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Sustainability of vegetable production in Akola district

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Abstract

Vegetables play an important role in both the regional and national economy of the agriculture sector. India continues to be the second largest producer of vegetables in the world next to China. The present study of Sustainability of Vegetable Production in Akola District was carried out during the year 2017-2018. The primary data of 60 growers were collected from six tahsils for onion, brinjal and tomato growers. Collected data was using simple tabular analysis worked out by using standardized cost concept by CACP i.e. cost-A₁, A₂, cost-B₁, B₂, cost-C₁, C₂ and benefit-cost ratio and sustainability value index (SVI). Per hectare cost of cultivation of onion, brinjal and tomato was ₹ 65612.35, ₹ 111635.17 and ₹ 128526.01, respectively. Per hectare profit in onion, brinjal and tomato cultivation was ₹ 111812.03, ₹ 201850.18 and ₹ 221736.89, respectively. The benefit cost ratio of selected vegetable at cost 'C' was higher in brinjal i.e. 2.74, followed by tomato 2.73 and onion 2.70 respectively. per hectare yield of onion, brinjal and tomato was 211.85 q, 270.45 q and 281.76 quintals respectively, and farmer received rate per quintal was ₹ 837.50, ₹ 1174.13 and ₹ 1243.13. The sustainability value index of vegetable production is observed that most sustainable in brinjal i.e. 0.45 followed by tomato 0.44 and onion 0.32 respectively. Hence it is concluded that brinjal vegetable production is profitable and sustainable as compared to onion and tomato.

Keywords: Onion, brinjal, tomato, sustainability value index, B:C ratio

Introduction

Vegetables play an important role in both the regional and national economy of the agriculture sector. These crops are generally of short duration hence more than once this crop can be raised on the basis of early, medium and late duration varieties. India continues to be the second largest producer of vegetables in the world next to China. In India, vegetable crops are grown in open field. During 2016-2017 in India area and production of vegetables was 10238 thousand ha, and 178172 metric tonnes. Maharashtra is leading state in vegetable cultivation. Its area under vegetable cultivation during 2016-2017 was 572 thousand ha and production was 9043 metric tonnes. West Bengal is highest in vegetable production in India. (Indian horticulture database 2017, National Horticulture Board).

The onion (*Allium cepa* L.) belongs to family Liliaceae. It is one of the most important commercially vegetable crops grown in India. Onion in India cultivation during 2016-17 was 1306 thousand ha and production was 22427 metric tonnes, and Maharashtra area was 471.66 thousand ha and production was 6773.08 metric tonnes. Brinjal or eggplant (*Solanum melongena* L.) is an important solanaceous crop of sub-tropics and tropics. Brinjal in India cultivation during 2016-17 was 733 thousand ha and production was 12510 metric tonnes, and Maharashtra area was 22.14 thousand ha and production was 433.28 metric tonnes. Tomato (*Lycopersicon esculentum* Mill.) is an important solanaceae family crop it is originated by native of tropical America. Tomato in India cultivation during 2016-17 was 797 thousand ha and production was 20708 metric tonnes, and Maharashtra area was 43.64 thousand ha and production was 957.17 metric tonnes. The area and production of vegetables is increasing day by day due to its popularity.

Objectives

1. To examine profitability of selected vegetable.
2. To find out sustainability in vegetable production.

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Methodology

For the present study the Akola district was selected considering the maximum area under vegetable cultivation in Akola District. Multistage sampling design was adopted in selection of district, tahsils, villages and selected onion, brinjal and tomato growers. The separate list of onion, brinjal and tomato growers was obtained from each village and five onion, brinjal and tomato growers were selected randomly from each village. Thus, 20 onion, 20 brinjal and 20 tomato growers were selected for study. The data were calculated from 60 selected vegetable growers in the year 2017-18.

Techniques of data analysis

Collected data was further tabular and analysed for fulfilment of different objective of study. The sustainability of vegetable production was using simple tabular analysis worked out by using standardized cost concept by CACP i.e cost-A₁, cost-B₁, B₂, cost-C₁, C₂, benefit- cost ratio and sustainability value index (SVI).

Sustainability value index (SVI) was calculate using the formula,

$$SVI = \frac{ANI - (1.96 \times SD)}{MNI}$$

$$CV = SD \times 100/ANI$$

Where,

SVI = Sustainability value index

ANI = Average net income

MNI = Maximum net income

SD = Standard deviation

CV = Coefficient of variation

The value of SVI calculated by this formula lies between 0 to 1. A value of SVI near to one gives that model is sustainable.

Results and Discussion

Examine profitability of selected vegetable

Per hectare average input utilization for onion, brinjal and tomato production

To obtain highest yield it is necessary to make optimum use of inputs such as seed, manures, fertilizers, human labour, bullock labour etc. Therefore it is felt necessary to study on various levels of input used during crop production. The information regarding per hectare input utilization for onion, brinjal and tomato is presented in table 1. The hired male and female labour utilization on onion, brinjal and tomato was 2.03, 3.40, 3.52 days and 19.25, 24.31 and 41.17 days respectively. From the above it is seen that, the utilization of hired male and female labour increases with increases in the size of holding. The utilization of bullock labour per hectare for onion, brinjal and tomato of selected holding was 5.09, 10.79 and 15.14 pair days respectively. From this, it was revealed that in case of onion farmers, bullock labour was used comparatively less than brinjal and tomato farmers and bullock labour utilization replaced by machinery power on the farm. The utilization of machinery (Hrs.) per hectare was 6.38, 7.84 and 5.14 hrs for onion, brinjal and tomato respectively. From this it was revealed that, in case of tomato farmers machinery used were comparatively less than onion and brinjal farmers. The quantity of seed used increased with the increased size of holding. It was onion i.e. 10 kg, followed by brinjal 198 gm and tomato 180 gm respectively. The per hectare manure utilization for onion, brinjal and tomato was 11.48, 13.18 and 15.00 quintals respectively. Similar results were reported by Lokapur *et al.* (2014) [2].

Table 1: Average input utilization for onion, brinjal and tomato production. (Unit/ha)

| Sr. No. | Particular | Unit | Onion | Brinjal | Tomato |
|---------|---------------------|----------|--------|------------|---------|
| | | | Input | | |
| 1 | Hired human labour | M. day | 2.03 | 3.40 | 3.52 |
| | | F. day | 19.25 | 24.31 | 41.17 |
| 2 | Bullock labour | pair day | 5.09 | 10.79 | 15.14 |
| 3 | Machine labour | hour | 6.38 | 7.84 | 5.14 |
| 4 | Seeds | kg/ gm | 10. kg | 197.72, gm | 180, gm |
| 5 | Manure | q | 11.48 | 13.18 | 15.00 |
| 6 | Fertilizers | kg | 136.48 | 170.68 | 202.65 |
| 7 | Plant protection | ml | 200 | 505.68 | 505.88 |
| 8 | Irrigation | No | 11.45 | 12.30 | 13.45 |
| 9 | Family human labour | M. day | 48.79 | 88.29 | 102.79 |
| | | F. day | 31.29 | 62.50 | 79.55 |

From the above table it is seen that, the utilization of manures is tomato high. The application of fertilizers per hectare in terms of overall in case of onion, brinjal and tomato was 136.48 kg, 170.68 kg and 202.65 kg, respectively. The use of plant protection chemicals were on paid for the onion, brinjal and tomato crops i.e. 200 ml, 505.68 ml and 505.88 ml per hectare for respectively. In case of irrigation showed that for onion, brinjal and tomato farmers respectively. Number of average irrigation given by onion, brinjal and tomato farmers was 11.45, 12.30 and 13.45 respectively. The family male and female labour utilization on onion, brinjal and tomato was 48.79, 88.29, 102.79 day and 31.29, 62.50, 79.55 days respectively.

Cost of cultivation of onion, brinjal and tomato

To workout gross returns at various cost concepts, Benefit-Cost ratio and net returns over various costs it is necessary to workout cost of cultivation of onion, brinjal and tomato. The per hectare average cost incurred on the production of vegetables for onion, brinjal and tomato has been worked out and is presented in Table 2.

From table no. 2 it is observed that the per hectare average cost 'A₁' of vegetable production was worked out to be ₹ 21593.84, ₹ 31646.08 and ₹ 37599.75 for onion, brinjal and tomato respectively. Where, as Cost 'B₂' was ₹ 51232.72, ₹ 84626.07 and ₹ 96033.41 for onion, brinjal and tomato respectively. and Cost 'C₂' was ₹ 65612.35, ₹ 111635.17 and ₹ 128526.01 for onion, brinjal and tomato farmers respectively. Results are in conformity with study made by Bala *et al.* (2011)

Among the different items of the cost rental value of the land stood at first position i.e. 44.97 per cent, 47.34 per cent and 45.37 per cent for onion, brinjal and tomato cultivation respectively, followed by Total working capital cost was 31.97 per cent, 25.59 per cent and 28.49 per cent on onion, brinjal and tomato cultivation. Family human labour stood at third rank which was 19.33 per cent, 21.80 per cent and 23.34 per cent respectively on farms. Since onion brinjal and tomato

of the costs are indirect cost, producer enjoyed more profit in the crops.

The different items of working capital, on onion machine charge was maximum which was 5.84 per cent of total cost followed by seed (5.59%), Hired human labour charge (4.90%), plant protection cost (4.88%), Fertilizer cost (3.95%), Bullock labour charge (3.33%), irrigation charge (1.75%) and manure cost (1.75%).

Table 2: Per hectare item wise expenditure in onion, brinjal and tomato cultivation (₹/ha)

| Sr. No. | Particular | Onion | | Brinjal | | Tomato | |
|---------|----------------------------------|---------------|-------|---------------|-------|---------------|-------|
| | | Amount (₹/ha) | % | Amount (₹/ha) | % | Amount (₹/ha) | % |
| I | Variable cost | | | | | | |
| 1 | Hired human labour. M/ F | 296.29 | 0.45 | 681.81 | 0.61 | 705.88 | 0.55 |
| | | 2916.67 | 4.45 | 3647.73 | 3.27 | 6176.47 | 4.81 |
| 2 | Bullock labour | 2185.19 | 3.33 | 5397.73 | 4.84 | 6352.94 | 4.94 |
| 3 | Machine charges | 3833.33 | 5.84 | 4704.55 | 4.21 | 3088.24 | 2.40 |
| 4 | Seed | 3661.11 | 5.58 | 2195.45 | 1.97 | 5157.65 | 4.01 |
| 5 | Manure | 1148.15 | 1.75 | 1318.18 | 1.18 | 1500.00 | 1.17 |
| 6 | Fertilizer | 2588.52 | 3.95 | 3532.50 | 3.16 | 4201.39 | 3.27 |
| 7 | Plant protection | 3200.00 | 4.88 | 8090.91 | 7.25 | 8094.11 | 6.30 |
| 8 | Irrigation charges | 1145.00 | 1.75 | 1230.00 | 1.10 | 1345.00 | 1.05 |
| | Total working capital (Σ 1 to 8) | 20974.26 | 31.97 | 30798.86 | 27.59 | 36621.68 | 28.49 |
| 9 | Interest on working Capital @ 7% | 489.40 | 0.75 | 718.64 | 0.64 | 854.51 | 0.66 |
| II | Fixed cost | | | | | | |
| 10 | Land revenue | 62.03 | 0.09 | 72.27 | 0.06 | 67.05 | 0.05 |
| 11 | Depreciation on capital assets | 68.15 | 0.10 | 56.31 | 0.05 | 56.51 | 0.04 |
| 12 | Cost-A ₁ (Σ 11) | 21593.84 | 32.91 | 31646.08 | 28.35 | 37599.75 | 29.25 |
| 13 | Rental value of land | 29508.70 | 44.97 | 52851.41 | 47.34 | 58310.10 | 45.37 |
| 14 | Cost-B ₁ (Σ 12-13) | 51102.54 | 77.89 | 84497.49 | 75.69 | 95909.85 | 74.62 |
| 15 | Interest on fixed capital @ 10% | 130.18 | 0.20 | 128.58 | 0.12 | 123.56 | 0.10 |
| 16 | Cost-B ₂ (Σ B1-15) | 51232.72 | 78.08 | 84626.07 | 75.81 | 96033.41 | 74.72 |
| 17 | Family human labour. M/ F | 9685.19 | 14.76 | 17659.10 | 15.82 | 20558.80 | 16.00 |
| | | 4694.44 | 7.15 | 9350.00 | 8.38 | 11933.80 | 9.29 |
| 18 | Cost-C ₁ (Σ B1-17) | 65482.17 | 99.80 | 111506.59 | 99.88 | 128402.45 | 99.90 |
| 19 | Cost-C ₂ (Σ B2-17) | 65612.35 | 100 | 111635.17 | 100 | 128526.01 | 100 |

In case of brinjal cultivation, among different items of working capital, on plant protection was maximum which was 7.25 per cent of total cost followed by Bullock labour charge (4.84%), machine charge (4.21%), Hired human labour charge (3.88%), Fertilizer (3.16%), seed (1.97%), manure cost (1.18%) and irrigation charge (1.10%). In tomato cultivation, among different items of working capital, on plant protection cost was maximum which was 6.30 per cent of total cost followed by Hired human labour charge (5.36%), Bullock labour charge (4.94%), seed cost (4.01%), Fertilizer cost (3.27%), machine charge (2.40%), manure cost (1.17%) and irrigation charge (1.05%).

The hired human labour charges were less because of availability of sufficient family human labour. The family human labour charge contributes 21.97 per cent, 24.20 per cent and 25.29 per cent in the total cost of cultivation in onion, brinjal and tomato respectively. The cost of cultivation of onion, brinjal and tomato i.e. ₹ 65612.35, ₹ 111635.17 and ₹ 128526.01 respectively.

Profitability of onion, brinjal and tomato production

It is revealed from Table. 3 that, the per hectare yield of onion, brinjal and tomato was 211.85 q, 270.45 q and 281.76 quintals respectively, and farmer received rate per quintal was ₹ 837.50, ₹ 1174.13 and ₹ 1243.13, onion, brinjal and tomato respectively. The gross returns onion, brinjal and tomato were

obtained i.e. ₹ 177424.38, ₹ 317542.11 and ₹ 350262.90 while total cost of cultivation was ₹ 65612.35, ₹ 111635.17 and ₹ 128526.01 respectively. The share of cost-A₁ and cost-B₂ in cost-C₂ was ₹ 21593.84 and ₹ 51232.72 in onion cultivation, ₹ 31646.08 and ₹ 88682.82 brinjal cultivation while ₹ 37599.75 and ₹ 96033.41 in tomato cultivation respectively. Similar results were obtained by Meena *et al.* (2016) [5].

The various measures of income were worked out at particular cost level and are also presented in Table 3. Farm business income (gross return-cost- A₁) on the farm i.e. onion, brinjal and tomato was ₹ 155830.54, ₹ 285896.03 and ₹ 312663.15 respectively. The farm business income is low cost of family human labour. Family labour income i.e. (gross return- cost-B₂) was estimated to ₹ 126191.66, ₹ 228859.28 and ₹ 254229.49 on onion, brinjal and tomato respectively. The net profit i.e. (gross return- cost-C₂) was arrived at ₹ 111812.03, ₹ 201850.18 and ₹ 221736.89 in onion, brinjal and tomato respectively. With output - input ratio of onion, brinjal and tomato was, i.e. 2.70, 2.74 and 2.73 respectively. It means that by an investment of ₹ 1 in onion cultivation, producer enjoyed a net profit of ₹ 1.70, brinjal cultivation net profit ₹ 1.74 whereas, in case of tomato cultivation, by investment and Rs. 1 as cost, producer enjoyed ₹ 1.73 as net profit.

Table 3: Per hectare profitability of onion, brinjal and tomato cultivation. (Rs/ha)

| Sr. No | Particular | Onion | Brinjal | Tomato |
|--------|--|-----------|-----------|-----------|
| 1 | Yield (qt) | 211.85 | 270.45 | 281.76 |
| 2 | Rate per quintal (₹) | 837.50 | 1174.13 | 1243.13 |
| 3 | Gross returns (₹) | 177424.38 | 317542.11 | 350262.90 |
| 4 | Cost-A ₁ | 21593.84 | 31646.08 | 37599.75 |
| 5 | Cost-B ₂ | 51232.72 | 88682.82 | 96033.41 |
| 6 | Cost-C ₂ | 65612.35 | 115691.92 | 128526.01 |
| 7 | Farm Business income (Gross returns minus Cost-A ₁) | 155830.54 | 285896.03 | 312663.15 |
| 8 | Family labour income (Gross returns minus Cost-B ₂) | 126191.66 | 228859.28 | 254229.49 |
| 9 | Net profit (Gross returns minus Cost-C ₂) | 111812.03 | 201850.18 | 221736.89 |
| 10 | Output-Input ratio (Gross returns divided by Cost-C ₂) | 2.70 | 2.74 | 2.73 |
| 11 | Per quintal cost of cultivation (Cost-C minus by produce value divided by main produce) | 309.71 | 427.78 | 456.15 |

It indicated that cultivation of onion, brinjal and tomato crops is more profitable because in rabbi and summer season, generally supply of vegetable reduce and due to low or unavailability of water and therefore producer can received more prices. Per quintal cost of cultivation in case of onion, brinjal and tomato was ₹ 309.71, ₹ 427.78 and ₹ 456.15. The per hectare profit from production of onion, brinjal and tomato was ₹ 111812.03, ₹ 201850.18 and ₹ 221736.89.

Sustainability value index of onion, brinjal and tomato

Sustainability value index is used to evaluate sustainability of onion, brinjal and tomato crops. The Sustainability Value Index was worked out and presented in table 4.

Table 4: Sustainability value index of onion, brinjal and tomato.

| Vegetables | ANI (₹) | MNI (₹) | CV (%) | SVI |
|------------|----------|-----------|--------|------|
| Onion | 47072.50 | 143650.00 | 6.09 | 0.32 |
| Brinjal | 68463.16 | 151287.50 | 3.54 | 0.45 |
| Tomato | 38505.50 | 85575.00 | 2.49 | 0.44 |

In above table it is observed that Maximum Net Income (MNI) highest in brinjal i.e. ₹ 151287.50, followed by ₹ 143650.00 onion and ₹ 85575.00 tomato respectively. Highest Average Net Income (ANI) brinjal i.e. ₹ 68463.16, followed by ₹ 47072.00 onion and ₹ 38505.50 tomato respectively. Results are in conformity with study made by Bhoge *et al.* (2014) [1]. The value of Sustainability Value Index (SVI) near to one gives that model is sustainable and value near to zero gives that Model is not sustainable. In SVI of Brinjal vegetable production is highest i.e. 0.45, followed by tomato 0.44 and onion 0.32 respectively.

Conclusions

The following broad conclusions are drawn from the present study:

1. Per hectare use of family male and female labour was maximum on onion, brinjal and tomato farms were 80.08, 150.79 and 182.34 man days respectively.
2. Per hectare cost of cultivation of onion, brinjal and tomato was ₹ 65612.35, ₹ 111635.17 and ₹ 128526.01, respectively.
3. Per hectare profit in onion, brinjal and tomato cultivation was ₹ 111812.03, ₹ 201850.18 and ₹ 221736.89, respectively.

4. The benefit cost ratio of selected vegetable at cost 'C' was higher in brinjal i.e. 2.70, followed by tomato 2.74 and onion 2.73 respectively.
5. The sustainability value index of vegetable production is observed that most sustainable in brinjal i.e. 0.45 followed by tomato 0.44 and onion 0.32 respectively.

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