

## TRENDS AND PERSPECTIVES OF SUSTAINABLE POTATO PRODUCTION IN ALIGARH DISTRICT, INDIA

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**Abstract:** *The rural population in India is largely engaged in vegetable cultivation apart from traditional agricultural practices. Vegetable cultivation has gained impetus since last decades due to increasing health awareness, population growth, urbanization and better marketing facilities. Earlier, small land holders used to grow vegetables but now with increasing demand and higher remunerations large land holders have also shifted towards vegetable cultivation. Potato is widely used due to its low cost, easy handling and transportation and its higher shelf life as compare to other vegetables. The present paper analyzes the dynamics of potato cultivation in Aligarh district, which is one the leading producing area of India. This paper tends to find out temporal change in the area under potato cultivation and substantial increase in the total production. There are promising benefits to the potato farmers and good prospects in future due increasing cold storage and agro-processing facilities. The present study also discusses the role various institutional, socio-economic, marketing and policy oriented factors constraining potato cultivation in the study area.*

**Key words:** Potato Cultivation, Veg. Farming, Agricultural Marketing, Farmers' Sustainability

### Introduction

India with diverse soil and climate comprising several agro-ecological regions provides ample opportunity to grow a variety of horticultural crops. These crops form a significant part of total agricultural produce in the country which covers fruits, vegetables, root and tuber crops, flowers, and ornamental, medicinal and aromatic plants, spices, condiments, plantation crops and mushrooms. Cultivation of these crops is labour intensive and generates lot of employment opportunities for the rural population. India, with more than 66 million tonnes of vegetables is the second largest producer vegetables in the world next only to Brazil and China (Economic Census 2005). Thus, cultivation of diversified crops plays a vital role in the prosperity of the nation and is directly linked with the health and happiness of the people (Asif, K. et al., 2016).

Potato is a starchy tuber of the plant *Solanum tuberosum*, native to the Andes in South America. It was introduced in Europe by the Spanish invaders and diffused to several countries. It is grown in more than 125 countries and consumed almost daily by more than a billion people. Hundreds of millions of people in developing countries depend on potatoes for their survival. Potato is also referred as the 'food of the poor'. In India also potato is reported to be very important during the times of food scarcity (Shakeel, et al., 2012). Once harvested, potatoes can be used for a variety of purposes: as a fresh vegetable for cooking at home, as raw material for processing into food products, food ingredients, starch and alcohol, as feed for animals, and as seed tubers for growing the next season's crop (FAO, 2009).

Potato cultivation is expanding strongly in the developing world, where the potato's ease of cultivation and nutritive content has made it a valuable food security and cash crop for millions of farmers. Developing countries are now the world's biggest producers and importers of potatoes and potato products. In India, potato was introduced by the Portuguese during 17<sup>th</sup>

Century AD. It was first cultivated in the mountains of the Western Ghats, Nilgiris and later on in the North India. At present potato is the most important and widely used vegetable in India. As a vegetable, potato is cultivated in almost all states of India. The major potato producing States are Uttar Pradesh, West Bengal, Bihar, Gujarat, Madhya Pradesh, Punjab, Haryana and Assam. Vegetable cultivation under market gardening is an important component of the value added cropping system of Indian agriculture. Earlier vegetables were cultivated as subsistence crops along with cereals, pulses and oilseeds and occupied a meagre share of total cropped area of the country. It is a caste oriented activity and mainly cultivated at small scale (Deshingkar P. et al. 2003). The cultivation of vegetable was traditionally confined to certain castes and still persists in larger parts of the country. Hence, this kind of cropping system could not get proper attention by the policy makers as well as by large farmers.

**Table 01: State wise Production of Potato and its Share (in Percent)**

State/UTs	Five Year Average (2012-13 to 2016-17)	
	Production	Percent Share
Uttar Pradesh	14502.63	31.96
West Bengal	10425.58	22.97
Bihar	6449.06	14.21
Gujarat	3015.68	6.64
Madhya Pradesh	2858.30	6.30
Punjab	2278.43	5.02
Haryana	769.17	1.69
Assam	1039.31	2.29
Chhattisgarh	625.87	1.38
Jharkhand	653.61	1.44
Maharashtra	335.97	0.74
Karnataka	558.04	1.23
Uttarakhand	403.04	0.89
Odisha	260.13	0.57
Rajasthan	166.93	0.37
Meghalaya	184.75	0.41
Himachal Pradesh	210.56	0.46
Tripura	146.88	0.32
Jammu & Kashmir	127.96	0.28
Nagaland	57.74	0.13
Tamil Nadu	103.25	0.23
Sikkim	51.18	0.11
Andhra Pradesh	74.51	0.16
Kerala	7.71	0.02
Mizoram	2.01	0.00
Telangana	61.82	0.14
Arunachal Pradesh	1.13	0.00
Others	14.70	0.03
<b>TOTAL</b>	<b>45383.50</b>	<b>100.00</b>

Source: State Departments of Horticulture & Agriculture

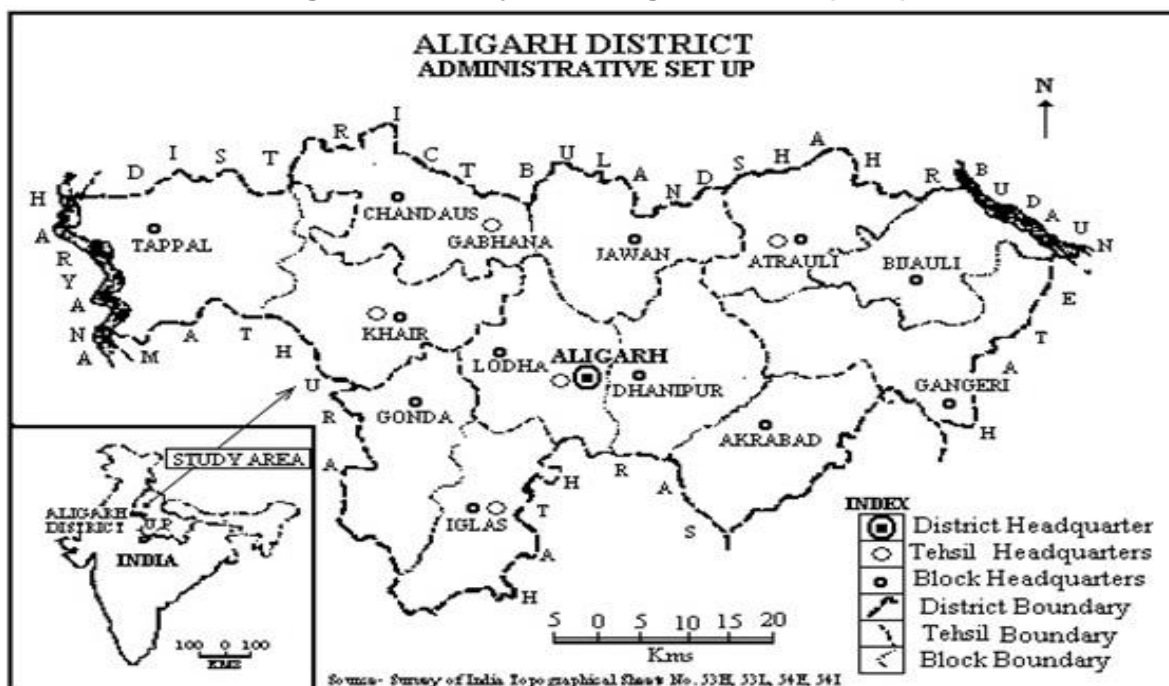
The Table 01 shows the state wise average share of potato production in India for the last five years. It is revealed that the whole Indo-Gangetic Plain is important for potato cultivation and the largest production is reported from Uttar Pradesh (31.96 percent) followed by West Bengal (22.97 percent ) and Bihar (14.21 percent). Among the Himalayan states a good performance has shown by the states of Uttarakhand (0.89 percent) and Himachal Pradesh (0.46 percent). In the North Eastern region, Assam (2.29 percent) followed by Meghalaya (0.41 percent) is the leading producer. Whereas, in the peninsular region Karnataka (1.23 percent), followed by Maharashtra (0.74 percent) and Tamil Nadu (0.23 percent), is the leading. However, the other states of peninsular region are lacking in potato cultivation.

The present paper aims to understand the dynamics of potato cultivation in the Northern Plains of Ganga River with the help of a case study. Aligarh district in the *doab* (land between two rivers) region of western Uttar Pradesh has been selected as study area (Asif, K., 2014). This region is a well-known potato belt of India. Here potato cultivation has a boon due to the availability of sandy loam soils and suitable climatic condition during winter season (*rabi* season between October and March). In the present study researchers analyze the area and production of potato in various development blocks of Aligarh District to understand the future prospects of potato cultivation. The paper intends to highlights the problems of the farmers, particularly related to the storage, marketing and processing.

### About the Study Area

The Aligarh district is situated in the semi-arid eco-system of the Western Uttar Pradesh. Geographically, Aligarh district is located in the fertile tract of rivers the Ganga and the Yamuna between 27°29' to 28°11' N latitudes and 77°29' to 78°38' E longitudes. There are 5 Tehsils/subdivisions and 12 development blocks in the district. The total geographical area is 3650 sq.km, with a population of 36,73,849 (1,951,996 males and 1,721,893 females) (Census, 2011). The district has a population density of 1,007 persons per sq. km. The population growth rate over the decade 2001-2011 was 22.78 percent. Aligarh has a sex ratio of 876 females for every 1000 males, and a literacy rate of 69.61 percent. About 65 percent of the workforce is engaged in agricultural activities. There are 1210 villages and 13 townships, 96 rural markets and 4 regulated markets in the study area for transaction of vegetables in the study area. The district is further sub- divided into 12 developmental blocks (Figure 01). Vegetable cultivation is an age-old farming system in Aligarh district.

**Figure 01: Study Area: Aligarh District (2019)**



The region experiences sub-tropical monsoon type of climate characterized by distinct seasonal rhythm. Summers start around April and continue till June with a mean maximum temperature of 40°C, occasionally shooting up to 46°C, while during winters it goes as low as 4°C. The average annual rainfall is about 55 cm that follow the summer season and usually starts up to the end of the June (Asif, K., 2014). Aligarh district is an extensive plain comprising alluvial soils, which are characterized by their depth and gray-brown colour. Their texture varies from sandy, sandy loam to clay loam. Jowar, bajra, maize, cotton, paddy, arhar and moong are major crops during kharif, while wheat, mustard, green peas and potato are commonly grown in

rabi season. Cotton and sugarcane (with small area) are major cash crops of the district. Vegetable cultivation is largely confined to small and marginal farmers who are located mainly in the peri-urban areas (Khan N. et al., 2012).

### Database and Methodology

The present study is based on secondary sources of data obtained from statistical bulletin of Aligarh district. The latest data available for block wise area under potato cultivation was used for the present work. Thus, block wise data from 2001- 2016 was used in the present study. The data regarding area, production and yield of potato in the district has been processed and computed. The study carries out with simple statistical techniques to analyze and interpret data. The dataset obtained was analyzed to understand the prospects of potato cultivation and the changes in trends of area, production and productivity of potato in the study area.

### Analysis and Discussion

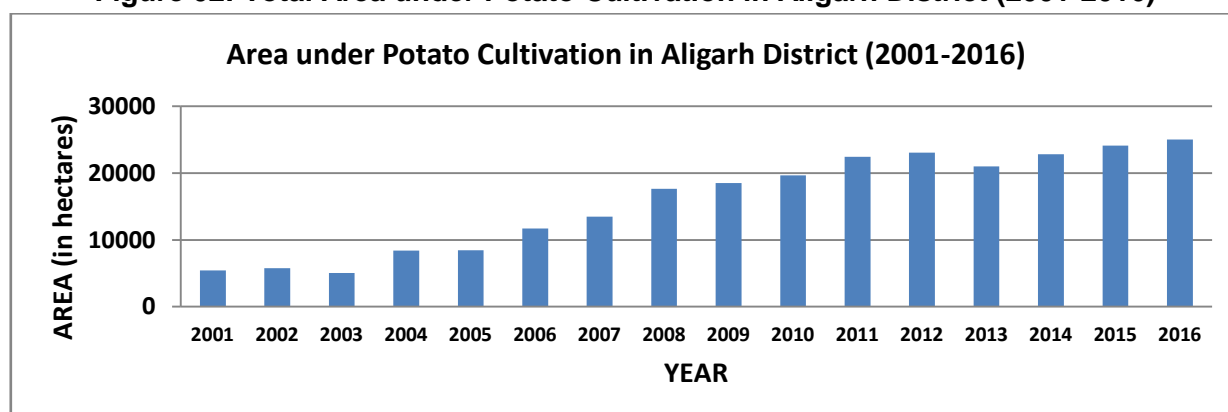
The Table 02 shows the block wise distribution of area under potato cultivation since 2001. It reveals that the area under potato cultivation during 2001 was only 5,425 hectares which increased to 24,987 hectares in 2016 (Figure 02). Thus a growth of 19,562 hectares (360.59 percent) took place over last 15 years. The steep rise in the area under potato cultivation is largely due to increasing population, better marketing and transportation facilities, rising consciousness of health benefits from vegetable intake, increasing urban demand for processed food items and agro-processing industries. The block wise variation is also observed in the study area. It varied from 89 hectares in Atrauli to 7,176 hectares in Iglas, during last 15 years. Thus, it was observed that all the blocks have small area under potato cultivation while only few blocks gave large area under its cultivation.

**Table 02: Block wise Distribution of Area under Potato Cultivation (2001-2016)**

Block	Block wise Area Under Potato Cultivation (in hectares)															
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Bijauli	244	156	216	187	230	248	256	335	422	330	353	363	331	321	350	393
Jawan	165	217	221	123	188	189	194	254	268	338	370	380	341	342	409	405
Akrabad	130	139	177	204	201	231	301	394	481	404	452	464	424	465	480	505
Gangiri	258	283	378	358	391	392	446	584	671	495	476	489	446	419	411	552
Atrauli	540	463	564	590	533	522	650	891	938	498	565	580	529	581	590	629
Tappal	28	17	215	261	200	134	133	174	184	798	773	794	724	744	821	861
Chandaus	174	151	220	89	230	342	289	378	399	660	926	951	868	902	1105	1032
Dhanipur	371	245	351	333	306	305	235	308	325	603	969	995	908	900	980	1080
Khair	39	637	702	823	772	508	505	661	698	1859	1883	1934	1765	1783	1788	2079
Lodha	261	276	398	339	496	817	989	1294	1365	1736	1978	2032	1854	1924	2099	2206
Gonda	861	845	1215	1313	1487	2575	3268	4277	4513	4410	5127	5266	4805	5201	5429	5715
Iglas	2354	2318	377	3763	3411	5437	6184	8094	8242	7501	8549	8781	8012	9210	9620	9530
<b>Total</b>	<b>5425</b>	<b>5747</b>	<b>5034</b>	<b>8383</b>	<b>8445</b>	<b>11700</b>	<b>13450</b>	<b>17644</b>	<b>18506</b>	<b>19632</b>	<b>22421</b>	<b>23029</b>	<b>21007</b>	<b>22792</b>	<b>24082</b>	<b>24987</b>

Source: Statistical Booklets (2001-2016)

**Figure 02: Total Area under Potato Cultivation in Aligarh District (2001-2016)**



The change in area under potato cultivation was observed in all the blocks in the district. Although there is an overall growth of 19,562 hectare in the total area under potato cultivation since last 15 years there is a large variation at the block level. All the blocks have shown a positive change although with high level of variations (Table 03). The maximum change was observed in Iglas block (7,176 hectares) followed by Gonda (4,854 hectares) and Khair block (2,040 hectares). It was observed that largest change has taken place in Iglas followed by Gonda blocks which had the largest and second largest area under potato during 2001 also. In 2001 Atrauli had third position in area under potato cultivation but it has shown minimum growth of only 89 hectares. Further Khair, Lodha, Tappal and Chandaus blocks have shown an exceptional growth during the same period. These blocks are adjoining the Iglas and Gonda block and people have gradually devoted their land to potato cultivation. Further, the development of marketing facilities over the last decade due to development of efficient transport networks, better connectivity to adjoining areas and increase in the number of cold storage facilities in these blocks has helped in growth of potato cultivation in the western blocks of the district.

**Table 03: Block wise Growth of Area under Potato Farming (2001-2016)**

Name of Block	2001	2016	Change (2001-2016)	
			Hectares	Percent
Iglas	2354	9530	7176	304.84
Gonda	861	5715	4854	563.76
Khair	39	2079	2040	5230.77
Lodha	261	2206	1945	745.21
Chandaus	174	1032	858	493.10
Tappal	28	861	833	2975.00
Dhanipur	371	1080	709	191.11
Akrabad	130	505	375	288.46
Gangiri	258	552	294	113.95
Jawan	165	405	240	145.45
Bijauli	244	393	149	61.07
Atrauli	540	629	89	16.48
<b>Total District</b>	<b>5425</b>	<b>26374</b>	<b>20949</b>	<b>386.16</b>

Source: Statistical Booklets (2001-2016)

**Table 04: Area, Yield and Total Production of Potato in Aligarh District (2001-2016)**

Year	Total Area (hectares)	Yield (quintals/hectares)	Production (quintals)
2001	5425	263.49	1429433.25
2002	5747	261.46	1502610.62
2003	5034	245.22	1234437.48
2004	8383	225.25	1888270.75
2005	8445	283.80	2396691.00
2006	11700	232.62	2721654.00
2007	13450	234.03	3147703.50
2008	17644	213.39	3765053.16
2009	18506	220.52	4080943.12
2010	19632	271.47	5329499.04
2011	22421	245.92	5513772.32
2012	23029	230.92	5317856.68
2013	21007	276.18	5801713.26
2014	22792	249.26	5681133.92
2015	24082	259.8	6256503.60
2016	24987	267.05	6672778.35

Source: Statistical Booklets (2001-2016)

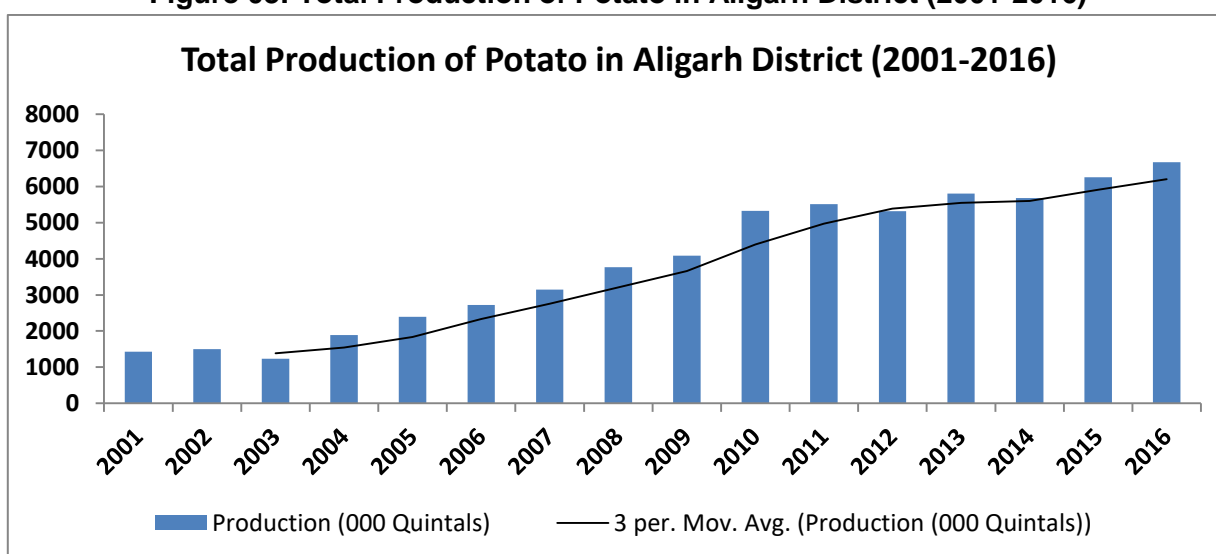
The Table 04 shows the area, yield and production of potato from 2001 to 2016. It was observed that the area under potato has increased considerable but yield has not increased significantly. The yield of potato in 2001 was 263.49 quintals/hectare which became 267.05 quintals/hectare in 2016. Thus, we can easily conclude that heavy increase in the production of potato is associated with the increase in area rather than yield which has remained almost the same since 2001. However, there may have overall fluctuation in the yield due to yearly variations in the inputs and climatic elements. This shows that, the traditional practice is still followed and new methods and techniques to increase the yield of the crop is not available or adopted by the farmers in the study area.

**Table 05: Change in Total Production of Potato in Aligarh District (2001-2016)**

Year	Production (quintals)	Change in Production	
		In Quintals	(in Percent)
2001	1429433.25	-	-
2002	1502610.62	73177.37	5.12
2003	1234437.48	-268173.00	-17.84
2004	1888270.75	653833.30	52.96
2005	2396691.00	508420.30	26.93
2006	2721654.00	324963.00	13.56
2007	3147703.50	426049.50	15.65
2008	3765053.16	617349.70	19.61
2009	4080943.12	315890.00	8.39
2010	5329499.04	1248556.00	30.59
2011	5513772.32	184273.30	3.46
2012	5317856.68	-195916.00	-3.55
2013	5801713.26	483856.60	9.09
2014	5681133.92	-120579.34	-2.08
2015	6256503.60	575369.68	10.13
2016	6672778.35	416274.75	6.65

Source: Computed by the Researchers based on Table 04

**Figure 03: Total Production of Potato in Aligarh District (2001-2016)**



The total production of potato in the study area has increased from 14,29,433.25 quintals in 2001 to 66,72,778.35 quintals in 2016. Thus, an increase of 52,43,345.10 quintals has been recorded during 15 years. This accounted for an average annual increase of



3,49,556.34 quintals. The production has increased regularly since the area under cultivation has increased steadily over the last 15 years (Figures 02 and 03). There is a regular increase in production over the last 13 years apart from 2003 and 2012 which showed a decline in potato production. The minimum increase in volume of potato production was 73,177.37 quintals found in 2002 whereas maximum increase was observed to be 12,48,556 quintals in 2010 followed by 6,53,833.3 quintals in 2004. Further, in terms of increase in percentage the minimum was 3.46 percent in 2011 whereas the maximum increase was observed as 52.96 percent in 2004 (Table 05).

**Figure 04 Potato Farming and Harvesting in the Iglas Block of Aligarh District**



Source: Photographs composed by the researcher.

### Factors Constraining the Potato Cultivation and Production

Production Related Factors	Socio-Economic Factors	Policy & Institutional Factors
<ul style="list-style-type: none"> <li>• Physical environment and production zones</li> <li>• Cultivation methods</li> <li>• Soil conservation</li> <li>• Water management</li> <li>• Pest and disease mgmt.</li> <li>• Harvesting</li> <li>• Storage and transport</li> <li>• Post-harvest management</li> </ul>	<ul style="list-style-type: none"> <li>• Social support to farmers</li> <li>• High production costs</li> <li>• Lack of credits</li> <li>• Price instability</li> <li>• Inefficiency of local markets</li> <li>• Limited access to higher value markets.</li> <li>• Lack of industrial support</li> <li>• Technology Infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>• Neglect of the potato subsector</li> <li>• Inadequate capacity building Initiatives.</li> <li>• Lack of support to farmers Organizations.</li> <li>• Entrepreneurship development</li> <li>• Research institutions</li> <li>• Skill Development programmes</li> <li>• Diffusion and expansion</li> </ul>

Source: Based on the Report 'Sustainable Potato Production: Guidelines for Developing Countries, Food and Agricultural Organization of the United Nations, 2009

### Conclusion

The area under potato cultivation in Aligarh district has observed a substantial increase from 5,425 hectares in 2001 to 24,987 hectares in 2016 as a result of which the production too has increased many times i.e. 14,29,433.25 quintals in 2001 to 66,72,778.35 quintals in 2016. This has shown sustainability in potato production in the district, which directly associated with the socio-economic growth of farmers. However, the potato farmers facing the constraints such as fluctuation in potato price, storage problems, potato seeds, irrigation, high price of diesel, not gets pesticides and fertilizers easily on subsidized rates. Many potato farmers especially small farmers store a small portion of their crops face so many problems in cold storage. If the proper

policy for potato production and marketing implemented by the government potato can be used for several purposes like starch, alcohol, potato chips etc. (Singh and Rai, 2011). the government can also earn foreign exchange from the export of potato and potato products.

Socio-economic development of small and marginal farmers is also expected through proper vegetable cultivation and marketing in rural areas. Still, many constraints in increasing productivity and use of new technology are being faced by Indian farmers (Prakash, 2009). Adoption of rural marketing system may leads to some change because it provides a platform for employment, income, social change. Rural markets must link with bigger markets, which is only possible when proper transportation network is provided. Improved infrastructure and institutional arrangement such as private storage facilities, consciousness of food quality and standard among small income group even in village area also led to enhancement in vegetable cultivation. In addition, the processing of farm produce can also play an important role in conserving the farming systems and effective utilization of the produce (Asif, et al., 2016).

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