

ECONOMIC IMPACT OF ONION RESEARCH ON FARMERS ECONOMY

C. M. Gulave¹, R. S. Nirpal² and B. S. Kakad³

1 Junior Research Assistant, Department of Agricultural Economics, MPKV, Rahuri-413722 India

2 Ph.D. Scholar, Department of Agricultural Economics, MPKV, Rahuri-413722 India

3 Assistant Professor, Department of Agricultural Economics, MPKV, Rahuri-413722 India

Email : shekhar.gulave53@gmail.com

ABSTRACT

Onion (Allium cepa L.) is one of the important bulb crop belonging to family Alliaceae. In India, Maharashtra is leading state in area and production of onion while Gujarat in productivity. MPKV, Rahuri has made significant contribution in farmers economy by releasing 6 excellent onion varieties for Maharashtra. At present four ruling varieties i.e. Baswant-780, N-53, N-2-4-1 and Phule Samarth released by MPKV, Rahuri occupy more than 30-40 % to the total area under onion of Maharashtra. The area, production and productivity of onion in Maharashtra were observed to be positive and significant. It indicates that the production of onion was increased by both area expansion and productivity improvement. The research investment has significantly contributed to TFP growth in onion. The average input, output and TFP index was 1.05, 1.35 and 1.31 percent respectively. Total economic worthiness of university released onion production technology over other competing varieties of onion in the region was ₹ 46,365.72 per hectare. The gross and net economic impact of university released onion varieties for eighteen was ₹ 44957.34 Crores and ₹ 4685.87 Crores.

Keywords: onion, economic impact, total factor productivity (tfp), partial budgeting

INTRODUCTION

Onion (*Allium cepa* L.) is one of the important bulb crop belonging to family Alliaceae and has gained the importance of a cash crop in recent years because of its very high export potential and grown throughout the world for its food and cuisinal value. Onion is characterized by its distinctive flavour and pungency, which is due to Allylpropyl-disulphide, a sulphur containing compounds found in the scales of the bulb. The red and yellow colour of outer skin of onion is due to presence of Anthocyanin and Quercetin, respectively. Anti-fungal activities in onion is due to a phenolic factor i.e., Catechol.

It is an herbaceous bulbous plant with a biennials seed production, annual for bulb production, the latter being the edible part. The leaves are tubular, cylindrical and the bulbs formed by the attachment of swollen leaf bases to underground part of stem which is small and rudimentary. Flowers are produced during second phase after formation of bulbs. The floral stalk is rigid, hollow, waxy and the plant is over a meter tall with an umbrella inflorescence and spherical shape. Length of peduncle commonly known a 'scape' varies with variety. The hermaphrodite flowers are white. Onion is a highly cross pollinated crop due to protandry in nature. Cross pollination is achieved by honey bees when they visit flowers for nectar.

Major onion producing countries are China, India, USA, Iran, Russia, Turkey, Egypt and Pakistan. China is the biggest onion producer with the production of 245 Million tonnes followed by India (234.85 Million tonnes). In India area, production and productivity of onion for the year 2018-19 was 12.62 million hectares, 234.85 million tonnes and productivity 18.60 t/ha, respectively (Source: Anonymous, 2018-19). In India, Maharashtra is leading state in area and production of onion while Gujarat in productivity. The major onion growing states includes Maharashtra, Karnataka, Madhya Pradesh, Rajasthan, Bihar, Andhra Pradesh, Gujarat, Haryana, West Bengal and Uttar Pradesh. Congenial Climate and hybrid varieties are the major factor in improving the current productivity levels. Many several factors like climatic and physiological which affect the yield of onion adversely and reduce productivity.

In the varietal front the Onion Research Scheme, Pimpalgaon Baswant, MPKV, Rahuri and Scheme for Research on Onion Storage, MPKV, Rahuri has made significant contribution in farmers economy by releasing 6 excellent onion varieties for Maharashtra. At present four ruling varieties i.e. Baswant-780, N-53, N-2-4-1 and Phule Samarth released by these research station occupy more than 35% of the area in the Maharashtra. Keeping in view of these aspects the present study was undertaken to analyze the impact

of University released onion Varieties in Maharashtra with the specific objectives viz., examine the area, production and productivity of onion, examine the varietal status of university released onion varieties, estimate the total factor productivity (TFP) growth in onion and assess the economic impact of university released onion varieties.

OBJECTIVE

To know the economic impact of onion research on farmers economy in Maharashtra

METHODOLOGY

The Onion Research Station, Pimpalgaon Baswant, MPKV, Rahuri and Scheme for research on Onion Storage, MPKV, Rahuri were selected for estimating the economic impact of university released varieties of onion in Maharashtra.

The data on area, production and productivity of onion for Maharashtra and India was collected from the published sources viz., Ministry of Agriculture & farmer’s welfare (Govt. of India). The information on expenditure on research, extension, salary, contingency etc. was availed from the office record of Onion research Station, Pimpalgaon Baswant and Scheme for research on Onion Storage, MPKV, Rahuri. The information on area under university released variety was taken from the office record of Chief Scientists (Seed), MPKV Rahuri during the year 2002-03 to 2019-20.

The time series data on costs and returns of onion crop for the year 1990-91 to 2019-20 were compiled from the onion quick estimate reports of State cost of cultivation scheme, Department of Agricultural Economics, MPKV, Rahuri.

Analytical tools

(i) Returns to Investment

For the present study three approaches were used viz.,

- (i) Log linear production function
- (ii) Total factor productivity
- (iii) Partial budgeting technique

(ii) Log linear production function

The TFP is influenced by research, extension, human capital, intensity of cultivation, application of plant nutrients, infrastructural development and climatic factors. As an input to public investment decisions, it is useful to understand the relative importance of these productivity-enhancing factors

in determining productivity growth. In order to assess the determinants of TFP, the TFP index was regressed against the following variables.

$$Y = a x_1^{b_1} x_2^{b_2} x_3^{b_3} x_4^{b_4} x_5^{b_5} x_6^{b_6} x_7^{b_7} x_8^{b_8} x_9^{b_9} x_{10}^{b_{10}} e^u$$

Where,

- Y = Total factor productivity index (TFP)
 - a = Constant term
 - X₁ = Research investment (Rs./ha)
 - X₂ = Rural Literacy (%)
 - X₃ = Rainfall(mm)
 - X₄ = Road Density (km.)
 - X₅ = N to P ratio
 - X₆ = GIA (%)
 - X₇ = Cropping intensity (%)
 - X₈ = Electricity (Agril. Consumption GWh)
 - X₉ = Max. Humidity
 - X₁₀ = Min. Humidity
 - T = Time variable (years 1, 2, 3....n)
 - u = Error term
- (b₁ to b₁₀) are regression coefficients of respective variables).

(iii) Total Factor Productivity approach

Analysis of Total Factor Productivity (TFP)

The Chain base- linking index takes into account the changes in relative values/costs throughout the period of study. This procedure has the advantage that no single period plays a dominant role in determining the share weights and biases are likely to be reduced. The TFP indices computed using the software TFPIP version 1.0, which developed by Tim Coelli, Centre for Efficiency and Productivity Analysis, University of Queensland, Australia. Time series data on costs and returns of onion crop for the years 1990-91 to 2019-20 was collected and compiled from the state cost of cultivation scheme, Department of Agricultural Economics, MPKV,Rahuri. All the data was calculated in real terms by deflating the time series data on investment using the Consumer Price Index (CPI) with 1990-91 as a base year.

TFP indices computed as follows:

Total output index:

$$(TOI) = TOI_t / TOI_{t-1} = \prod_j (Q_{jt} / Q_{jt-1})^{(R_{jt} + R_{jt-1})/2}$$

Total input index:

$$(TII) = TII_t / TII_{t-1} = \prod_j (X_{jt} / X_{jt-1})^{(S_{jt} + S_{jt-1})/2}$$

Total factor productivity index (TFPI) of tth year is 100 times the ratio of TOI, to the TII, and is given by,

$$TFPI_t = (TOI_t/TH_t) \times 100$$

Input price index is given by,

$$\frac{IPI_t}{IPI_{t-1}} = \prod_j \left[\frac{P_t}{P_{t-1}} \right]^{(S_j + S_{j-1})^{\frac{1}{2}}}$$

Where,

R_{jt} = Share of jth output in total revenue

Q_{jt} = Output 'j'

S_{jt} = Share of ith input in total input cost

X_{it} = input 'i'

P_{it} = Price of ith in period t

By specifying TOI t-1, THt-1 and IPIt-1 equal to 100 in the initial year, the above equation provides the total output, total input, total factor productivity and input price indices for the specified period 't'.

TFP share: TFP share in percentage is calculated as 100-input share

$$\text{Where input share (\%)} = \frac{\text{output index}}{\text{input index}} \times 100$$

(iv) Partial budgeting :

Partial budgeting is used to find the economic viability of partial change in the farm such as use of new variety or new technology or new innovation or new practice or new equipment or new service. Partial budget approach was used for estimating the impact of research outcome on income generation. (Boehlje and Eidman, 1984).

In this study the four components of partial budgeting were considered viz: i. Added expenditure due to cultivation of improved onion variety ii) Reduced returns due to cultivation of improved onion variety iii) Reduced cost due to cultivation of improved onion variety and iv) Added returns due to cultivation of improved onion variety. For upscaling the economic impact the probability performance of the technology, rate of adoption of technology and depreciation of the technology was considered.

RESULTS AND DISCUSSION

Area, production and productivity of onion in major states and India

The information on area, production and productivity of onion during the year 2018-19 in major producing states including India is presented in Table1.

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

(Area –000 ha, Production – 000 Tonnes and Productivity- T/ha)

Sr. No.	State	Area	Rank	Production	Rank	Productivity	Rank
1	Maharashtra	444.37 (35.19)	1	8047.14 (34.26)	1	18.11	7
2	Karnataka	190.52 (15.09)	2	2645.61 (11.27)	3	13.89	11
3	Madhya Pradesh	148.71 (11.78)	4	3714.79 (15.82)	2	24.98	2
4	Rajasthan	70.48 (5.58)	5	1388.42 (5.91)	5	19.70	6
5	Bihar	61.03 (4.83)	6	1403.03 (5.97)	6	22.99	3
6	Andhra Pradesh	45.32 (3.59)	7	970.55 (4.13)	8	21.42	5
7	Gujrat	44.33 (3.51)	8	1111.09 (4.73)	7	25.06	1
8	West Bengal	35.28 (2.79)	9	638.38 (2.72)	10	18.10	8
9	Haryana	32.01 (2.53)	10	696.92 (2.97)	9	21.77	4
10	Uttar Pradesh	26.85 (2.09)	11	439.64 (1.89)	11	16.37	9
11	Others	163.88 (12.98)	3	2428.77 (10.34)	4	14.82	10
	All India	1262.83 (100.00)		23485.07 (100.00)		18.60	

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

It is revealed from the table 1 that, Maharashtra state ranks first in area and production of onion in India. However, in case of productivity Gujrat ranks first and Maharashtra ranks seventh in productivity of onion. In India three major states Maharashtra, Karnataka and Madhya Pradesh contributes more than 60 per cent area and production of the onion. Maharashtra state alone contributes nearly 35 per cent area and production of the country.

Status of onion varieties released by MPKV, Rahuri

The Onion and Grape Research Station, Pimpalgaon Baswant and Scheme for research on Onion Storage, MPKV, Rahuri has released good varieties of onion since its establishment. The important onion varieties released since their establishment is presented in Table 2.

The varieties Baswant-780, N-53 were very old varieties released in the year 1986 and 1987 respectively for Kharif and Late kharif season. These varieties were very popular amongst the farmers in earlier period. Simultaneously, in 1987 university released promising varieties of onion N-2-4-1 for Rabi season. In between 1986 to 1996 university released promising varieties of onion viz., Baswant-780, N-53 and N-2-4-1 which also occupied major area of onion. Among the four, Phule Samarth variety is popular in farmers for kharif season due to its characters like controlled vegetative

growth coupled with rapid bulb development, early maturity (75 – 90 days), high yield potential for regular and late kharif season and excellent keeping quality (2-3 months) and N-2-4-1 for rabi season due to its characters like red colour which improves in storage, Excellent storage ability, Resistant to premature bolting. Hence, the seeds of all improved varieties of onion especially Baswant-780, N-2-4-1, N-53 and Phule Samarth were tremendously demanded by the farmers.

Table 2 : Yearwise onion varieties released by MPKV Rahuri

Sr. No.	Variety	Kharif/Late kharif/Rabi	Year of release
1	Baswant-780	Kharif/late kharif	1986
2	N-2-4-1	Rabi	1987
3	N-53	Kharif	1987
4	Phule Safed	Kharif/rabi	1994
5	Phule Suvarna	Kharif	1996
6	Phule Samarth	Kharif/late kharif	2004

University alone unable to supply the huge demand of seed. The MAHABEEJ, Akola, NSC, Pune and private companies selling the seeds to farmers from 2002 onwards. At present the area under onion varieties released by MPKV, Rahuri is 30-40 % to the total area under onion of Maharashtra. The information on varietal spread of onion on sample farms in western Maharashtra for the year 2018-19 is presented in Table 3.

The data on area under different onion varieties from 10 districts of western Maharashtra was collected.

Table 3 : Variety wise area under onion varieties on sample farms 2018-19

(n=243)

Sr. No.	Variety	Kharif/Late kharif/Rabi	Area (ha)	Total area under university released onion varieties (%)
1	Baswant 780	Kharif/late kharif	6.44 (4.06)	35.05
2	Phule Samarth	Kharif/late kharif	14.83 (9.34)	
3	N-53	Kharif	28.81 (18.14)	
4	N-2-4-1	Rabi	5.57 (3.51)	
5	Pune Phursungi	Rabi	57.94 (36.49)	
6	Panchganga	Kharif/Late kharif/Rabi	16.75 (10.55)	
7	Local	Kharif/Rabi	19.67 (12.39)	
8	AFDR	Kharif	3.18 (2.00)	

Sr. No.	Variety	Kharif/Late kharif/Rabi	Area (ha)	Total area under university released onion varieties (%)
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)	

It is revealed from the table that the university released onion varieties were dominant in farmer's field and contributing nearly 35 percent area to the total area under onion for the year 2018-19. Among the different university released varieties Phule Samarth variety was mostly (28%) preferred by the farmers followed by N-53, N-2-4-1 and

Baswant-780.

Total factor productivity growth and its share in onion

The output, input and TFP indices of onion crop are presented in Table 4.

Table 4 Input, output and TFP index of onion

Sr. No.	Year	Input Index	Output Index	TFP Index	Input Share	TFP Share
1	1990-91	1.00	1.00	1.00	100.00	0.00
2	1991-92	1.30	2.30	1.78	56.33	43.67
3	1992-93	1.08	1.12	1.04	96.01	03.99
4	1993-94	1.01	0.78	0.78	128.59	-28.59
5	1994-95	0.97	1.79	1.84	54.32	45.68
6	1995-96	1.39	2.10	1.51	66.08	33.92
7	1996-97	0.90	1.19	1.33	75.34	24.66
8	1997-98	1.04	1.20	1.15	86.90	13.10
9	1998-99	1.01	1.07	1.06	94.28	05.72
10	1999-2000	1.03	1.08	1.05	95.69	04.31
11	2000-01	0.91	1.21	1.34	74.72	25.28
12	2001-02	1.25	1.11	0.89	112.63	-12.63
13	2002-03	0.77	0.81	1.06	94.70	05.30
14	2003-04	1.78	2.17	1.22	81.93	18.07
15	2004-05	0.64	1.05	1.63	61.45	38.55
16	2005-06	0.97	1.98	2.04	48.91	51.09
17	2006-07	1.09	0.88	0.80	124.84	-24.84
18	2007-08	1.16	2.32	2.00	49.89	50.11
19	2008-09	0.94	1.55	1.65	60.75	39.25
20	2009-10	1.10	0.63	0.57	175.63	-75.63
21	2010-11	1.53	1.27	0.83	120.06	-20.06
22	2011-12	0.81	0.99	1.22	81.73	18.27
23	2012-13	0.99	1.18	1.19	83.89	16.11
24	2013-14	1.01	0.80	0.79	126.27	-26.27
25	2014-15	0.98	1.18	1.20	83.06	16.94
26	2015-16	1.01	0.99	0.98	101.70	01.70
27	2016-17	0.85	1.95	2.29	43.73	56.27
28	2017-18	0.97	1.75	1.81	55.25	44.75
29	2018-19	0.90	1.85	2.06	48.45	51.55
Total		30.35	39.28	38.12	2483.14	416.86
Average		1.05	1.35	1.31	85.63	14.37

From the Table 5, it is observed that the TFP for onion was lowest i.e. 0.57 in 2009-10 and highest TFP index was observed in 2016-17 (2.29).The output index of onion ranges from 0.63 to 2.32.

Total factor productivity measures the efficiency of all the inputs to a production process. Increase in TFP results usually from technological innovations or improvements.

Table 5 CGR of Input Index, Output Index and TFP Index

Sr. No.	Period	Input Index	Output Index	TFP Index
1	Period I (1990-91 to 1999-2000)	-0.97	-1.75	-0.79
2	Period II (2000-01 to 2009-10)	0.44	-0.28	-0.72
3	Period III (2010-11 to 2018-19)	-3.09	3.68*	6.77 **
4	Overall (1990-91 to 2018-19)	-0.45	0.07	0.53

*, ** and *** indicate significance at 10, 5 and 1 % level

The annual compound growth rates of total input indices was decreased at the rate of 0.45 per cent per annum where as the growth of output and TFP indices increased at the rate of 0.07 and 0.53 per cent per annum from 1990-91 to 2018-19.

The decade wise result of output indices, input indices and TFP of onion revealed that the annual compound growth rates of input, output and TFP indices decreased at the rate of 0.97, 1.75 and 0.79 per cent per annum in period I (1990-91 to 1999-2000), respectively. However, the total output and TFP indices have significantly increased at the rate of 3.68 and 6.77 per cent per annum, respectively in period III (2010-11 to 2018-19). This could be attributed mainly due to the release of onion varieties by MPKV, Rahuri viz., Phule Samarth, Baswant-780, N-53 and N-2-4-1. This has largely

TFP is the output per unit of non-input. The average input, output and TFP index was 1.05, 1.35 and 1.31 percent respectively. The average TFP share was 14.37 percent for the entire period under study. The results were corroborates with finding of Immanuelraj *etal* (2013) and Suresh *etal* (2015).

The compound growth rates of input, output and TFP index is presented in Table 5.

helped to reduce the cost of production of onion during recent years.

Prioritization of research resource allocation

To address the issue of technological progress and sustainability of onion crop in Maharashtra, the onion crop was classified into five groups according to the magnitude of growth in TFP as under, as given by Chand *etal* (2011).

It is revealed from the table that, the onion crop has witnessed negative, negative and high growth in TFP for the period I, period II and period III respectively. It indicates that there is a contribution of technology after the year 2010-11 and it may be due the non-input factors viz., high yielding varieties of onion, humidity, rainfall, N to P ratio etc. Similar results were reported by Chand *etal* (2011).

Table 6 : Trends in total factor productivity growths in onion crop of Maharashtra

Period	Growth				
	Negative growth (TFP growth < 0)	Stagnant growth (TFP growth positive but < 0.5 %)	Low growth (TFP growth of 0.5-1%)	Moderate growth (TFP growth of > 1.0-2.0%)	High growth (TFP growth of> 2 %)
Period I (1990-91 to 1999-2000)	Negative	--	--	--	--
Period II (2000-01 to 2009-10)	Negative	--	--	--	--
Period III (2010-11 to 2018-19)	--	--	--	--	High growth
Entire period (1990-91 to 2018-19)	--	--	Low growth	--	--

Sources of total factor productivity (TFP) growth in onion

The growth rate in TFP was analyzed to quantify the contributions of various factors to TFP growth such as

research investment, rural literacy, rainfall, road density, N to P ratio, gross irrigated area, Cropping intensity, Electricity consumption and humidity (maximum and minimum) etc. (Table 7).

Table 7 : Estimated parameters of TFP for onion for the period 2000-01 to 2018-19

Sr. No.	Variables	Coefficients	Standard error
Intercept (a)		11.27	29.58
X ₁	Research Investment (₹/ha)	0.14**	0.05
X ₂	Rural Literacy (%)	-5.78	13.76
X ₃	Rainfall (mm)	-0.56	0.93
X ₄	Road Density (km.)	1.12**	0.53
X ₅	N to P ratio	0.66	1.74
X ₆	GIA (%)	0.15**	0.07
X ₇	Cropping intensity (%)	5.28	6.65
X ₈	Electricity (Agril. Consumption GWh)	-0.31	1.73
X ₉	Max. Humidity	3.98	6.87
X ₁₀	Min. Humidity	0.85**	0.44
R ²		0.76	
n (No. of observations)		18	

*, ** and *** indicate significance at 10, 5 and 1 % level

The results indicate that research investment (0.14), Road density (1.12), GIA (0.15) and Min. Humidity (0.85) have significantly contributed to TFP growth in onion. The co-efficient viz., N to P ratio, Cropping intensity and maximum humidity were positive but non-significant. The estimated R² value was 0.76 indicating that 76 percent of variation in TFP was jointly explained by the ten independent variables. The results were comparable with the findings of Kumar *et al* (1992) and Kumar *et al* (1994).

Table 8 : Economic impact of university released onion varieties

Debit side	Cost (₹/ha)	Credit Side	Cost (₹/ha)
Particulars		Particulars	
A. Item of added expenditure due to cultivation of 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		

Economic impact of university released onion varieties

Partial budgeting approach was used to capture the economic impact of the university released onion varieties. In partial budgeting the debit and credit side is prepared (Table 8). Table 8 includes list of all increased expenses due to new technology over the counterfactual (or control which is competing to university variety). In this study the control or check variety of onion is local variety.

Debit side	Cost (₹/ha)	Credit Side	Cost (₹/ha)
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 month	664.69		
xii. Management cost @ 5 %	1107.82		
xiii. Risk premium @ 5 %	1107.82	D. Added returns from university released varieties	
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 variety.	25079.75		
B. Reduced returns due to cultivation of improved onion varieties			
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 : ₹ 71445.47- ₹ 25079.75 = ₹ 46365.72			

It is noted from the Table 8 that the total additional cost (direct +indirect)of university released varieties over other competing varieties was observed to be ₹ 25079.75 per hectare. However the reduced costs (or saving) and added returns due to university released varieties over other competing varieties was ₹ 71445.47. Thus, the total economic worthiness of university released onion production technology over other competing varieties of onion in the region was ₹ 46,365.72 per hectare. The results were comparable to the earlier studies (Kumar, Nandia & Prakash, 2011).

Upscaling the economic impact

The upscaling the economic impact of onion research is presented in Table 9. Accordingly the ultimate economic impact of onion per hectare works out to $46365.72 \times 0.85 \times 0.75 \times 1 = ₹ 29558.15$. The area under university released onion varieties for the year 2017-18 was 216000 ha. So, the total economic impact to the farming community in Maharashtra state was ₹638.46 crores for the year 2019-20. Similar results were reported by (Kumar, Nandia & Prakash, 2011).

Table 9: Upscaling the economic impact 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	₹ 46365.72
5	Economic impact of university released variety per ha	₹ 29558.15
6	Area adopted under university released Onion in 2019-20	216000 ha
7	Economic impact for the year 2019-20	₹ 638.46 Crores

Economic impact of onion varieties in Maharashtra

The economic impact of onion varieties for 18 years (from 2002-03 to 2019-20) has been estimated and presented in the Table 10. The gross and net gain from university released 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 gross and net economic impact of onion varieties to the farming community in Maharashtra state for the 18 years was ₹ 4685.87 crores and ₹ 44957.34 crores. Similar results were reported by (Pokharkar, Gulave & Yadav, 2018).

Table 10 : Economic impact of onion varieties in Maharashtra

Sr. No.	Year	Gross Gain (₹/ha)	Net Gain (₹/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

CONCLUSION

- (I) The area, production and productivity of onion in Maharashtra were observed to be positive and significant. It indicates that the production of onion was increased by both area expansion and productivity improvement.
- (II) The research investment has significantly contributed to TFP growth in onion.
- (III) The gross and net economic impact of university released onion varieties for eighteen was ₹ 44957.34 Crores and ₹ 4685.87 Crores.

SUGGESTION

The farmers in Maharashtra earned gross economic returns of ₹ 44957 Crores and net economic benefit of ₹ 4686 Crores from MPKV, Rahuri released onion varieties during 18 years (2002-03 to 2019-20). Therefore, it is suggested that the substantial funds be provided for research activities in onion by the government.

REFERENCES

- Anonymous, (2018-19) Report published by Ministry of Agriculture & farmer's welfare, Government of India, New Delhi.
- Boehlje, M.D., & Eidman, V.R. (1985). Farm Management- An overview of farm business analysis. *American Journal of Agricultural Economics*, 67(2), 446-447
- Chand, R. Praduman Kumar and Sant Kumar. (2011). Total Factor Productivity and Returns to Public Investment on Agricultural Research in India, *Agricultural Economics Research Review* Vol. 25(2) :181-194.
- Chaudhary, D. (2018). Scientific Cultivation of Onion (*Allium cepa* L.) in Dr. KV Peter (Eds) *Phytochemistry of Fruits and Vegetables*. Brillion Publishing, New Delhi, 239-260.
- Pokharkar, V.G., C.M. Gulave & D.B. Yadav 2018. Economic impact of pomegranate research and extension on

APPENDIX-I

Area under different varieties of onion in Maharashtra

Year	Breeder seed (qtls)	foundation seed(qtls)	Certified seed(qtls)	Total seed (qtls)	Grand Total	KG	Seed rate	Area	M.S. area (Ha)	% to M.S.
2000-01	1.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2001-02	0.90	2640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2002-03	1.20	2160.00	5280.00	5280.00	5280.00	528000	10.00	52800	120700	43.74
2003-04	1.05	2880.00	4320.00	4320.00	4320.00	432000	10.00	43200	133600	32.34
2004-05	1.65	2520.00	5760.00	5760.00	5760.00	576000	10.00	57600	203700	28.28
2005-06	1.09	3960.00	5040.00	5040.00	5040.00	504000	10.00	50400	107100	47.06
2006-07	1.37	2616.00	7920.00	7920.00	7920.00	792000	10.00	79200	229800	34.46
2007-08	2.05	3288.00	5232.00	5232.00	5232.00	523200	10.00	52320	204600	25.57
2008-09	2.93	4920.00	6576.00	6576.00	6576.00	657600	10.00	65760	211900	31.03
2009-10	2.70	7032.00	9840.00	9840.00	9840.00	984000	10.00	98400	251600	39.11
2010-11	2.82	6480.00	14064.00	14064.00	14064.00	1406400	10.00	140640	329600	42.67
2011-12	4.23	6768.00	12960.00	12960.00	12960.00	1296000	10.00	129600	248400	52.17
2012-13	4.30	10152.00	13536.00	13536.00	13536.00	1353600	10.00	135360	264000	51.27
2013-14	2.21	10320.00	20304.00	20304.00	20304.00	2030400	10.00	203040	398500	50.95
2014-15	3.66	5304.00	20640.00	20640.00	20640.00	2064000	10.00	206400	443200	46.57
2015-16	3.46	8784.00	10608.00	10608.00	10608.00	1060800	10.00	106080	553300	19.17
2016-17	4.13	8304.00	17568.00	17568.00	17568.00	1756800	10.00	175680	473100	37.13
2017-18	4.50	9912.00	16608.00	16608.00	16608.00	1660800	10.00	166080	472800	35.13
2018-19	0.45	10800.00	19824.00	19824.00	19824.00	1982400	10.00	198240	428400	46.27
2019-20	3.34	1080.00	21600.00	21600.00	21600.00	2160000	10.00	216000	686600	31.46

farm economy. *Indian Journal of Economics and Development*. 14(3), 497-503.

Immanuelraj, T.K. & B.R. Atteri (2013). Total factor productivity of sugarcane in Maharashtra, *BIOINFOLET-A Quarterly Journal of Life Sciences*, 10 (2b), 697-699.

Kumar, Praduman and Mruthyunjaya (1992) Measurement and analysis of total factor productivity growth in wheat, *Indian Journal of Agricultural Economics*, 52(4):693-706

Kumar, Praduman and Rosegrant, Mark W. (1994)

Productivity and sources of growth for rice in India, *Economic and Political Weekly*, 29 (52): A183-A188.

Kumar, K.R, Nandia B.S., & Prakash, T.N. (2011). The economic impact of aerobic rice technology in Karnataka. *Indian Journal of Agricultural Economics*, 47(3), 451-457.

Suresh, K., & Chandrakant, M.G. (2015). Total factor productivity and returns to investments in Ragi (Finger millets) crop research in Karnataka state, India. *Indian Journal of Economics and Development*. 3(3), 199-205.

Received : September 2021 : Accepted : November 2021