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Impact analysis of university released onion varieties on farm economy

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Abstract

In this study, impact analysis of university released onion varieties was analysed and quantified using Partial budgeting approach. For this purpose, varieties released by the Onion Research station Pimpalgaon Baswant, Nashik and Scheme for Research on onion storage Department of Horticulture, Mahatma Phule Krishi Vidyapeeth Rahuri have been considered as they were appreciably performing with increasing adoption over time. The total additional cost (direct + indirect) of university released varieties over other competing varieties was observed to be Rs. 25079.75 per hectare. However, the reduced costs (or saving) and added returns due to university released varieties over other competing varieties was Rs. 71445.47 Thus, the total economic worthiness of university released onion production technology over other competing varieties of onion in the region was Rs. 46365.72 per hectare for the year 2019-20. The gross and net economic impact of onion variety to the farming community in Maharashtra state for 18 years (2002-03 to 2019-2020) was Rs. 44957.34 crores and Rs. 4685.87 crores, respectively. Therefore, it is advocated that government may allocate substantial funds for research and extension in onion crop.

Keywords: Onion, economic impact, partial budgeting

Introduction

Onion is an important commercial vegetable crop in India. The area, production and productivity of onion in the World were 5.1 Mha 99.94 Mt and 19.4 t/ha respectively for the year 2019 (FAO Website). India is the 2nd largest producer of onion, in the World next only to China but the productivity of onion in India is very low i.e. 17.01 tonne/ha as compared to China and other countries like, Egypt, Netherlands and Iran etc. However, the onion productivity was very low in India as compared to other countries, India ranks 7th in the onion productivity. Major states producing onion are Maharashtra, Karnataka, Gujarat, Madhya Pradesh, Andhra Pradesh, Odisha and Uttar Pradesh in India. The Maharashtra state ranks first in area and production of onion in the country, contributing nearly one third area and production of onion in the country. However, Maharashtra state was far behind in onion productivity as compared to other states of India.

However, in case of productivity Gujarat ranks first and Maharashtra ranks fifth in productivity of onion. This was true in onion production of Maharashtra, as a result this crop continues to be the focus of attention for politician, policy makers, academicians and others. Maharashtra has made significant progress in the production of onion during the past three decades. In Maharashtra MPKV, Rahuri has released remarkable varieties of onion viz., Baswant-780, N-53, N-2-4-1, Phule Safed, Phule Suvarna, Phule Samarth etc., to increase the productivity which are tolerant to drought. These varieties are responsible for the socio-economic and political changes in the farming communities in Maharashtra. In this context, it was imperative to examine the impact of university released onion varieties on income generation. It was revealed from the study that, the university released onion varieties were dominant in farmers filed and contributing nearly 60 per cent area to the total area under onion in western Maharashtra. Among the different university released onion varieties.

Selection of Study Area

In Maharashtra area under onion is dominantly covered by the varieties released by Onion research station, Pimpalgaon Baswant and Scheme for Research on onion storage Department of Horticulture, Mahatma Phule Krishi Vidyapeeth Rahuri. So, these two research schemes were purposively selected for the study. Both primary and secondary data were used for the study. The data regarding research and extension expenditure and out-come on agriculture

research on onion crop was collected from the financial records of research station.

Sources of Data

The primary data regarding research investment, outcome of onion and seed cell was taken from Onion research station, Pimpalgaon Baswant and Scheme for Research on onion storage Rahuri research unit. The year wise data regarding i) expenditure on research (ii) expenditure on pay and contingency (iii) expenditure on agriculture district wise development and extension etc. was collected and used in the analysis of the present study. The cost of cultivation of onion was collected from official record of state cost of cultivation scheme.

Analytical Tools Partial budgeting

Partial budgeting framework in farm management economics provides a simple, convenient, transparent, objective methodology where scientists who generated the technologies can find the economic impact of their innovation with the help of economists. Partial budgeting is a basic method designed to evaluate the economic consequences of minor adjustments in a farming business. This tool specifically focuses on the implications of the intended change in a business operation by comparing the benefits and costs resulting from implementing the alternative with respect to the current practice. Partial budgeting is a planning and decision-making framework that is used to compare the costs and benefits of alternatives faced

by a farm business. It focuses only on the changes in income and expenses that would result from implementing a specific alternative. Partial budgeting technique was used to capture the economic impact of the university released onion varieties. There are four components in partial budgeting. First, the added costs due to the new variety are considered. This includes list of all increased expenses due to new variety over the counterfactual (or control). In this study the control or check variety of onion was local variety. The second component was the reduced returns or reduced income due to new variety in relation to the counterfactual. The third component was the reduced costs due to new variety over the counterfactual which include reductions of certain expenses such as seed, bullock labour cost. The fourth component was the added income due to the new variety over the counterfactual, due to increase in yield. The third and fourth component added to the 'returns side' or the credit side of the partial budget. The final step in partial budget was the summary indicated by the difference between the credit and the debit. The onion varieties were released from the year 1986 onwards. However, the majority and prominent varieties of onion were released after the 1989.

Results and Discussion

Area, Production, and Productivity of onion

The information on state wise area, production and productivity of onion for the year 2018-19 is presented in Table1.

Table 1: Area, Production and Productivity of onion in India (2018-19)

| Sr. No | State | Area | Production | Productivity |
|--------|----------------|----------------|-----------------|--------------|
| 1 | Maharashtra | 444.37 (35.19) | 8047.14 (34.26) | 181.90 |
| 2 | Madhya Pradesh | 148.71 (11.78) | 3714.79 (15.82) | 249.80 |
| 3 | Karnataka | 190.52 (15.09) | 2645.61 (11.27) | 138.86 |
| 4 | Bihar | 61.03 (4.83) | 1403.03 (5.97) | 229.88 |
| 5 | Rajasthan | 70.48 (5.58) | 1388.42 (5.91) | 196.99 |
| 6 | Gujarat | 44.33 3 (3.51) | 1111.09 (4.73) | 250.64 |
| 7 | Andhra Pradesh | 45.32 (3.59) | 970.55 (4.13) | 214.16 |
| 9 | Haryana | 32.01 (2.53) | 696.92 (2.97) | 217.72 |
| 10 | West Bengal | 35.28 (2.79) | 638.38 (2.72) | 180.95 |
| 11 | Uttar Pradesh | 26.90 (2.13) | 440.38 (1.88) | 163.71 |
| 12 | Others | 163.88 (12.98) | 2428.77 (10.34) | 148.20 |
| 13 | India | 1262.83 100 | 23485.07 100 | 185.97 |

(Area –000 ha, Production – 000 tons and Productivity- qtls/ha)

Source: Ministry of Agriculture and Farmers welfare, Govt. of India, 2018-19.

(Fig in the parentheses indicates percentage to the total India) Table 1. indicates that the maximum onion production takes place in Maharashtra (8047.14 thousand tonne) state followed by Madhya Pradesh (3714.79 thousand tonnes.), Karnataka (2645.61 thousand tonnes), Gujarat (1111.09 thousand tonnes.), Bihar (1403.16 thousand tonnes.), and Andhra Pradesh (970.55 thousand tonne). In India Maharashtra, Madhya Pradesh and Karnataka states nearly contributed more than 60 per cent in area and production of onion in 2018-19. The Maharashtra state ranks first in area and

production of onion in the country, contributing nearly one third area and production of onion in the country. However, Maharashtra state was far behind in onion productivity as compared to other states of India. Gujarat state ranks first (25.06 t/ha) in productivity followed by Madhya Pradesh (24.98 t/ha) and Bihar (22.29 t/ha).

In Maharashtra the farmers cultivate onion throughout the year even though there was a much fluctuations in the prices of onion. The onion productivity is low in Kharif season than rabi season. This might be the reason of low productivity of onion in Maharashtra besides the natural calamities.

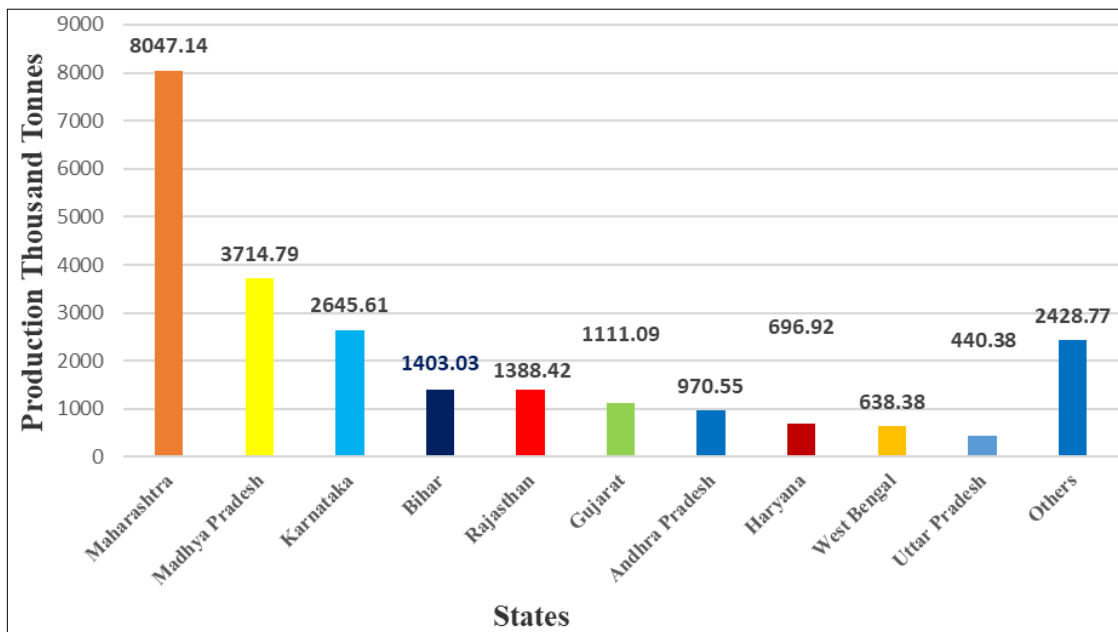


Fig 1: State-wise production of onion (2018-19)

Varietal status of onion

A large number of onion varieties have been developed by different Universities and Institutes in India for cultivation in different regions and also in different seasons. The varieties commonly available to farmers for cultivation of onion are the varieties developed by NHRDF, Nasik, Maharashtra and some important onion varieties released by MPKV, Rahuri.

However, the onion varieties released by two research schemes i.e., Onion research scheme Pimpalgaon, Baswant and Onion storage scheme, MPKV Rahuri, are presented in Table No.2 The varieties viz., Baswant-780 and N-2-4-1 were very old varieties released in the year 1986 and 1987 respectively

Table 2: Onion varieties released MPKV, Rahuri

| Sr. No | Varieties | Kharif/Late kharif/Rabi | Released year | Research Station |
|--------|---------------|-------------------------|---------------|--|
| 1 | Baswant -780 | Kharif/late kharif | 1986 | Onion Research Station, Pimpalgaon Baswant, Nashik |
| 2 | N-53 | Rabi | 1987 | Onion Research Station, Pimpalgaon Baswant Nashik |
| 3 | N-2-4-1 | Kharif | 1987 | Onion Research Station, Pimpalgaon Baswant Nashik |
| 4 | Phule Safed | Kharif/rabi | 1994 | Onion Storage Scheme MPKV, Rahuri |
| 5 | Phule Suvarna | Kharif/rabi | 1997 | Onion Storage Scheme MPKV, Rahuri |
| 6 | Phule Samarth | Kharif/late kharif | 2004 | Onion Storage Scheme MPKV, Rahuri |

But these varieties are very popular amongst the farmers in earlier period and now days also. Baswant -780 variety is famous among the farmers due to its characters of high yield potential, suited for two seasons i.e., kharif and late kharif

(Rangada), bulbs are globose in shape with crimson red colour, 13% TSS, less percentage of bolting, suitable for warm and humid climate.

Table 3: Varietal spread of onion on sample farms in Maharashtra

| Sr. No | Variety | Season | Area (ha) | | Total area under university released onion varieties (%) | |
|--------|----------------|-------------------------|------------------|------------------|--|---------|
| | | | 2018-19 | 2019-20 | 2018-19 | 2019-20 |
| | | | N=243 | N=63 | | |
| 1 | Baswant 780 | Kharif/late kharif | 6.44 (4.06) | 0.38 (1.32) | 35.05 | 59.72 |
| 2 | Phule Samarth | Kharif/late kharif | 14.83 (9.34) | 8.11 (28.21) | | |
| 3 | N-53 | Kharif | 28.81 (18.14) | 4.63 (16.10) | | |
| 4 | N-2-4-1 | Rabi | 5.57 (3.51) | 4.05 (14.09) | 64.95 | 39.28 |
| 5 | Pune Phursungi | Rabi | 57.94 (36.49) | 10.28 (35.76) | | |
| 6 | Panchganga | Kharif/Late kharif/Rabi | 16.75 (10.55) | -- | | |
| 7 | Local | Kharif/Rabi | 19.67 (12.39) | 0.4 (1.39) | | |
| 8 | AFDR | Kharif | 3.18 (2.00) | 0.9 (3.13) | | |

| | | | | | | |
|----|--------|-------------|--------------------|-------------------|--|--|
| 9 | China | Kharif/Rabi | 2.37 (1.49) | -- | | |
| 10 | Ellora | Kharif/Rabi | 1.68 (1.06) | -- | | |
| 11 | V-5 | -- | 1.56 (0.98) | -- | | |
| | Total | | 158.80 (100.00) | 28.75 (100.00) | | |

(figure in parenthesis indicate that percentage of total area under onion)

In between 1994 to 1997 university released promising varieties of onion viz., Phule safed and Phule Suvarna which also occupied major area of onion. In the year 2004, university released another promising variety of onion viz., Phule Samarth. This Phule Samarth variety is very famous in farming community due to its good storage quality (2-3

months), less duration i.e.,80-90 days, bulbs dark red and globular, resistant to premature bolting, good for kharif and late kharif i.e., rangda seasons, natural top fall rapid bulb development, fetches higher market price etc. At present the area under onion varieties released by MPKV, Rahuri is 35-40 per cent to the total area under onion of Maharashtra.

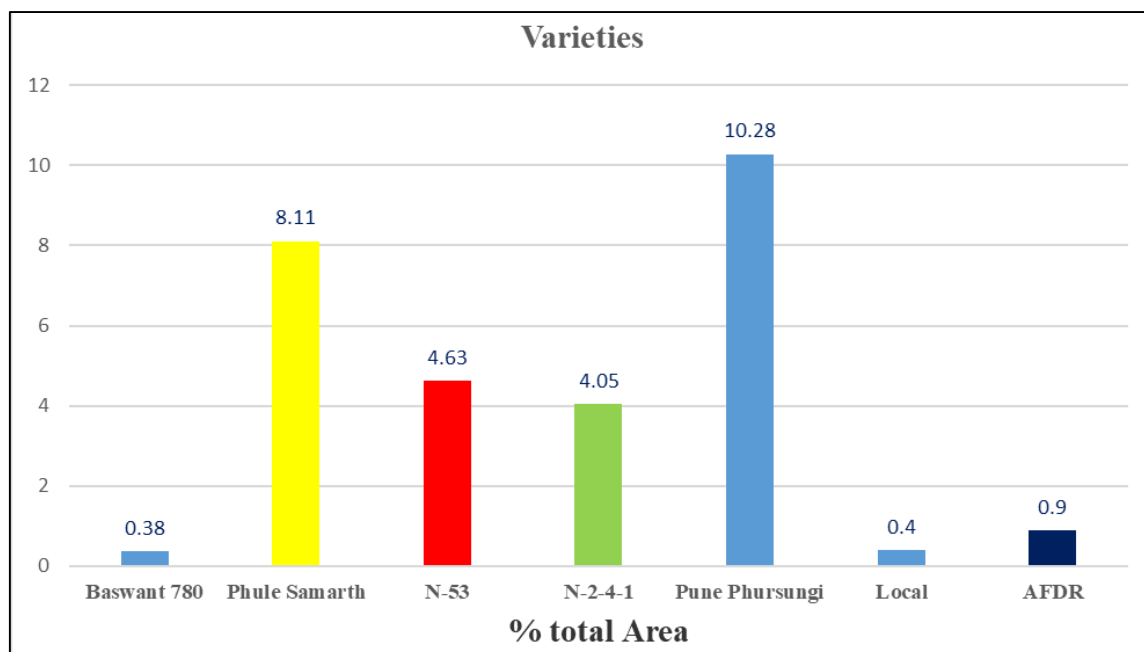


Fig 2: Variety wise area under onion varieties on sample farms (2019-20)

Economic Impact of the University Released Onion Varieties

Partial budgeting technique was used to capture the economic impact of the university released onion varieties. There are four components in partial budgeting. First, the added costs due to the new variety are considered. This includes list of all increased expenses due to new variety over the counterfactual (or control). In this study the control or check variety of onion was local variety. The second component was the reduced returns or reduced income due to new variety in relation to the counterfactual. The third component was the reduced costs due to new variety over the counterfactual which include reductions of certain expenses such as seed, bullock labour cost. The fourth component was the added income due to the new variety over the counterfactual, due to increase in yield.

The third and fourth component added to the ‘returns side’ or the credit side of the partial budget. The final step in partial budget was the summary indicated by the difference between the credit and the debit. The onion varieties were released from the year 1986 onwards. However, the majority and prominent varieties of onion were released after the 1989.

In Maharashtra farmers were grown university released different onion varieties across the different regions over a period of time. However, the area under university released onion varieties tremendously increased from their release year. Area under university released onion varieties i.e. Baswant- 780, N-2-4-1, N-53 and Phule Samarth was 35 per cent hence economic impact of these varieties is become essential.

Table 4: Economic impact of onion varieties in Maharashtra

| Debit side | Cost (Rs/ha) | Credit Side | Cost (Rs/ha) |
|--|--------------|---|--------------|
| Particulars | | Particulars | |
| A. Item of added expenditure due to cultivation of University released onion varieties | | B. Reduced cost (or saving) due to cultivation of university released varieties | |
| i. Human labour | 6549.57 | Seed | 6785.15 |
| ii. Bullock labour | 2007.27 | Irrigation | 724.36 |
| iii. Machine labour | 3151.34 | -- | |

| | | | |
|--|----------|--|----------|
| iv. Manure | 8136.05 | -- | |
| v. Chemical fertilizers | 372.41 | -- | |
| vi. Biofertilizers | 627.62 | -- | |
| vii. Micronutrients | 507.79 | -- | |
| viii. Plant protection | 617.26 | --- | |
| ix) Weedicide | 187.03 | -- | |
| x. Total additional cost | 22156.34 | Total saving due to cultivation of university released varieties | 7509.51 |
| xi. Opportunity cost of capital @ 6% per annum for 6 months | 664.69 | -- | |
| xii. Management cost @ 5% | 1107.82 | -- | |
| xiii. Risk premium @ 5% | 1107.82 | D. Added returns from university released varieties over competing variety | |
| xiv. Research cost per ha. | 27.42 | 72.82 qtls @878.00 per qtls | 63935.96 |
| xvi. Extension cost per ha. | 15.67 | -- | |
| Total additional cost due to cultivation of university released onion varieties. | 25079.75 | -- | |
| B. Reduced returns due to cultivation of improved onion varieties | | -- | 71445.47 |
| Total debit side | 25079.75 | Total credit side | 71445.47 |

Economic impact of university released onion production technology over competing varieties of onion in the region: Rs 71445.47- Rs 25079.75 = Rs 46365.72

According to the availability of data on seed sale it was decided to estimate the economic impact of onion varieties on farmer economy from 2002-03 onwards. The list of all increased expenses due to new variety over the counterfactual were presented in the Table. Table 4. reveals that the total additional cost (direct + indirect) of university released onion varieties over other competing varieties was observed to be Rs 25079.75 per hectare. However, the reduced costs (or saving) and added returns due to university released onion varieties over other competing varieties was RS 71445.47. Thus, the total economic worthiness of university released onion production technology over other competing varieties of onion in the region was Rs 46365.72 per hectare.

Up scaling the Economic Impact: In order that the results of the partial budgeting were applicable for wider area under university released onion varieties, linear extrapolation of the benefits of Rs. Rs 46365.72 per ha was not tenable due to operation of the law of diminishing marginal returns at an early stage in agriculture. Accordingly, to reflect the operation of LDNR, three parameters such as i) Probability performance of the technology, ii) Rate of adoption of the technology and iii) Depreciation in the technology are applied in linear extrapolation.

These implicitly capture the operation of the LDNR since the field conditions are not akin to the lab conditions and the farmer was different from the researcher. The upscaling the economic impact of onion research was presented in Table 5.

Table 5: Upscaling the economic impact of onion covering the area of adoption.

| Sr. No. | Economic Impact of University Released Onion Varieties | Value |
|---------|---|------------------|
| 1 | Probability performance of Onion variety | 0.85 |
| 2 | Rate of adoption of Onion variety | 0.75 |
| 3 | Depreciation of technology (if 1, No depreciation) | 1 |
| 4 | Economic worthiness of university released variety per ha | RS 46365.72 |
| 5 | Economic impact of university released variety per ha | RS 29558.15 |
| 6 | Area adopted under university released Onion in 2019-20 | 216000 ha |
| 7 | Economic impact for the year 2019-20 | RS 638.46 Crores |

Probability performance of the new variety is performance of University released onion variety as compared to potential yield on farmer field. It is assumed to be 0.85 since the scientists estimated that the varietal performance in the field conditions is to the tune of 0.85 as opposed to 1.00 in the controlled conditions. Rate of adoption of the new variety is estimated to be 0.75 as indicated by the extension personnel, who conducted the field trials. Any technology will have depreciation because of the product life cycle of technology. Depreciation of technology is the difference between introduction year and withdrawal year of the variety. For onion, the depreciation of technology is considered as 1, because on an average university released onion varieties are replaced by 10 years by its own varieties.

The upscaling the economic impact of onion research is presented in Table 5. Accordingly, the ultimate economic impact of onion varieties per hectare works out to $46365.72 \times 0.85 \times 0.75 \times 1 =$ `Rs. 29558.15. The area under

university released onion varieties for the year 2019-2020 was 216000 ha. So, the total economic impact to the farming community in Maharashtra state was Rs. 638.46 crores for the year 2019-2020.

6 Total economic impact of onion varieties in Maharashtra

For estimation of total economic impact of onion varieties for 18 years (from 2002-03 to 2019-20) deflation method was used to estimate net and gross gain on the basis of consumer price index. The total economic impact has been estimated and presented in the Table 6. The gross and net gain from university released onion varieties for the year 2019-20 over check variety has been deflated on the basis of Consumer Price Index (CPI). It is noted from the Table that the net and gross economic impact of onion varieties to the farming community in Maharashtra state for the 18 years was 4685.87 Crores and Rs. 44957.34 Crores respectively.

Table 6: Economic impact of University released onion varieties in Maharashtra.

| Sr. No. | Year | Gross Gain (Rs/ha) | Net Gain (Rs/ha) | Area (ha) | Net Economic Impact (Crores) | Gross Economic Impact (Crores) |
|---------|---------|--------------------|------------------|-----------|------------------------------|--------------------------------|
| 1 | 2002-03 | 83688.46 | 8722.78 | 52800.00 | 46.06 | 441.88 |
| 2 | 2003-04 | 85834.32 | 8946.45 | 43200.00 | 38.65 | 370.80 |
| 3 | 2004-05 | 87945.00 | 9166.44 | 57600.00 | 52.80 | 506.56 |
| 4 | 2005-06 | 92866.94 | 9679.45 | 50400.00 | 48.78 | 468.05 |
| 5 | 2006-07 | 102615.41 | 10695.53 | 79200.00 | 84.71 | 812.71 |
| 6 | 2007-08 | 111417.38 | 11612.95 | 52320.00 | 60.76 | 582.94 |
| 7 | 2008-09 | 124072.81 | 12932.02 | 65760.00 | 85.04 | 815.90 |
| 8 | 2009-10 | 144103.14 | 15019.76 | 98400.00 | 147.79 | 1417.97 |
| 9 | 2010-11 | 160114.60 | 16688.62 | 140640.00 | 234.71 | 2251.85 |
| 10 | 2011-12 | 174606.98 | 18199.15 | 129600.00 | 235.86 | 2262.91 |
| 11 | 2012-13 | 194439.85 | 20266.32 | 135360.00 | 274.32 | 2631.94 |
| 12 | 2013-14 | 219954.58 | 22925.70 | 203040.00 | 465.48 | 4465.96 |
| 13 | 2014-15 | 236256.26 | 24624.81 | 206400.00 | 508.26 | 4876.33 |
| 14 | 2015-16 | 247648.07 | 25812.17 | 106080.00 | 273.82 | 2627.05 |
| 15 | 2016-17 | 258505.30 | 26943.81 | 175680.00 | 473.35 | 4541.42 |
| 16 | 2017-18 | 264590.89 | 27578.11 | 166080.00 | 458.02 | 4394.33 |
| 17 | 2018-19 | 270542.83 | 28198.48 | 198240.00 | 559.01 | 5363.24 |
| 18 | 2019-20 | 283587.87 | 29558.15 | 216000.00 | 638.46 | 6125.50 |
| | | | | Total | 4685.87 Crores | 44957.34 Crores |

Conclusions

The area under onion in Maharashtra state was found to be more stable and consistent rather than production and productivity. The gross and net economic impact of onion variety to the farming community in Maharashtra state for the 18 years was Rs 44957.34 crores and Rs.4685.87 crores, respectively. Therefore, it was recommended that the state government may provide substantial funds for research and extension in onion crop.

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