-compost**

**Calculation of expenses for the cultivation of vegetables on rooftop farming-:**

Tomato(*Solanum lycopersicum*)$VP_1$ :- For 10 pots Grow Bags, Synthetic Bags, Poly Bags 10×4 = 40.00,Soil Preparation Cost 10×20=200,Manure and fertilizer 10×5 =50, Water Supply cost 10×8×50=4000 Lits =100, Seeds and seedlings (3 Seedlings/bag 30×5 =150,Labour Cost 10×20= 200.

Pumkin(*Cucurbita maxima*)$VP_2$ :-Grow Bags 10×5 =50, Soil Preparation Cost 10×20=200, Manure and fertilizers 10×10 =100,Water Supply cost 10×10×50=5000 Lits =100, Seeds 10×5 =50, Labour Cost =10×20= 200.

Bellpepper (*Capsicum annuum*)$VP_3$ :- Grow Bags 10×5=50, Soil Preparation Cost 10×20=200, Coco peat 10×5=50, Manure and Fertilizers 10×5=50, Water Supply Cost 10×10×40 =4000 lits 80, Seeds (2 S/Bag)=20×5= 100, Labour Cost =10×20= 200.

Cauliflower (*Brassica oleracea*)$VP_4$:-GrowBags 10×4=40,Soil Preparation Cost =10×20=200,Manure and fertilizers 10×5=50, Water Supply Cost10×10×20= 2000 lits =50,Seedling 10×5=50, Labour Cost 10×20=200.

Cabbage (*Brassica oleraceae*)$VP_5$ :-Grow Bags 10×5=50,Soil Preparation Cost 10×15 =150. Manure and fertilizer 10×5=50, Water Supply cost =10×10×50 =5000 Liters =100, Seeds 10×5 =50. Labour Cost=10×20= 200.

Lady finger (*Abelmoschus esculentus*) $VP_6$ :- For1Grow Bags (6"/4"), Grow Bags =1×800 = 800.1bag= Approximately 50 crops=800÷50=16.00/Crop,Soil Preparation Cost 1×100=100.00/Crop,Manure and fertilizers 1×5=100, Water Supply cost 10 ×5×100 =500Lit =50.00, Seeds=100×2 = 200.00, Labour Cost = 100.00.

Cucumber(*Cucumis sativus*)$VP_7$:- Grow Bags 10×5=50.00 (1'×1'),Soil Preparation Cost =10×30 =300,Manure and fertilizers =10×10 =100, Water Supply Cost 10 ×10× 70= 7000= 100.00 Seeds =30×5 = 150.00 (3Seeds/pots), Labour Cost = 200.

Brinjal (*Solanum melongena*)$VP_8$:-Grow Bags 10×6 = 60.00, Soil preparation Cost =10×25=250.00, Manure and fertilizers 10× 5 = 150,Water Supply Cost=10 12×50=6000 Lits=100.00, Seedlings (3plants/bag) =30×= 150, LC= 200.

Bottle Gourd(*Lagenaria siceraria*)$VP_9$:-Grow Bags 10×5=50.00 Soil Preparation Cost 10×20=200,Manure and fertilizers 10×10=100, Water Supply cost =10×10×50=5000 Lits=100.00Seeds (3plants/bag) =30×5 =150.00 LC= 200.

Bitter Gourd **(***Momordica charantia*)$VP_{10}$ :- Grow Bags =10×5=50,SP=10×20=200,Manure and fertilizers 10×10 =100,Water Supply Cost 10× 10× 45=4500. Lit =80, S (3plants/bag) 30×5 =150,Labour Cost 10×20= 200.

Radish **(***Raphanus sativus***)** $VP_{11}$:- For 1 Grow bag, (6"×4") Grow Bags =1×800 =800,1 Grow Bags /50/Crops =800÷50=16, Soil Preparation Cost 1×200 =200, Coco Peat =50, Manure and fertilizers 1×100 =60, Water Supply Cost=1×3×1=3000 Lits=80. S 200 =20, Labour Cost1×100 = 100.

**Table 3. 2 Analysis of statistical value of cost benefits ratio with % of profi (Rs).**

| Vegetable Plants (VP) | Name of the plants | Cost of cultivation | Benefits | Profits | Cost- Benefit ratio | Cost-Profit ratio | % of profit |
|---|---|---|---|---|---|---|---|
| $VP_1$ | Solanum lycopersicum | 740 | 1800 | 1060 | 2.432 | 1.432 | 143.24 |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $VP_2$ | Cucurbita maxima | 700 | 3200 | 2500 | 4.571 | 3.571 | 357.14 |
| $VP_3$ | Capsicum annuum | 730 | 1600 | 870 | 2.193 | 1.193 | 119.17 |
| $VP_4$ | Brassica oleracea | 590 | 900 | 310 | 1.525 | 0.525 | 52.54 |
| $VP_5$ | Brassica oleracea var. | 600 | 800 | 200 | 1.332 | 0.332 | 33.33 |
| $VP_6$ | Abelmoschus esculentus | 566 | 1600 | 1034 | 2.826 | 1.826 | 184.27 |
| $VP_7$ | Cucumis sativus | 900 | 1600 | 700 | 1.772 | 0.772 | 77.77 |
| $VP_8$ | Solanum melongena | 910 | 2400 | 1490 | 2.634 | 1.634 | 263.73 |
| $VP_9$ | Lagenaria siceraria | 800 | 3000 | 2200 | 3.758 | 2.758 | 275 |
| $VP_{10}$ | Momordica charantia | 780 | 2000 | 1220 | 2.56 | 1.56 | 154.62 |
| $VP_{11}$ | Raphanus sativus | 526 | 1050 | 524 | 1.993 | 0.993 | 199.61 |

**Cost-benefit ratio of cultivated vegetables on rooftop farming-:**

**$VP_1$:-** Total Cost- 740.00Benefits 30×2 = 60kg =60×30.00 = 1800.00 (Cost=30.00/Kg), Profit-1800-740 =1060.00 Cost-Benefit Ratio $\frac{740}{1800} = \frac{37}{90} = \frac{1}{2.432}$ = 1: 2.432,Cost-Profit Ratio $\frac{740}{1060} = \frac{37}{53} = \frac{1}{0.698}$=1: 1.432, Percentage of Profit $\frac{1060}{740} \times 100$ = 143.24 % ,

**$VP_2$:-**Total Cost=700**,** Benefits= 40×4= 160Kg =160×20.00 =3200.00 (Cost=20.00/kg) Profit =3200 -700 =2500, Cost-Benefit Ratio =$\frac{700}{3200} = \frac{7}{32} = \frac{1}{4.571}$= 4.571,Cost-Profit ratio =$\frac{700}{2500} = \frac{7}{25} = \frac{1}{3.57}$=1:3.57 Percentage of profit =$\frac{2500}{700} \times 100$=357.14% .

**$VP_3$:-** Total Cost=730Benefits = 20×1 =20Kg = 20×80.00 =1600.00(Cost=80.00/kg) Profit = 1600-730 =870.00 Cost-Benefit Ratio =$\frac{730}{1600} = \frac{73}{160} = \frac{1}{2.19}$=1:2.19 Cost-Profit Ratio =$\frac{730}{870} = \frac{73}{87} = \frac{1}{1.19}$ =1:1.19 Percentage of Profit=$\frac{870}{730}$ × 100 =119.17%.

**$VP_4$:-**Total Cost = 590, Benefits = 10×1.5 = 15kg = 15×60 = 900.(Price=50.00/kg) Profit= 900-590= 310, Cost-Benefit ratio=$\frac{590}{900} = \frac{59}{90} = \frac{1}{1.52}$= 1:1.52 Cost-Profit ratio =$\frac{590}{310} = \frac{59}{31} = \frac{1}{0.525}$ = 1: 0.52, Percentage of profit =$\frac{310}{590} \times 100$ = 152.54%.

**$VP_5$:-**Total Cost = 600 Benefits =10×2 = 20kg =20×40.00= 800.00 (Cost=40.00/kg) Profit =800-600= 200.00 Cost-Benefit Ratio =$\frac{600}{800} = \frac{6}{8} = \frac{3}{4} = \frac{1}{1.33}$ = 1:1.33 Cost-Profit Ratio=$\frac{200}{600} = \frac{2}{6} = \frac{1}{3} = \frac{1}{0.33}$ = 1: 0.33.Percentage of Profit=$\frac{200}{600} \times 100$= 33.33%.

**$VP_6$:-**Total Cost = 566.00Benefits= 100×400 Gm= 40Kg = 40×40.0 = 1600,Cost=40.00/kg) Profit= 1600 - 566 =1034.00 Cost-Benefit Ratio=$\frac{566}{1600} = \frac{1}{2.82}$= 1:2.82 Cost-Profit ratio=$\frac{566}{1034} = \frac{1}{1.82}$ = 1:1.82 Percentage of profit =$\frac{1034}{566} \times 100$=182.27%**.**

**$VP_7$:-**Total Cost = 900Benefits=10×4 = 40Kg =40×40.00 = 1600.00 (Cost=40.00/kg) Profit= 1600-900=700.00 Cost-Benefit Ratio=$\frac{900}{1600} = \frac{1}{1.77}$ = 1:1.77 Cost-Profit Ratio =$\frac{900}{700} = \frac{1}{1.28}$ = 1:0.77, Percentage of profit=$\frac{700}{900} \times 100$ =77.77%.

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**VP8:**-Total Cost = 910 Benefits10× 8 = 80Kg= 80×30= 2400(Cost=30.00/kg) Profit 2400-910=1490.00 Cost-Benefit Ratio $\frac{910}{2400} = \frac{1}{2.63}$ = 1:2.63, Cost-profit Ratio $\frac{910}{1490} = \frac{1}{1.63}$ = 1:1.63 Percentage of profit $\frac{1490}{910} \times 100 =$ 163.73%.

**VP9:**-Total Cost =800 Benefits10×10 = 100Kg= 100×30.00= 3000.00 (Cost=30.00/Kg) Profit 3000 -800= 2200.00 Cost-Benefit Ratio $\frac{800}{3000} = \frac{1}{3.75}$= 1:3.75, Cost-Profit Ratio $\frac{800}{2200} = \frac{1}{2.75}$ = 1:2.75 Percentage of Profit $\frac{2200}{800}\times$ 100= 275%.

**VP10:**-Total Cost =780 Benefits 10×4 = 40Kg (Cost=50.00/kg) = 40×50.00 = 2000.00 Profit 2000-780=1220 Cost-Benefit Ratio $\frac{780}{2000} = \frac{1}{2.56}$= 1:2.56, Cost-Profit Ratio $\frac{780}{1220} = \frac{1}{1.56}$= 1:1.56, Percentage of Profit $\frac{1220}{789}\times100$ = 156.21 %.

**VP11:**-Total Cost =526 Benefits 1×35 =35Kg (Cost=30.00/kg) = 35×30=1050.00 Profit 1050-526=524.00 Cost-Benefit Ratio $\frac{526}{1050} = \frac{1}{1.99}$ =1:1.99, Cost-Profit Ratio $\frac{526}{524} = \frac{1}{1.003}$ =1:1.003 Percentage of Profit $\frac{1050}{526}\times100$=199.61%.

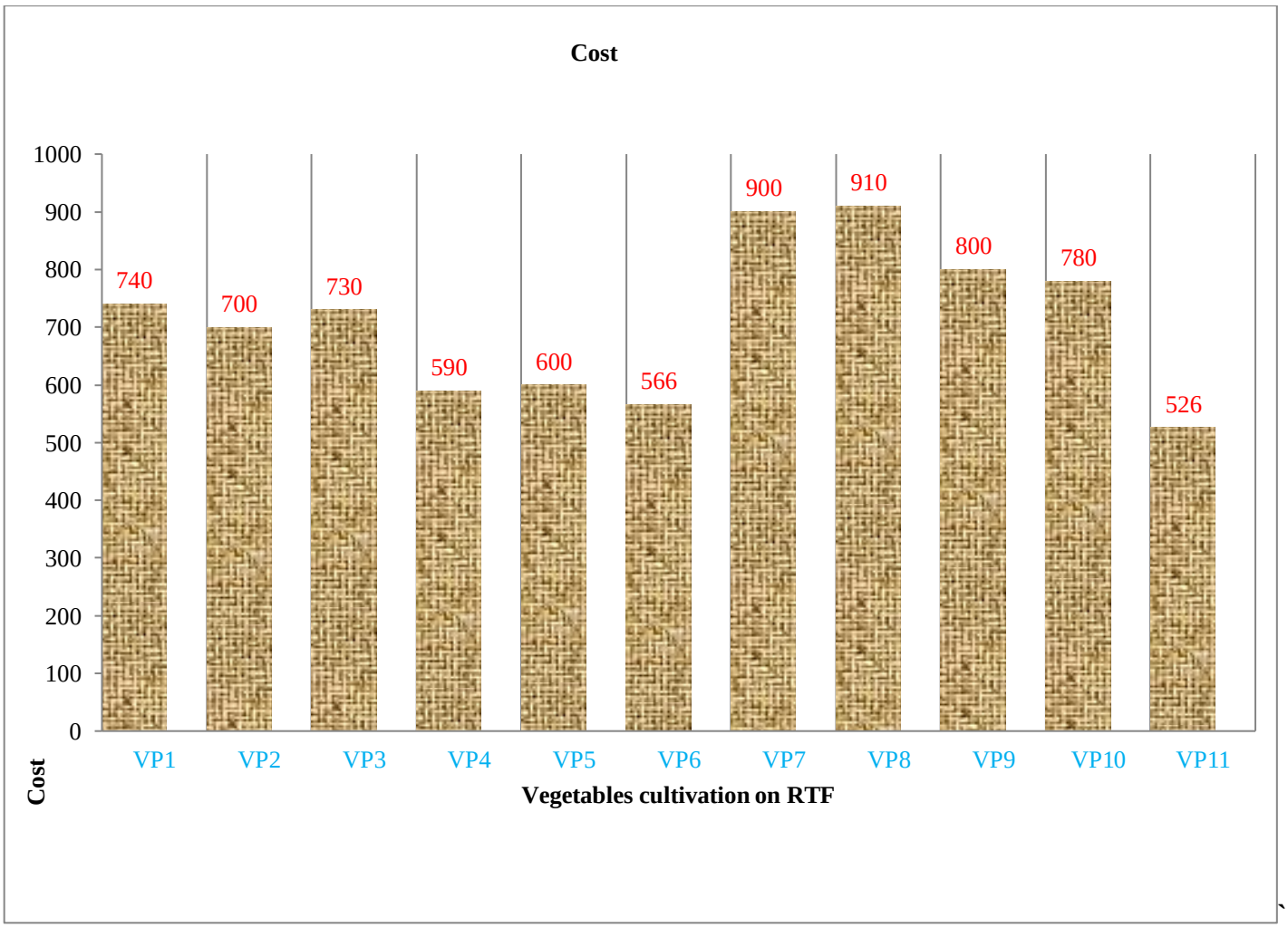


**Fig. 3. 1 Cost for vegetable cultivation on rooftop farming.**

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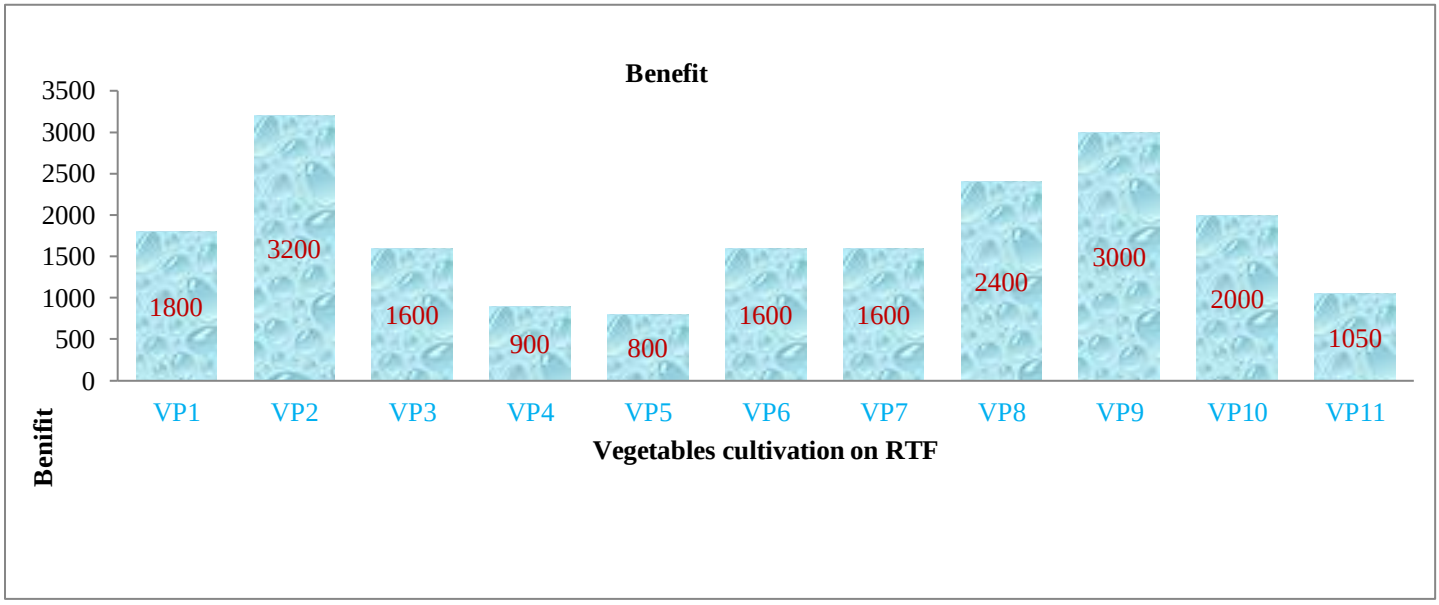


**Fig. 3. 2 Benefit for vegetable cultivation on RTF.**

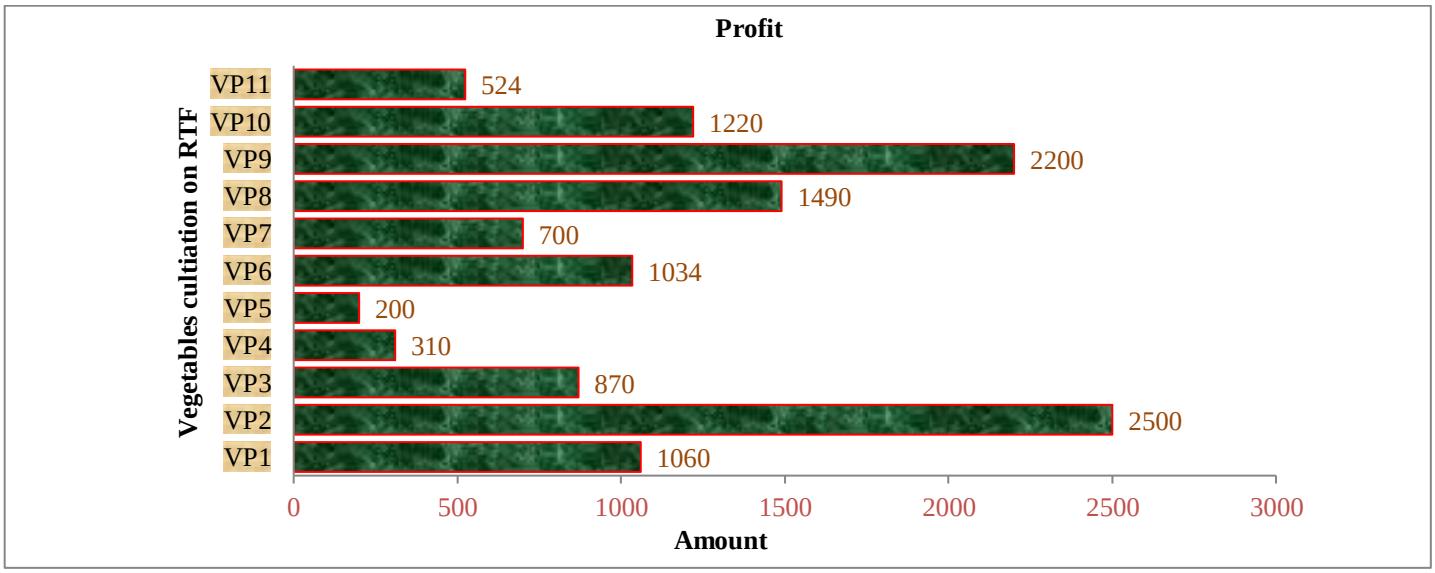


**Fig. 3. 3 Profit for vegetable cultivation on rooftop farming.**

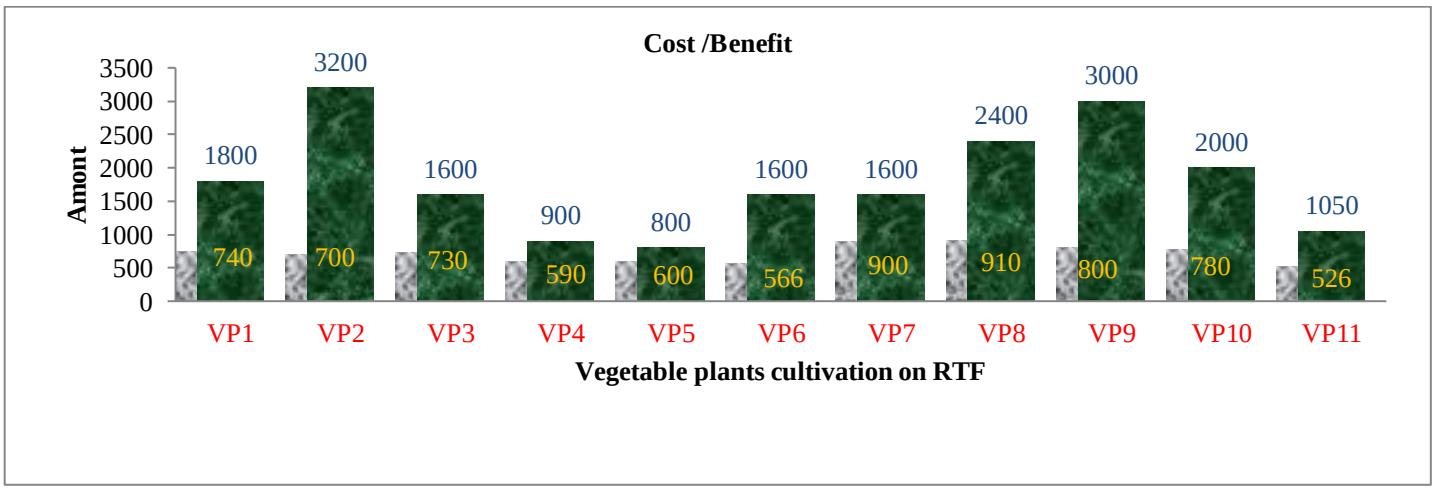


**Fig. 3. 4 Cost-Benefits for vegetables cultivation on RTF.**

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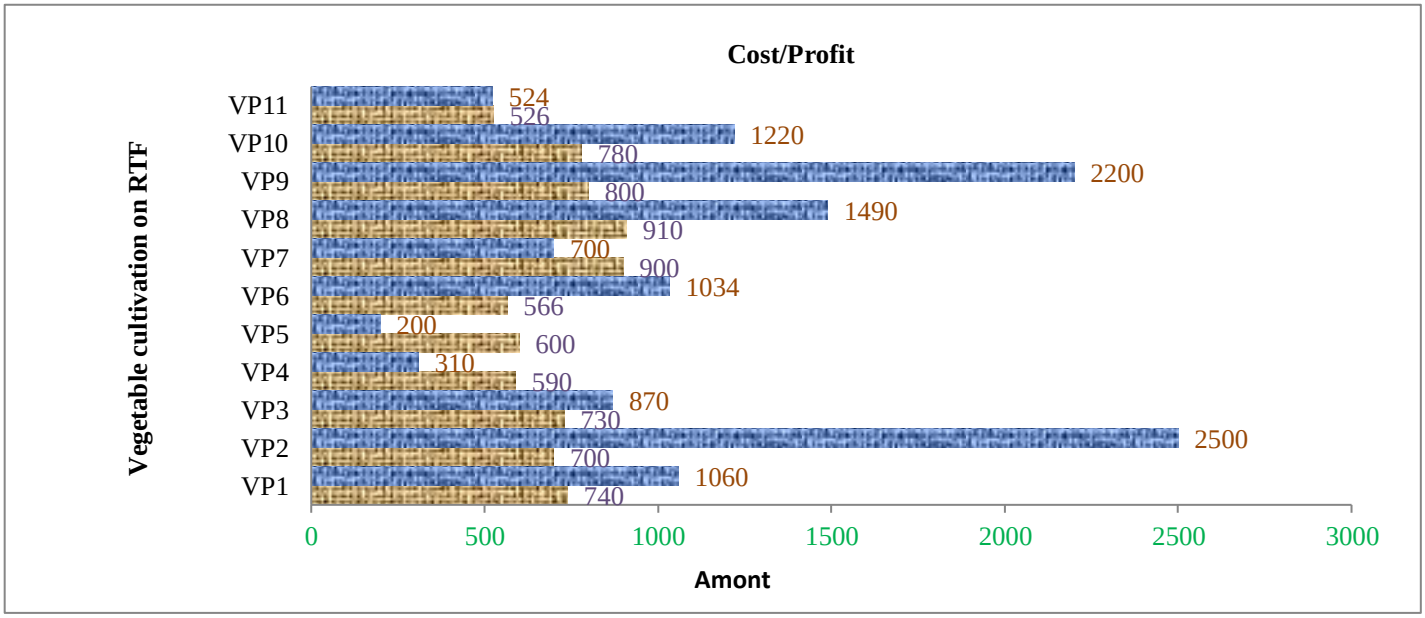


**Fig. 3. 5 Cost-profits for vegetable cultivation on RTF.**

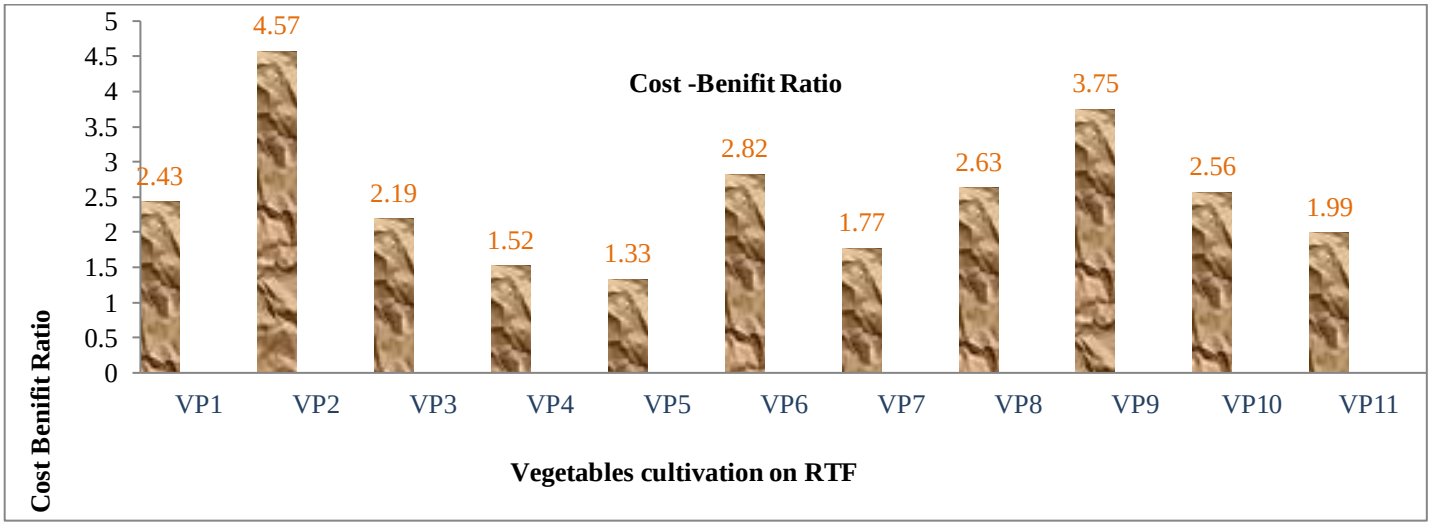


**Fig. 3. 6 Cost-benefit ratio for cultivation plants on RTF.**

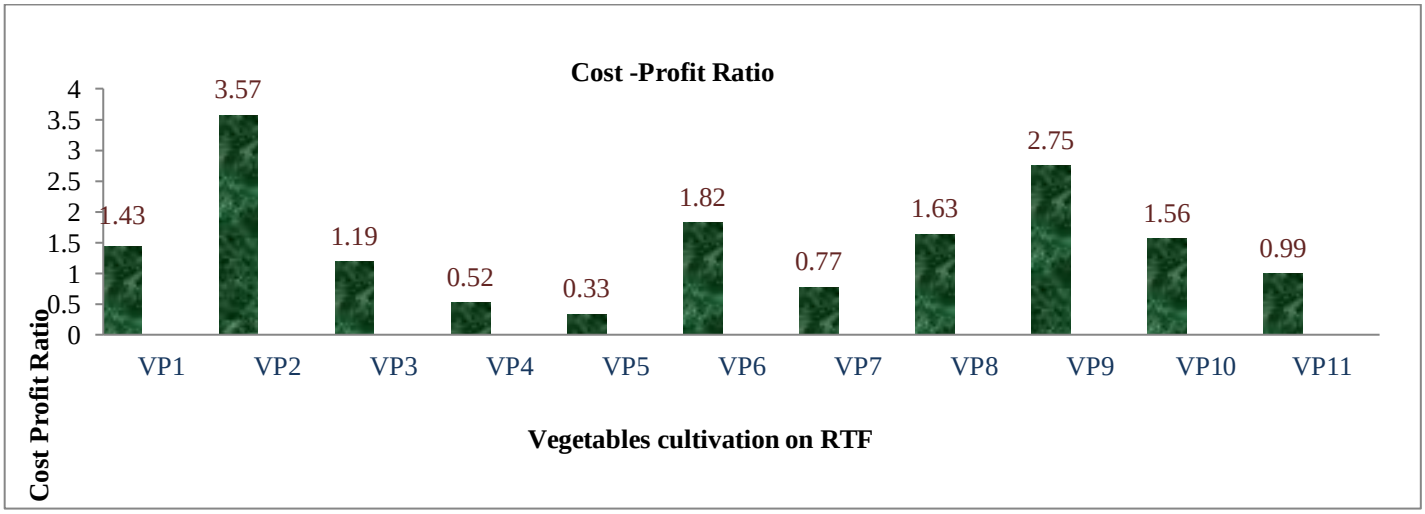


**Fig. 3. 7 Cost-profit ratio for vegetable cultivation on RTF.**

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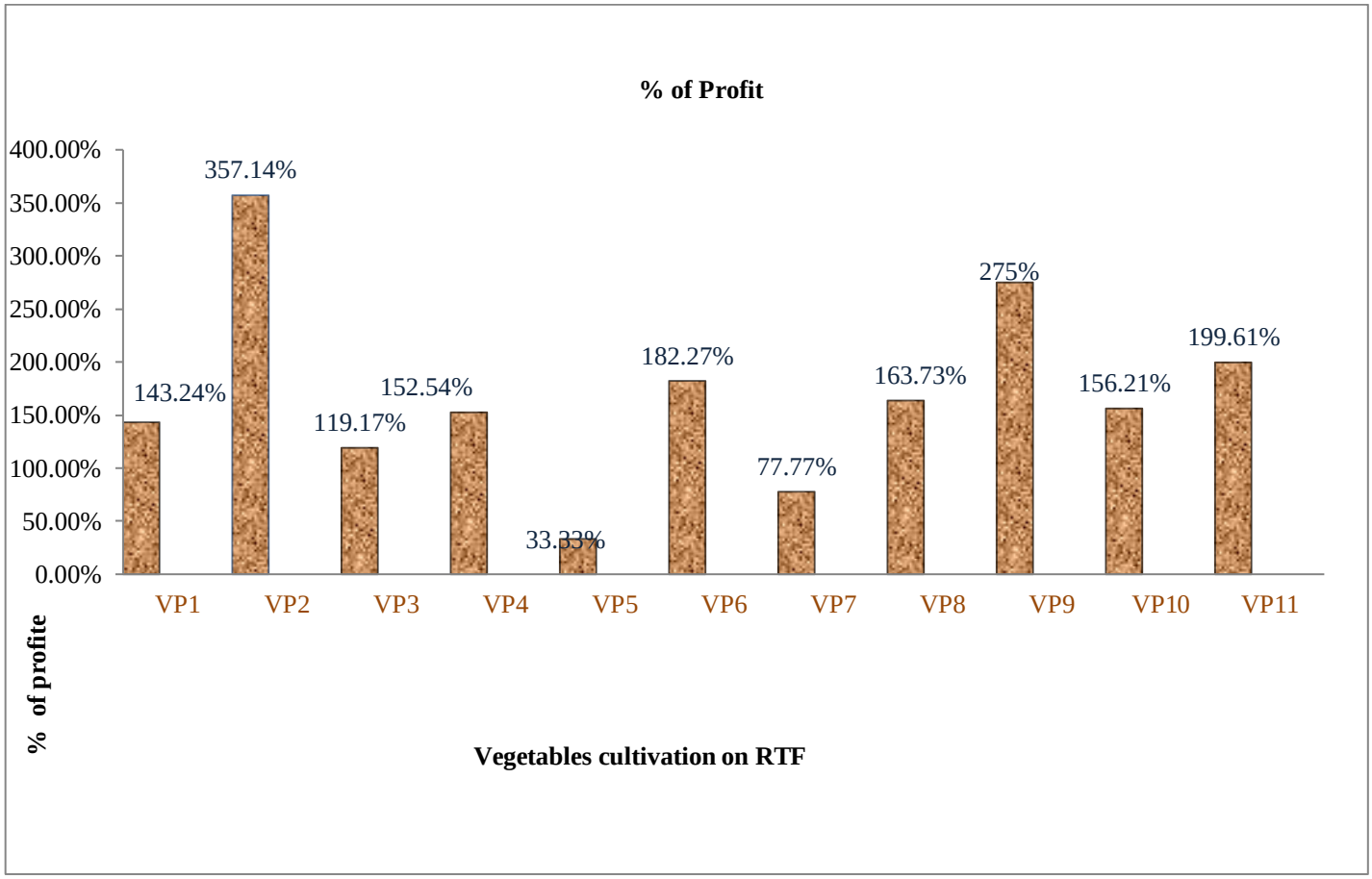


**Fig. 3. 8 Percentage (%) of profit for vegetable cultivation on RTF.**

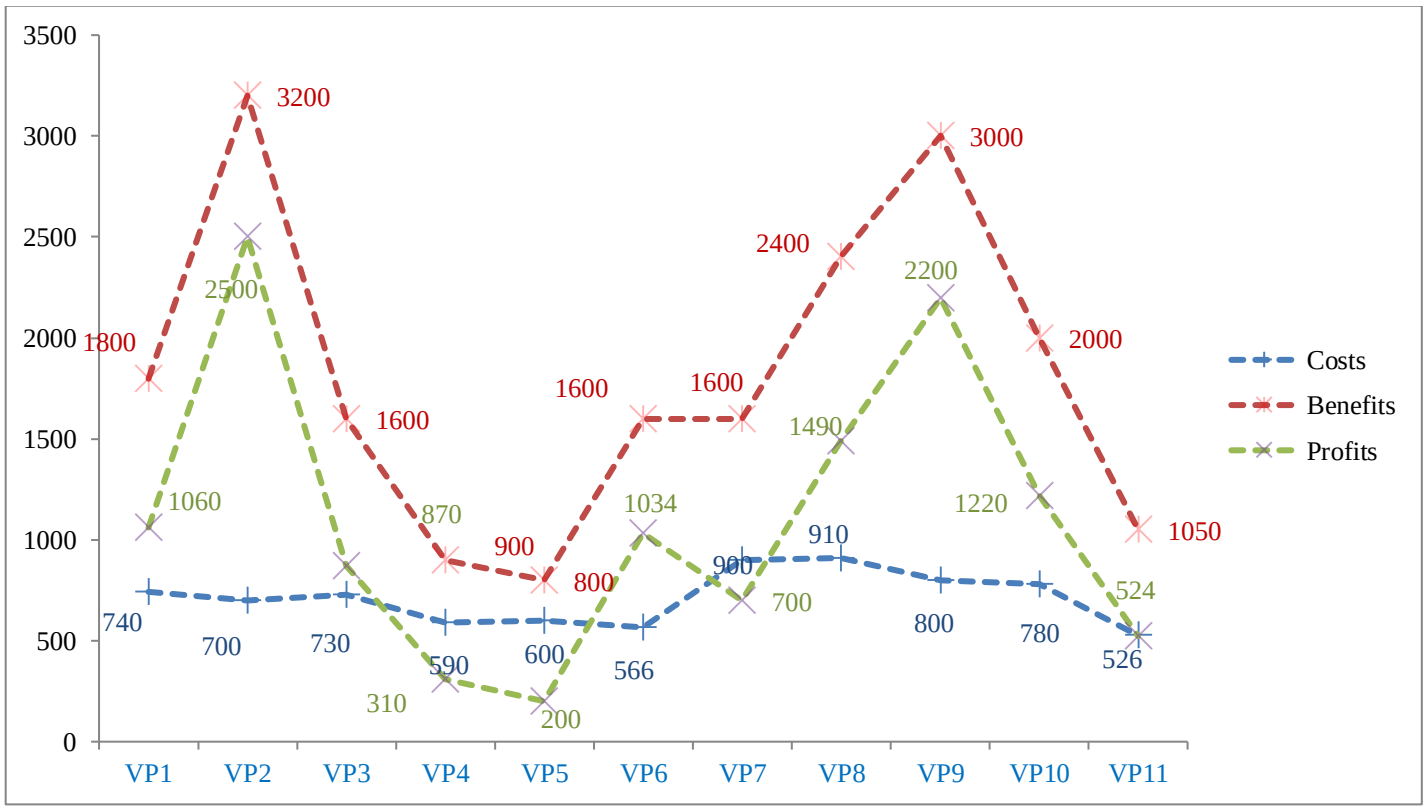


**Fig. 3. 9 Cost, benefit and profit for vegetable cultivation on RTF.**

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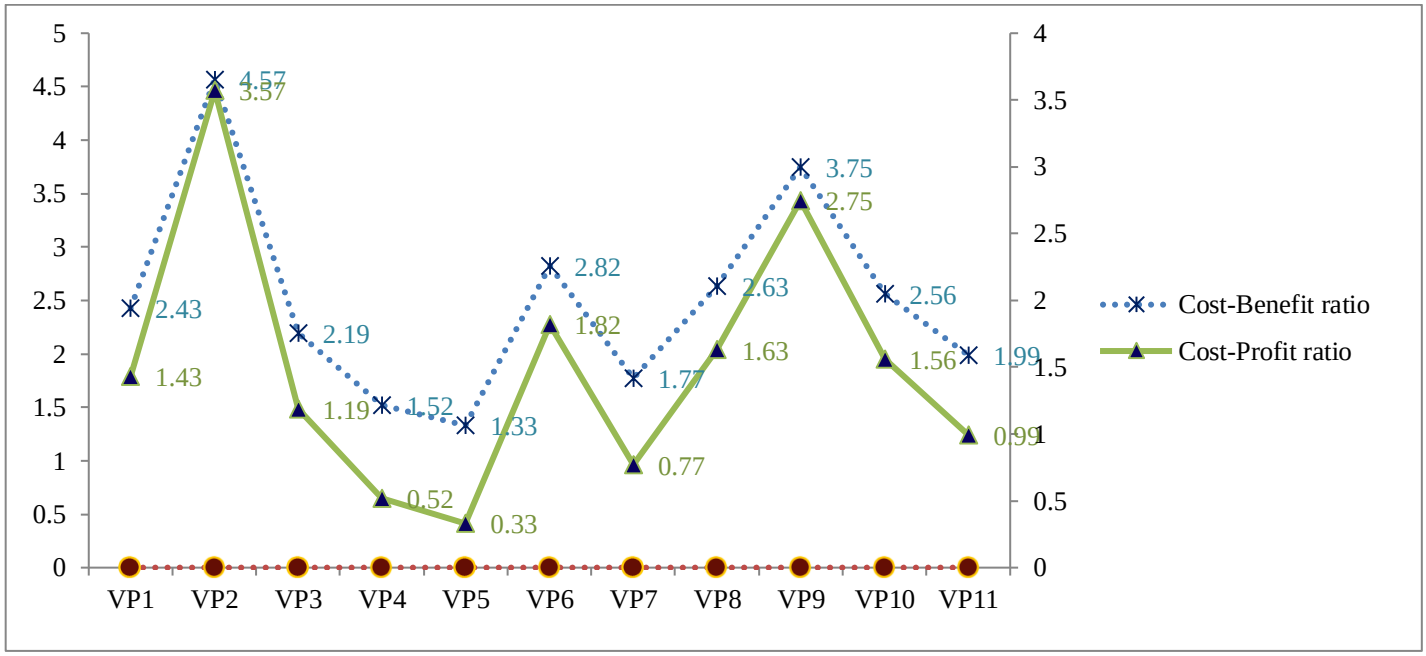


**Fig. 3. 10 Cost-benefit ratio and cost profit ratio vegetable cultivation on RTF.**

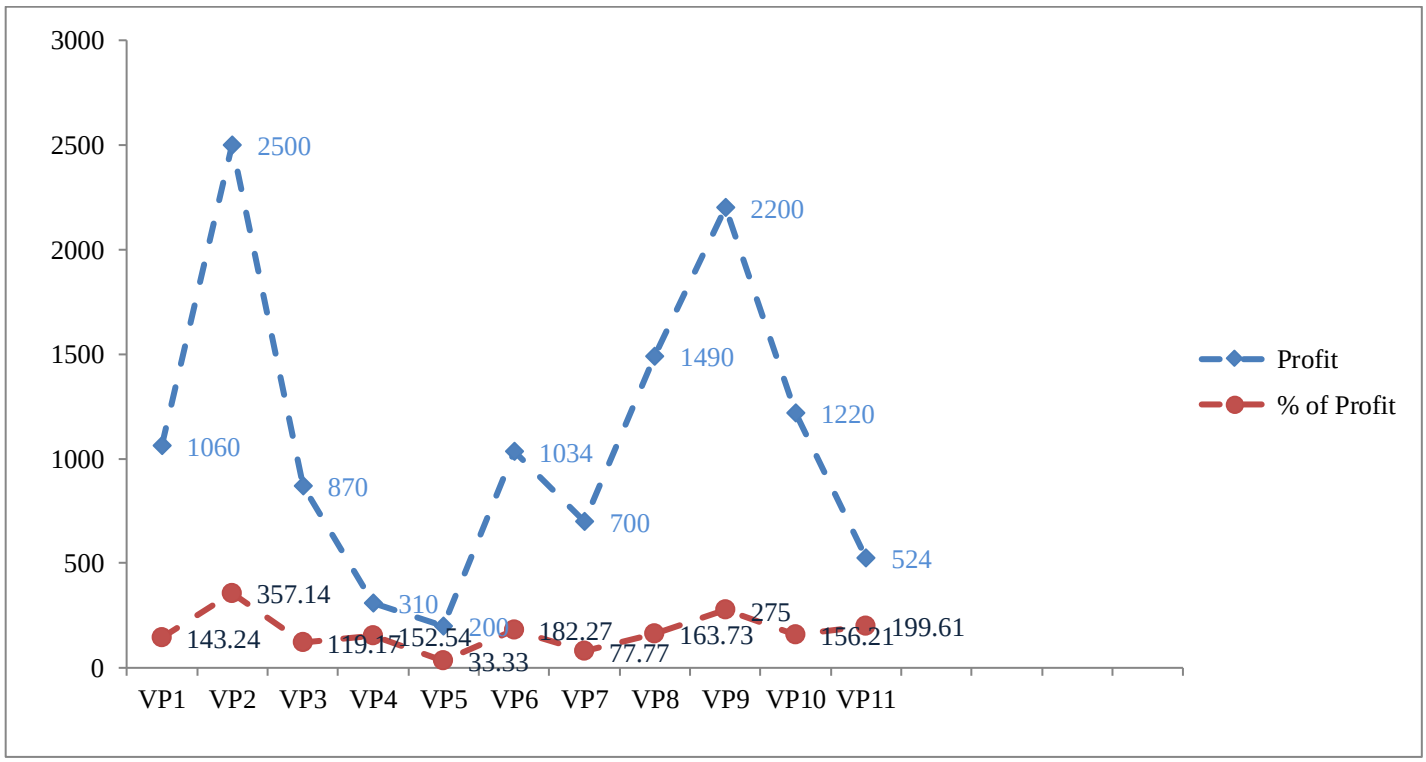


**Fig. 3. 11 Comparison of profit and % of profit for vegetable cultivation on RTF.**

## DISCUSSION

Calculated the expenses of vegetable cultivation for 10 plants and pots grown had tabulated sampling of 11 type of vegetable4 plants grown in RTF express in the table -1,These were denoted vegetable plants (VP) and numerical form up to 11 common plants VP1,VP2,VP3...VP11 and explained the sources of expenses cost for Grow bag, soil, compost, bio-fertilizer, water supply, seed, seedling, propagules, planted materials labour cost has essential for the RTF (Table 3.1).The study discussion of the cost, profit, cost-profit ratio and the percentage of profit from the growing vegetable of the RTF. According to data VP2 (*Cucurbita maxima*) having high profit rate rupees 2500 of cost700 and the benefit 3200 per 10 plants. However VP11 (*Raphanus sativous)* highest profit rupees 524 in the sense of cost 526 and the benefit 1050. (Table 3.2) express the data of cost of cultivation

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,benefit after the sale and amount of profit, cost-benefit ratio and the cost-profit ratio and the percentage of profit of 11 essential vegetables studied. Fig 3.1 presents costing of the vegetable cultivation which are the benefit of the pants, the benefit of the vegetable showing in (Fig 3.2) which have VP2 rupees 3200 and VP9 rupees 30highest among them. Further Profit and benefit recorded respectively (Table 3.3 &3.4).The study of cost–benefit ratio of cultivated plants VP2-4.57,VP9-375,VP6-2.82 and VP8-2.63.Next to the (Fig 3.7) presented Cost–profit ratio of vegetable VP2-3.57,VP9-2.76 and VP6-1.82.respectivly.The calculation of % of profit has been reported in terms of Percentage of cost by the Profit (Fig 3.8) highly profited vegetables has VP2,VP9,VP11,VP6.(Fig-3.9) explore the data of cost-benefit and the profit given by vegetable plants gown on RTF. Comparison of Cost-Benefit ratio and Cost-Profit ratio of growing vegetables has 4.57 and 3.57 VP2, respectively. 3.76 and2.75 VP9 (Fig 3.10).Profit and Percentage of profit of different vegetable plants has different. Finally highly profitable vegetable growing by most of the city farmers on rooftop farming..

## CONCLUSSION

Various type of Vegetables cultivated on the RTF on the basis of profit making such as VP2, VP9, VP6 etc. The profit depends upon the production, market value and demand. The vegetables demand increase by the consumer choice and organic vegetable because of present of high nutritive value. Different season has different demand and the price id altered accordingly. Best choice of vegetable cultivation as per the demand and price. So the choice have vegetables plants are important for RTF. High profit vegetable cultivation has played an crucial rule for perception and economic growth of urban farmers. For that has cultivation of vegetable on RTF. The cost–benefit ratio analysis of rooftop farming vegetables cultivated plants need to choice of plants being cultivated on rooftop farming.

### Conflict of Interest

This original research article has the partial work of Ph.D thesis of author in Bhubaneswar city in India, The funding of this research had spent by author. No any conflict of interest has been occurred in this to published article.

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