



Research Article

A STUDY ON COMPOUND GROWTH OF AREA, PRODUCTION AND PRODUCTIVITY OF RAPESEED AND MUSTARD CROP IN BURDWAN DISTRICT, WEST BENGAL

KONAR ARUNIMA* AND DEY G.

Department of Agricultural Economics, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, 741252, West Bengal, India

*Corresponding Author: Email - arunimakonar90@gmail.com

Received: April 20, 2018; Revised: April 26, 2018; Accepted: April 27, 2018; Published: April 30, 2018

Abstract- The study has been conducted in Burdwan District and West Bengal on the basis of area, production and productivity over a period of 11 years from 1999-2000 to 2010-11. The study is based mainly on secondary data. Data used in the study are mostly taken from secondary sources such as Area, production and productivity of principal crops in West Bengal 2011-12, Evaluation wing, Directorate of Agriculture, Govt. of West Bengal, District Statistical Handbook, Burdwan 2011-12, Bureau of Applied Economics and Statistics, Govt. of West Bengal, Economic Review, Statistical Appendix 2011-12, Bureau of Applied Economics and Statistics, Govt. of India. The study has been carried out with the objectives of finding Compound growth of area, production and productivity of Rapeseed and Mustard in Burdwan District and West Bengal. It is found that in Burdwan District area and production of rapeseed and mustard have recorded negative compound growth rate to the extent of 3.50 and 3.53 percent per annum respectively over a period of 11 years from 1999-2000 to 2010-11. But growth rate of productivity of this crop is noted to be 0.05 percent in the district. Compound growth rate of area, production and productivity of this crop in West Bengal are 0.17, 1.00 and 0.32 percent per annum respectively in same period of time.

Keywords- Area, Production, Productivity, Compound Growth Rate, Rapeseed and Mustard

Citation: Konar Arunima and Dey G. (2018) A Study on Compound Growth of Area, Production and Productivity of Rapeseed and Mustard Crop in Burdwan District, West Bengal. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 10, Issue 8, pp.-5867-5871.

Copyright: Konar Arunima and Dey G. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

Introduction

Rapeseed and Mustard is the second most important edible oil crop in India after groundnut. It is one of the principal crops in West Bengal. But West Bengal is a deficient state. Only one tenth of consumption requirement are produced in our state. Even at national level a portion of consumption requirement of edible oil is imported from outside. In the context of agricultural situation of West Bengal importance of this study arises from this fact that almost all the people in this state use mustard oil as edible food. But little portion of consumption requirement is produced in our state. A small number of cultivators allocate land to this crop. It is a general opinion that farmers are rational in allocating their scarce resources to various profitable crops. Present study is attempted with the main objectives of finding compound growth of area, production and productivity of Rapeseed and Mustard crop in Burdwan District and West Bengal. The compound growth rate is a useful measure of growth over multiple time periods to calculate the trend in area, production and productivity of Rapeseed and Mustard in Burdwan District and West Bengal [1-10].

Materials and Methods

Study is based mainly on secondary data. Data have been collected from different sources i.e., Area, production and productivity of principal crops in West Bengal 2011-12, Evaluation wing, Directorate of Agriculture, Govt. of West Bengal, District Statistical Handbook, Burdwan 2011-12, Bureau of Applied Economics and Statistics, Govt. of West Bengal, Economic Review, Statistical Appendix 2011-12, Bureau of Applied Economics and Statistics, Govt. of India. Tabular method of analysis will be extensively used in the study. Beside this Compound Growth rate will be employed in this study. It is a cross-sectional study. The study pertains to 2011-12 agricultural year.

Formula of Compound Growth Rate:

$$y = ab^x$$

Where, a is constant

$(b-1) \times 100$ is a CGR percent per annum.

x is time period.

The above equation may be converted into a linear equation in logarithmic term as follows:

$$\log y = \log a + x \log b$$

$$\log y = Y$$

$$\log a = A$$

$$\log b = B$$

Then the equation is converted to, $Y = A + xB$

To obtain A and B the known normal equations can be formed. These are:

$$\sum Y = NA + B \sum x \quad \dots\dots\dots (1)$$

$$\sum xY = A \sum x + B \sum x^2 \quad \dots\dots\dots (2)$$

Whereas, a = Antilog A

b = Antilog B

Results and Discussions

In the following table data on area, production and productivity of rapeseed and mustard of Burdwan district and West Bengal are presented. On the basis of this dataset compound growth rates of area, production and productivity are estimated.

Table-1 Area, Production and Productivity of Rapeseed and Mustard in Burdwan District and West Bengal

Year	Burdwan			West Bengal		
	Area (In thousand ha)	Production (In thousand tonnes)	Productivity (In kgs. Per hectare)	Area (In thousand ha)	Production (In thousand tonnes)	Productivity (In kgs. Per hectare)
1999-00	34.3	30.5	891	346	278.5	805
2000-01	49.3	51.9	1054	436	417	956
2001-02	50.3	37.6	748	439.6	336.9	766
2002-03	42.2	36.2	850	408.3	328.5	805
2003-04	46.5	41.9	901	452	419.4	928
2004-05	46.5	31	668	457.5	342.7	749
2005-06	29.2	27.5	944	421.5	383	909
2006-07	28.9	21.3	737	421.5	338.6	803
2007-08	25.6	21.8	850	407.5	361.7	888
2008-09	27.1	19.9	734	412.5	315.3	764
2009-10	25.2	24.1	945	410.3	443	850
2010-11	20.3	20.1	991	410.8	419.6	1021

Source: i) Area, production and productivity of principal crops in West Bengal 2011-12, Evaluation wing, Directorate of Agriculture, Govt. of West Bengal.

ii) District Statistical Handbook, Burdwan 2011-12, Bureau of Applied Economics and Statistics, Govt. of West Bengal.

iii) Economic Review, Statistical Appendix 2011-12, Bureau of Applied Economics and Statistics, Govt. of India.

Table-2 Calculation of Compound Growth Rate of Area of Rapeseed and Mustard in Burdwan District

Year (x) (N =12)	Area in thousand ha in Burdwan	Index No. (y)	x	logy	xy	x logy	x ²	y ²	(logy) ²
1999-00	34.3	76.85	-11	1.88	-834.35	-20.68	121	5905.92	3.53
2000-01	49.3	110.46	-9	2.04	-994.14	-18.36	81	12201.41	4.16
2001-02	50.3	112.70	-7	2.05	-788.90	-14.35	49	12701.29	4.20
2002-03	42.2	94.56	-5	1.98	-472.80	-9.9	25	8941.59	3.92
2003-04	46.5	104.19	-3	2.02	-312.57	-6.06	9	10855.56	4.08
2004-05	46.5	104.19	-1	2.02	-104.19	-2.02	1	10855.56	4.08
2005-06	29.2	65.43	+1	1.82	65.43	1.82	1	4281.08	3.31
2006-07	28.9	64.75	+3	1.81	194.25	5.43	9	4192.56	3.28
2007-08	25.6	57.36	+5	1.76	286.80	8.80	25	3290.17	3.10
2008-09	27.1	60.72	+7	1.78	425.04	12.46	49	3636.92	3.17
2009-10	25.2	56.46	+9	1.75	508.14	15.75	81	3187.73	3.06
2010-11	20.3	45.49	+11	1.66	500.39	18.26	121	2069.34	2.76
Total		$\sum y = 953.16$	$\sum x = 0$	$\sum \log y = 22.57$	$\sum xy = -1526.9$	$\sum x \log y = -8.85$	$\sum x^2 = 572$	$\sum y^2 = 82119.13$	$\sum (\log y)^2 = 42.65$

Table-3 Calculation of Compound Growth Rate of Area of Rapeseed and Mustard in West Bengal

Year (x) (N =12)	Area in thousand ha in West-Bengal	Index No. (y)	x	logy	xy	x logy	x ²	y ²	(logy) ²
1999-00	346.0	85.01	-11	1.92	-935.11	-21.12	121	7226.70	3.68
2000-01	436.0	107.13	-9	2.02	-964.17	-18.18	81	11476.83	4.08
2001-02	439.6	108.01	-7	2.03	-756.07	-14.21	49	11666.16	4.12
2002-03	408.3	100.32	-5	2.00	-501.60	-10.00	25	10064.10	4.00
2003-04	452.0	111.06	-3	2.04	-333.18	-6.12	9	12334.32	4.16
2004-05	457.5	112.41	-1	2.05	-112.41	-2.05	1	12636.00	4.20
2005-06	421.5	103.56	+1	2.01	103.56	2.01	1	10724.67	4.04
2006-07	421.5	103.56	+3	2.01	310.68	6.03	9	10724.67	4.04
2007-08	407.5	100.12	+5	2.00	500.6	10.00	25	10024.01	4.00
2008-09	412.5	101.35	+7	2.01	709.45	14.07	49	10271.82	4.04
2009-10	410.3	100.81	+9	2.00	907.29	18.00	81	10162.65	4.00
2010-11	410.8	100.93	+11	2.00	1110.23	22.00	121	10186.86	4.00
Total		$\sum y = 1234.27$	$\sum x = 0$	$\sum \log y = 24.09$	$\sum xy = 974.38$	$\sum x \log y = 0.43$	$\sum x^2 = 572$	$\sum y^2 = 127498.8$	$\sum (\log y)^2 = 48.36$

Table-4 Calculation of Compound Growth Rate of Production of Rapeseed and Mustard in Burdwan District

Year (x) (N =12)	Production in thousand tonnes in Burdwan	Index No. (y)	x	logy	xy	x logy	x ²	y ²	(logy) ²
1999-00	30.5	76.25	-11	1.88	-838.75	-20.70	121	5814.06	3.53
2000-01	51.9	129.75	-9	2.11	-1167.75	-19.01	81	16835.06	4.45
2001-02	37.6	94.00	-7	1.97	-376.00	-13.81	49	8836.00	3.88
2002-03	36.2	90.50	-5	1.95	-452.5	-9.78	25	8190.25	3.80
2003-04	41.9	104.75	-3	2.02	-314.25	-6.06	9	10972.56	4.08
2004-05	31.0	77.50	-1	1.88	-77.50	-1.88	1	6006.25	3.53
2005-06	27.5	68.75	+1	1.85	68.75	1.85	1	4726.56	3.42
2006-07	21.3	53.25	+3	1.73	159.75	5.18	9	2835.56	2.99
2007-08	21.8	54.50	+5	1.74	272.50	8.68	25	2970.25	3.03
2008-09	19.9	49.75	+7	1.70	348.25	11.88	49	2475.06	2.89
2009-10	24.1	60.25	+9	1.78	542.25	16.02	81	3630.06	3.17
2010-11	20.1	50.25	+11	1.70	552.75	18.71	121	2525.06	2.89
Total		$\Sigma y = 909.50$	$\Sigma x = 0$	$\Sigma \log y = 22.31$	$\Sigma xy = -1282.50$	$\Sigma x \log y = -8.92$	$\Sigma x^2 = 572$	$\Sigma y^2 = 75816.73$	$\Sigma (\log y)^2 = 41.66$

Table-5 Calculation of Compound Growth Rate of Production of Rapeseed and Mustard in West Bengal

Year (x) (N =12)	Production in thousand tonnes in West Bengal	Index No. (y)	x	logy	xy	x logy	x ²	y ²	(logy) ²
1999-00	278.5	80.92	-11	1.90	-890.12	-20.90	121	6548.04	3.61
2000-01	417.0	121.17	-9	2.08	-1090.53	-18.72	81	14682.16	4.32
2001-02	336.9	97.89	-7	1.99	-685.23	-13.93	49	9582.45	3.96
2002-03	328.5	95.45	-5	1.97	-477.25	-9.85	25	9110.70	3.88
2003-04	419.4	121.87	-3	2.08	-365.61	-6.24	9	14852.29	4.32
2004-05	342.7	99.58	-1	1.99	-99.58	-1.99	1	9916.17	3.96
2005-06	383.0	111.30	+1	2.05	111.30	2.05	1	12387.69	4.20
2006-07	338.6	98.39	+3	1.99	295.17	5.97	9	9680.59	3.96
2007-08	361.7	105.11	+5	2.02	525.55	10.10	25	11048.11	4.08
2008-09	315.3	91.62	+7	1.96	641.34	13.72	49	8394.22	3.84
2009-10	443.0	128.73	+9	2.11	1158.57	18.99	81	16571.41	4.45
2010-11	419.6	121.93	+11	2.09	1341.23	22.95	121	14866.92	4.37
Total		$\Sigma y = 1273.96$	$\Sigma x = 0$	$\Sigma \log y = 24.23$	$\Sigma xy = 464.84$	$\Sigma x \log y = 2.15$	$\Sigma x^2 = 572$	$\Sigma y^2 = 137640.80$	$\Sigma (\log y)^2 = 48.95$

Table-6 Calculation of Compound Growth Rate of Productivity of Rapeseed and Mustard in Burdwan District

Year (x) (N =12)	Productivity in Kgs. Per ha in Burdwan	Index No. (y)	x	logy	xy	x logy	x ²	y ²	(logy) ²
1999-00	891.0	99.25	-11	1.99	-1091.75	-21.89	121	9850.56	3.96
2000-01	1054.0	117.41	-9	2.06	-1056.73	-18.54	81	13785.10	4.24
2001-02	748.0	83.32	-7	1.92	-583.28	-13.44	49	6942.22	3.68
2002-03	850.0	94.68	-5	1.97	-473.40	-9.85	25	8964.30	3.88
2003-04	901.0	100.37	-3	2.00	-301.11	-6.00	9	10074.18	4.00
2004-05	668.0	74.41	-1	1.87	-74.41	-1.87	1	5536.84	3.49
2005-06	944.0	105.16	+1	2.02	105.16	2.02	1	11058.62	4.08
2006-07	737.0	82.10	+3	1.91	246.30	5.73	9	6740.41	3.65
2007-08	850.0	94.69	+5	1.98	473.44	9.90	25	8966.19	3.92
2008-09	734.0	81.77	+7	1.91	572.37	13.37	49	6686.32	3.64
2009-10	945.0	105.27	+9	2.02	947.45	18.18	81	11081.77	4.08
2010-11	991.0	110.40	+11	2.04	1214.37	22.44	121	12188.16	4.16
Total		$\Sigma y = 1148.83$	$\Sigma x = 0$	$\Sigma \log y = 23.69$	$\Sigma xy = -21.59$	$\Sigma x \log y = 0.05$	$\Sigma x^2 = 572$	$\Sigma y^2 = 111874.7$	$\Sigma (\log y)^2 = 46.78$

Table-7 Calculation of Compound Growth Rate of Productivity of Rapeseed and Mustard in West Bengal

Year (x) (N =12)	Productivity in Kgs. Per ha in WestBengal	Index No. (y)	x	logy	xy	x logy	x ²	y ²	(logy) ²
1999-00	805.0	95.56	-11	1.98	-1051.25	-21.78	121	9131.71	3.92
2000-01	956.0	113.49	-9	2.05	-1021.45	-18.49	81	12879.98	4.20
2001-02	766.0	90.93	-7	1.96	-636.56	-13.71	49	8268.26	3.84
2002-03	805.0	95.56	-5	1.98	-477.84	-9.90	25	9131.71	3.92
2003-04	928.0	110.17	-3	2.04	-330.51	-6.12	9	12137.42	4.16
2004-05	749.0	88.92	-1	1.94	-88.92	-1.94	1	7906.76	3.76
2005-06	909.0	107.91	+1	2.03	107.91	2.03	1	11644.56	4.12
2006-07	803.0	95.33	+3	1.98	285.99	5.94	9	9087.80	3.92
2007-08	888.0	105.42	+5	2.02	527.11	10.11	25	11113.37	4.08
2008-09	764.0	90.70	+7	1.96	634.91	13.70	49	8226.49	3.84
2009-10	850.0	100.91	+9	2.00	908.20	18.04	81	10182.82	4.00
2010-11	1021.0	121.21	+11	2.08	1333.33	22.92	121	14691.86	4.32
Total		$\Sigma y = 1216.11$	$\Sigma x = 0$	$\Sigma \log y = 24.02$	$\Sigma xy = 190.92$	$\Sigma x \log y = 0.8$	$\Sigma x^2 = 572$	$\Sigma y^2 = 124402.70$	$\Sigma (\log y)^2 = 48.08$

Table-8 Compound Growth Rate (percent per annum) of Area, Production and Productivity of Rapeseed and Mustard in Burdwan District and West Bengal

	Area	Production	productivity
Burdwan	-3.50	-3.53	0.02
West Bengal	0.17	1.00	0.32

Solution of Compound Growth Rate of Area of Rapeseed and Mustard in Burdwan District: [From Table-2]

$$\Sigma Y = NA + B \Sigma x \quad \dots\dots\dots (1)$$

$$\Sigma xY = A \Sigma x + B \Sigma x^2 \quad \dots\dots\dots (2)$$

From equation (1) we get,

$$22.57 = 12A + B \times 0$$

$$\text{Or, } 12A = 22.57$$

$$\text{Or, } A = 22.57/12 = 1.88$$

$$a = \text{Antilog } A = \text{Antilog } (1.88) = 76.00$$

From equation (2) we get,

$$-8.85 = 0 + B \times 572$$

$$\text{Or, } 572 B = -8.85$$

$$\text{Or, } B = -8.85/572 = -0.015472$$

$$b = \text{Antilog } B = \text{Antilog } (-0.015472) = 0.965$$

Here, compound growth rate of area of rapeseed and mustard in Burdwan District

$$= (b-1) \times 100 \text{ percent}$$

$$= (0.965-1) \times 100$$

$$= -3.50 \text{ ppa.}$$

Solution of Compound Growth Rate of Area of Rapeseed and Mustard in West Bengal: [From Table-3]

From equation (1) we get,

$$24.09 = 12A + B \times 0$$

$$\text{Or, } 12A = 24.09$$

$$\text{Or, } A = 24.09/12 = 2.01$$

$$a = \text{Antilog } A = \text{Antilog } (2.01) = 101.74$$

From equation (2) we get,

$$0.43 = 0 + B \times 572$$

$$\text{Or, } 572 B = 0.43$$

$$\text{Or, } B = 0.43/572 = 0.000752$$

$$b = \text{Antilog } B = \text{Antilog } (0.000752) = 1.001732$$

Here, compound growth rate of area of rapeseed and mustard in West Bengal

$$= (b-1) \times 100 \text{ percent}$$

$$= (1.001732-1) \times 100$$

$$= 0.17 \text{ ppa.}$$

Solution of Compound Growth Rate of Production of Rapeseed and Mustard in Burdwan District: [From Table-4]

From equation (1) we get,

$$22.31 = 12A + B \times 0$$

$$\text{Or, } 12A = 22.31$$

$$\text{Or, } A = 22.31/12 = 1.86$$

$$a = \text{Antilog } A = \text{Antilog } (1.86) = 72.30$$

From equation (2) we get,

$$-8.92 = 0 + B \times 572$$

$$\text{Or, } 572 B = -8.92$$

$$\text{Or, } B = -8.92/572 = -0.01559$$

$$b = \text{Antilog } B = \text{Antilog } (-0.01559) = 0.96$$

Here, compound growth rate of production of rapeseed and mustard in Burdwan District

$$= (b-1) \times 100 \text{ percent}$$

$$= (0.96-1) \times 100$$

$$= -3.53 \text{ ppa.}$$

Solution of Compound Growth Rate of Production of Rapeseed and Mustard in West Bengal: [From Table-5]

From equation (1) we get,

$$24.23 = 12A + B \times 0$$

$$\text{Or, } 12A = 24.23$$

$$\text{Or, } A = 24.23/12 = 2.01$$

$$a = \text{Antilog } A = \text{Antilog } (2.01) = 104.51$$

From equation (2) we get,

$$2.15 = 0 + B \times 572$$

$$\text{Or, } 572 B = 2.15$$

$$\text{Or, } B = 2.15/572 = .0037522$$

$$b = \text{Antilog } B = \text{Antilog } (0.0037522) = 1.01$$

Here, compound growth rate of production of rapeseed and mustard in West Bengal

$$= (b-1) \times 100 \text{ percent}$$

$$= (1.01-1) \times 100$$

$$= 1.00 \text{ ppa.}$$

Solution of Compound Growth Rate of Productivity of Rapeseed and Mustard in Burdwan District: [From Table-6]

From equation (1) we get,

$$23.69 = 12A + B \times 0$$

$$\text{Or, } 12A = 23.69$$

$$\text{Or, } A = 23.69/12 = 1.974$$

$$a = \text{Antilog } A = \text{Antilog } (1.974) = 94.225$$

From equation (2) we get,

$$0.05 = 0 + B \times 572$$

$$\text{Or, } 572 B = 0.05$$

$$\text{Or, } B = 0.05/572 = 0.0000874$$

$$b = \text{Antilog } B = \text{Antilog } (0.0000874) = 1.0002$$

Here, compound growth rate of productivity of rapeseed and mustard in Burdwan District

$$= (b-1) \times 100 \text{ percent}$$

$$= (1.0002-1) \times 100$$

$$= 0.02 \text{ ppa.}$$

Solution of Compound Growth Rate of Productivity of Rapeseed and Mustard in West Bengal: [From Table-7]

From equation (1) we get,

$$24.02 = 12A + B \times 0$$

$$\text{Or, } 12A = 24.02$$

$$\text{Or, } A = 24.02/12 = 2.0016$$

$$a = \text{Antilog } A = \text{Antilog } (2.0016) = 100.38$$

From equation (2) we get,

$$0.8 = 0 + B \times 572$$

$$\text{Or, } 572 B = 0.8$$

$$\text{Or, } B = 0.8/572 = 0.001398$$

$$b = \text{Antilog } b = \text{Antilog } (0.001398) = 1.003225$$

Here, compound growth rate of productivity of rapeseed and mustard in West Bengal

$$= (b-1) \times 100 \text{ percent}$$

$$= (1.003225 - 1) \times 100$$

$$= 0.32 \text{ ppa}$$

Compound growth rates of area, production and productivity of rapeseed and mustard in Burdwan district and West Bengal are presented in Table 4. It is found that in Burdwan district area and production of rapeseed and mustard have recorded negative compound growth rate to the extent of 3.50 and 3.53 percent per annum respectively over a period of 11 years from 1999-2000 to 2010-11. But growth rate of productivity of this crop is noted to be 0.05 percent in the district. Compound growth rate of area, production and productivity of this crop in West Bengal are 0.17, 1.00 and 0.32 percent per annum respectively in same period of time.

Conclusion

The results of the study indicate a negative compound growth rate of area and production of rapeseed and mustard during the period of 11 years from 1999-2000 to 2010-11. But a positive growth rate has been observed in case of productivity of rapeseed and mustard during the same period. In Burdwan district area and production of rapeseed and mustard have recorded negative compound growth rate to the extent of 3.50 and 3.53 percent per annum respectively over a period of 11 years from 1999-2000 to 2010-11. But growth rate of productivity of this crop is noted to be 0.05 percent in the district. Compound growth rate of area, production and productivity of this crop in West Bengal are 0.17, 1.00 and 0.32 percent per annum respectively in same period of time.

Application of research: Compound Growth Rate may be used for estimating change over time in important parameters of development like income, employment, investment, etc at national as well as state level.

It may also be used in making comparative study on growth of different sectors in an economy.

Abbreviations:

ppa: Percent Per annum

CGR: Compound Growth Rate

Acknowledgment / Funding: Author thankful to Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, 741252, West Bengal, India

***Research Guide or Chairperson of research: Dr G. Dey**

University: Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, 741252, West Bengal, India

Research project name or number: MSc Thesis

Author Contributions: All author equally contributed

Author statement: All authors read, reviewed, agree and approved the final manuscript

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

References

- [1] Bureau of Applied Economics and Statistics, Govt. of West Bengal. 2011-12. District Statistical Handbook, Burdwan 2011-12.
- [2] Bureau of Applied Economics and Statistics, Govt. of India. 2011-12. Economic Review, Statistical Appendix 2011-12.
- [3] Directorate of Economics & Statistics, Ministry of Agriculture, Government of India. 2000. Cost-of-cultivation-of-principal-crops-in-India-2000. 258 pp.
- [4] Directorate of Agriculture, Govt. of West Bengal. 2011-12. Area, production and productivity of principal crops in West Bengal 2011-12, Evaluation wing.
- [5] Dixit S. K., Kuchhadiya D. B., Shiyani R. L. and Pandya H. R. (1992) *Agricultural Situation in India*, 47(3), 175-178
- [6] Dutta A. (2011) *Satsa Mukhaptra Annual Technical Issue*, 15, 101-105.
- [7] Gaddi G. M., Koppad M. B., Gummagolmath K. C. and Naik A. D. (1999) *Karnataka Journal of Agricultural Sciences*, 12(1/4), 93-98.
- [8] Ghosh B. K. (2010) *Trends in Agricultural Economics*, 3(3), 135-146.
- [9] Goswami K. and Chatterjee B. (2000) *Indian Journal of Regional Science*, 32(2), 69-76.
- [10] Gudmewad S. G., Sarsamkar R. A. and Mate A. S. (2008) *Agriculture Update*, 3(1/2), 86-90.
- [11] Helal M. U., Islam N., Kadir M. and Miah N. R. (2016) *Agricultural Research and Technology*, 1 (5), 001-006.
- [12] Kachroo J., Kachroo D. and Sharma A. (2010) *Agricultural Situation in India*, 66 (10), 589-600.