International Journal of Research (IJR) Vol-1, Issue-8, September2014 **ISSN 2348-6848**

Growth and modernization of Agriculture in Jammu and Kashmir

Samir-Ul-Hassan.,[1] Dr. Kanhaiya Ahuja[2], Munasir hussain[3]

1. Department of Economics, North Eastern Hill University Shillong, Meghalaya
2. Professor School of Economics, Devi Ahilya Vishwavidyalaya, Indore, (M.P)
3. School Of Economics, Devi Ahilya Vishwavidyalaya, Indore, (M.P)

Abstract

Since the long stagnation of Jammu and Kashmir economy during 90's due terrorism, the state has shown the increasing trend in its growth of economy since beginning of 21th century. With this changing environment in the state, Agriculture sector enhances growth and stagnant industrial sector start growing which opens routs for the growth of services sector by peace and harmony in the state in last 13 years by 1999 to 2012. In this paper we focus upon the different dimensions of growth in the agriculture of Jammu and Kashmir from last thirty years. This paper takes a more emphasizing on aspect of technological progress and the transformation of traditional agriculture of Jammu and Kashmir which become responsible for small growth in the industrial sector of the state. The paper concludes that Agriculture in the state is growing tremendously but still the use of modern agriculture measure is limited due to slow growth in industrial sector.

Key words: Agriculture sector, Industrial sector, Production, output and modern measures

Introduction

Agriculture plays an important role in contributing to socio-economic development in many countries. Agriculture and industry being integral component of development process due to their mutual interdependence or linkages, the contribution of agriculture in the economy in general and of industry in particular well knows almost all regions. Increased productivity in agriculture has been achieved in several parts of the world mainly by modernizing agriculture. Modernization consists largely of using improved seeds, modern farm machinery such as tractors, harvesters, threshers, etc., chemical fertilizers and pesticides in an optimal combination with water. By modernization in Agriculture sector most developed countries of today got their industrial revolution especially England in 1770. Modernization in agriculture open doors for the growth of other sectors and enhances the economy of a country. Agricultural economists in particular have long focused on how agriculture can best contribute to overall economic growth and modernization. Many early analysts (Rosenstein-Rodan, 1943; Lewis, 1954; Scitovsky, 1954; Hirschman, 1958;

Jorgenson, 1961; Fei and Ranis, 1961) highlighted that agriculture because of its abundance of resources and its ability to transfer surpluses to the more important industrial sector. (Dholakia and Dholakiia 1987) analyze that modernization of agriculture leads to an increase in the total factor productivity in agriculture. (Mahendradev 1987) growth of food grains production in many states including the hitherto low growth states such as Rajasthan, Madhaya Pradesh and West Bengal, and that this acceleration in the growth of production could be attributed to the spread of bio chemical technology to these states. (Mruthyunjaya and Kumar 1989) spread of new farm technology is always uneven in terms of regions and crops leading to imbalances in the initial period. (Dhanagare 1987 and SatyaPaul 1989) argue that the new agricultural technology has adverse effects on land distribution and income disparity among farm families. (Yang and Zhu 2013) analyze that when agriculture relies on traditional technology, industrial development reduces the relative price of industrial products, but has a limited effect on per capita income because most labor has to remain in farming. Growth is not sustainable until this relative price drops below a certain threshold, thus inducing farmers to adopt modern technology that employs industry- supplied inputs. (Schultz 1964) argues that subsistence food requirements present a fundamental challenge to poor economies and that the modernization of agriculture is essential for sustained growth. (Anderson, 2000) find that commonly attributed to the slow rise in the demand for food as compared with other goods and services as incomes rise; and the more rapid development of new technologies for agriculture, relative to those for other sectors. (Hayami and Herdt, 1977; Pinstrup-Andersen et al., 1976; Binswanger, 1980; Hazell and Haggblade, 1993) observe that rapid agricultural productivity growth is a pre-requisite for the market mediated linkages to be mutually beneficial. Productivity growth that resulted from agricultural R&D has had an enormous impact on food supplies and food prices, and consequent beneficial impacts on food security and poverty reduction

Thus modernization of agriculture is the key element in the growth process of the agriculture sector. The growth in agriculture sector can be sustainable only when modernization enters in this sector on every part and in every aspect related with this sector. Thus in this paper we try to find out in which direction the agriculture sector in the Jammu and Kashmir is going and how long modernization is penetrated and expended in the agriculture sector of the state.

Objective of the study

- To study the growth of Agriculture in the state.
- To identify the modernization of Agriculture in Jammu and Kashmir.

Material and Methods

The study has been taken from 1999 to 2012, because this period has remained with developmental phase in the state. The growth and modernization of agriculture in

any region explores not only the agriculture but also those components which help them to grow. In analyzing the growth and modernization of agriculture we analyze the production pattern of state and also the modern inputs which agriculture took from industry for developmental purposes. The growth of all the aspects has been minutely analyzed with the formulas like:

Growth rate = $Y_c - Y_b / Y_b * 100$
Where
Y_c = value of variable on current year
Y_b = value of variable on base year

Results and Discussion

Growth of Agriculture in Jammu and Kashmir

Jammu and Kashmir has a distinct geographical outlook having three agro climatic zones Jammu, Kashmir and Ladakh, each zone has its own particular climatic character that describe its cropping pattern and productivity. Agriculture is the mainstay of J&K and hence it has a strategic role to play in the economic development of the state. It is the main source of income and employment for majority of population in the state. Paddy and fruits is the main crop of Kashmir zone followed by maize and wheat. Jammu region is dominated by wheat and maize crops while in Ladkh barley is the major cereal crop followed by wheat. State has also the honor amongst the world's few places where saffron is cultivated. Average size of operational holding at state level stood at 0.67 hectares which reflects no change in the holding size in comparison to the holding size in census (2011). In view of the potential available, fruit growing has become a major industry and contributes largely to the export trade of the state. It absorbs a large chunk of people in the various processes through which it passes. During the first few five year plans priority was assigned to achieve self-sufficiency in food grains production, over the year's horticulture emerged as an indispensable and growing part of agriculture, offering a wide range of choices to the farmers for crop diversification. The pattern of growth and production and share of crops in the state have fluctuated in last few years in which the food grain production is increasing but at the same time diversification is taking place in the agriculture production. As shown in below table. 1.

Table 1: Production of major crops and their share in total food crops sown in Jammu and Kashmir. (000 Qtl)

S.No	Year	Rice	wheat	Maize	Pulses	cereals & mallets	Total foodcrops
1	1999-00	3915 (29.44)	4343 (32.66)	4712 (35.48)	145 (1.09)	177 (1.33)	13297
2	2000-01	4153 (37.09)	1487 (13.20)	5258 (46.96)	128 (1.14)	170 (1.51)	11196
3	2001-02	4223 (31.62)	3430 (25.67)	5381 (40.28)	125 (0.93)	198 (1.48)	13357
4	2002-03	4214 (31.76)	4055 (30.56)	4651 (35.06)	142 (1.09)	203 (1.53)	13265
5	2003-04	5048 (32.94)	4595 (29.98)	5326 (34.75)	132 (0.86)	225 (0.14)	15323
6	2004-05	4928 (32.79)	4782 (31.82)	4922 (32.75)	152 (1.01)	243 (1.61)	15027
7	2005-06	5574 (37.11)	4575 (30.45)	4535 (30.19)	135 (0.89)	201 (1.33)	15020
8	2006-07	5546 (35.15)	4983 (31.58)	4869 (30.89)	141 (0.89)	238 (1.50)	15777
9	2007-08	5620 (34.67)	4959 (30.59)	4745 (29.27)	153 (0.94)	230 (1.41)	16208
10	2008-09	5712 (33.18)	5101 (29.63)	5025 (29.19)	182 (1.10)	230 (1.32)	16250
11	2009-10	6615 (35.60)	4822 (29.95)	4780 (29.45)	218 (1.34)	232 (1.42)	16267
12	2010-11	8146 (46.89)	3000 (17.27)	5898 (33.95)	325 (1.87)	241 (1.38)	17371
13	2011-12	8476 (47.34)	3000 (16.75)	6098 (34.05)	328 (1.83)	269 (1.54)	17904

Sources: Economic Survey 2007-08 and 2012-13 of Jammu and Kashmir (Figure in Brackets is percent share of the crop in total production.)

The table shows the production and share of some major crops sown in Jammu and Kashmir from the period 1999-00 to 2011-12. In the table it is revealed that in the period of thirteen years of study the total production of food crops has increased from 13297 thousand quintals to 17904 thousand quintals from 1999-00 to 2011-12. In this respect rice production has increased from 3915 thousand quintals to 8476 thousand quintals in the same period and the share in the total food crop production of rice has increased from 29.44 percent to 47.34percent in the study period. The share of rice production is still highest in total production of food crop of J& K as for as the production of wheat and maize is concerned their share in total food crop production has decreased from 32.66 percent to 16.75 percent and 35.43 percent to 34.05 percent from 1999-00 to 2011-12 for the wheat and maize respectively. The increase in production is due to increase of irrigation and fertilizer consumption in the state.

In the state of Jammu and Kashmir there are other food and non food crops which are increasing tremendously. Most of them are sugarcane, oil seeds and fruits. These crops bring diversification in the cropping pattern of Jammu and Kashmir. The most important non food crops of Jammu and Kashmir, whose production is increasing at fast rate, are fruits, Saffron and other dry fruits as shown below table 2 .

Table 2: Production of other food/non-food crops of Jammu and Kashmir.(000 Qtls).

S.No	Year	Sugarcane	Potatoes	Chills	Oilseeds	Saffron(Qt)	Fruits(000mton)
1	1999-00	4.1	293	5	535	77.88	1092.18
2	2000-01	4.5	172	10	282	35.91	1180.20
3	2001-02	4.6	201	19	422	30.3	1222.41
4	2002-03	5.2	185	10	266	65.25	1252.11
5	2003-04	6.9	184	10	421	51.54	1301.62
6	2004-05	6.3	148	11	407	48.34	1331.86
7	2005-06	8.1	152	10	366	88.52	1403.23
8	2006-07	8.1	189	6	413	48.50	1504.01
9	2007-08	2.9	183	7	535	91.31	1636.20
10	2008-09	4.5	179	8	701	50.60	1691.00
11	2009-10	5.6	180	7	855	48.22	1728.01
12	2010-11	7.2	201	9	971	46.00	2222.11
13	2011-12	7.8	222	11	976	49.55	2161.52

Sources: Economic Survey 2007-08 and 2012-13 of Jammu and Kashmir

By analyzing above table we revealed that production of other food crops like potato, oilseeds and chills have increased over the year except potatoes which are showing decrease in production from 2001-01 and is continuously decreasing but from last two years it has increased due to change in cropping pattern from food crops to fruits because initially the land under fruit plant grows nothing are this land is cultivated for other crops like pulses potatoes chills etc. till the fruit plan become able to give its output. In the non-food crops the most important item are fruits like Apple, pears, mangos, grapes etc. are increasing continuously. Those have increased from 1092.18 thousand metric tons to2161.52 thousand metric tons from 1999-00 to2011-12. These have increased the export of fruits of Jammu and Kashmir and have generated millions of rupees in last four or five years. The Agriculture of the state is growing at 3.98 percent in which major contribution is from rice and fruits. If we see the growth rate of food production we can see that the cash crops are increasing greater than food crops in the Jammu and Kashmir.

Table 3: Growth rate of major agriculture crops of Jammu and Kashmir.(% over previous year).

S.No	Year	Rice	Maize	Wheat	Pulses	cereals and mallets	Fruits	Oilseeds	Total food crops
1	1999-00	-	-	-	-	-	-	-	-
2	2000-01	6.07	11.58	-65.76	-11.72	-3.95	8.05	-47.28	-15.76
3	2001-02	1.68	2.33	130.6	-2.34	16.47	3.55	49.64	19.30
4	2002-03	-0.21	-13.56	18.22	13.60	2.52	2.45	-36.96	-0.60
5	2003-04	19.79	14.51	13.31	-7.04	10.83	3.91	58.27	15.52
6	2004-05	-2.37	-7.58	4.06	12.87	8.00	2.30	-3.32	-1.94
7	2005-06	13.10	-7.86	-4.32	-11.18	-17.28	5.40	-10.07	-0.04
8	2006-07	-0.50	7.36	8.91	4.44	18.40	7.19	12.84	5.03
9	2007-08	1.00	-2.56	-0.48	8.51	-3.36	8.77	29.5	-0.44
10	2008-09	1.63	5.90	2.86	18.95	0	3.36	2.05	0.25
11	2009-10	15.80	-4.87	-5.46	19.78	0.86	2.18	1.64	0.10
12	2010-11	23.14	23.38	-37.78	49.08	3.87	28.59	13.56	6.78
13	2011-12	4.05	3.39	0	0.92	11.61	-2.74	0.51	3.06

Sources: calculated from table 1 and 2

By identifying the production and growth of major crops of Jammu and Kashmir from above tables it shows that the production of the crops in the state has increased but the fluctuation in growth rate restrict the overall production of food crops/non food crops. In 2000-01 it was increasing at 6.07 percent but in 2011-12 it is growing at 4.50 percent. Same was in case of pulses, sugarcane and oilseeds. But there are only fruits which have shown tremendous growth. They have increased from 1092.18 thousand metric tonnes to 2161.52 thousand metric tonnes from 1999-00 to 2011-12. The growth rate of fruits has always remained high in the study period. It was growing at8.05 in 2000-01 and has increased to28.59 percent in 2010-11. The main thing observed from the above table 10 is that the growth rate of fruits has always remain positive in year by year and this shows that cropping pattern is changing from food crops to non food crops in the state.

The per capita availability of food grains which the state produces is very much low and distribute upto 1.5 kg to per person in the stat. Lakhs of tons of food crops are imported due to low production of these crops in the state. This results decrease in cropping pattern and now a days despite some particular areas, rice and wheat land is shifted to fruit cultivation and this is growing at very high rate in the state which causes serious problem of food security in the state. The major production of food products are coming from Jammu region and Kashmir region is emerging in horticulture area. Below is the productivity of some major crops of the state. The table shows that the productivity of important food crops in the state has increased. The rice has increased from 1562 kg per hectare to 2396 kg per hectare from 1999-00 to 2011-12 with 53.39 percent increase in this period.

Table 4: Productivity of some major crops of Jammu and Kashmir. (kg/hect)

SN.O	Year	Rice	Wheat	Maize	Saffron
1	1999-00	1562	1769	1485	3.13
2	2000-01	1702	529	1592	1.92
3	2001-02	1690	1321	1648	1.27
4	2002-03	1784	1633	1451	0.11
5	2003-04	1943	1804	1659	2.27
6	2004-05	1971	1892	1525	1.88
7	2005-06	2152	1810	1413	1.57
8	2006-07	2196	1872	1505	2.96
9	2007-08	21354	1782	1569	1.64
10	2008-09	2180	1835	1592	3.75
11	2009-10	2212	1882	1601	4.21
12	2010-11	2349	1800	1877	3.01
13	2011-12	2396	1800	2000	2.68

Sources: Economic Survey 2007-08 and 2012-13 of Jammu and Kashmir economy.

In the productivity of maize it has increased from 1485 to 2000 kg per hector in the same period with 34.68 percent increase in the period of 13 years. Similarly of wheat has increased from 1769 kg per hector in 1999-00 to 1800 kg per hectare in 2011-12 with only 6.3 percent increase in productivity in this period. On the other hand the important cash crop of Jammu and Kashmir, saffron has shown fluctuation in

its yield / hectare. The productivity of saffron is decreasing in the state and has reaches to2.68 kg's per hectare from 3.13 kegs in 1999-00. The table assumes that in the period main concern was laid on the productivity of rice which decreases the importance of other food crops. It is because rice is main food consumed in the state than other crops like wheat and maize. As the wheat and maize are mostly consumed in Jammu region and their productivity is high in this region. Thus from production point of view it can analyzed that state production of food crops is changing and increasing with diversification to other non-food crop production.

Modernization of Agriculture in Jammu and Kashmir Agriculture

Analysis of the agriculture transformation in the state economy from the perspective is to be considered as the sources of interrelationship between these two sectors. As we observe that the area expansion, agriculture production and growth of agriculture production and the yield performance of many major crops like rice, wheat, maize has increased a lot and the non-food crops has also increased their production by the inputs like fertilizers, pesticides, insecticides come from industrial sector and these crops are also benefiting from substitution effect. The increase in production of food crops and non-food crops of the state was due to using of HYV of seeds. In this unit we will explore the extent of such changes taking place in the farm sector of Jammu and Kashmir which come from Industrial sector over the period of last threaten years which analyze us the dependency of agricultural production on Industrial output. We have to show in how many dimensions of Agricultural sector, industrial sector affects like HYV, Irrigation, Chemical Fertilizers, implements etc which help in increase in production of Agriculture in the Jammu and Kashmir.

High yield variety of seeds:-The HYV of seeds were introduced in the agriculture of the Jammu and Kashmir from very beginning although such seeds were introduced for cultivation of area under rice, wheat and maize initially but with the period of time the area under new HYV of seeds for pulses, oilseeds and other cereals & millets were increased. As shown below.

Table 5: Area under High yield variety of seeds of different crops in Jammu and Kashmir. (000/hect)

SNo	Year	Rice	Wheat	Maize	Total area under HYV	Gross cropped area	% in GCA of HYV
1	1999-00	250	245	317	812	1078	75.32
2	2000-01	244	280	330	854	1114	75.85
3	2001-02	249	259	326	835	1106	75.49
4	2002-03	236	248	329	814	1077	75.57
5	2003-04	259	254	321	835	1102	75.55
6	2004-05	250	252	322	825	1101	75.82
7	2005-06	259	252	320	832	1100	74.94
8	2006-07	252	266	323	842	1126	75.64
9	2007-08	263	278	302	844	1133	74.77

10	2008-09	264	272	300	839	1177	72.51
11	2009-10	266	289	301	861	1192	72.84
12	2010-11	282	292	318	856	1207	70.91
13	2011-12	270	292	303	829	1223	67.78

Sources: Economic Survey 2007-08 and 2012-13 of Jammu and Kashmir economy

It is revealed from the table 5 that area brought under HYV of seeds haws increased at aggregate level of 829 thousand hectares which cover 67.78 percent of gross cropped area of the state. Careful analysis of above table indicates that percentage of area under HYV of seeds to total area sown was almost constant till 2007-08, but after that it starts decreasing and went to 67.78 percent in 2011-12. It was due to decrease in cropping pattern of food crops. It also reveals from the table that whole area under principal crops is brought under HYV of seeds in the state.

Irrigation: Since the modern farming technology has been successful in irrigated area and that Jammu and Kashmir is deficient in rainfall, so development of irrigation potential in the state become necessary for reducing the dependency on import of food grains and other agricultural items. A major constraint to the development of agriculture in Jammu and Kashmir is the fact that 50 percent of the ultimate irrigation potential of the state has been harnessed. The ultimate irrigation potential in the Jammu and Kashmir has been assessed at 13509 thousand hectares which include 250 thousand hectares through major and medium irrigation and 1108 thousand hectares through minor irrigation projects. Below table 6.11 shows the total irrigated area under different crops in Jammu and Kashmir.

Table 6: Total irrigated area under different crops of Jammu and Kashmir. (000 hect.)

SN.O	Year	Rice	Wheat	Maize	Pulses, Cereal & millets	Other food crops	Total non-food crops	Total irrigated area
1	1999-00	225	62	28	12	27	84	438
2	2000-01	220	74	32	4	34	85	449
3	2001-02	223	69	29	18	24	85	448
4	2002-03	220	67	27	16	25	79	434
5	2003-04	223	69	23	10	26	80	446
6	2004-05	227	71	26	20	28	81	453
7	2005-06	234	73	27	12	32	80	458
8	2006-07	231	74	22	12	39	82	459
9	2007-08	229	77	22	11	37	84	463
10	2008-09	232	80	24	10	39	86	472
11	2009-10	260	82	23	10	43	84	502
12	2010-11	282	86	16	11	44	81	520
13	2011-12	270	87	16	14	67	79	527

Sources: Economic Survey 2007-08 and 2012-13 of Jammu and Kashmir economy

The table 6 reveals that rice has been the only food crop having assured irrigation. The irrigation area of rice has increased from 225 thousand hectares in 1999-00 to 270 thousand hectares in the end of the study period while as for maize it has decreased from 28 thousand hectares to 16 thousand hectares in the same period. The

total are aunder wheat is 303 thousand hectare while as 16 thousand hectare is irrigated. The irrigated area for non-food crops and for pulses millets and cereals it has fluctuated, from 12 thousand hectares to 14 thousand hectares for pulses cereals and millets and for non –food crops from 84 thousand hectares to 79 thousand hectares from1999-00 to 2011-12. The total irrigated area of the state has increased from 438 thousand hectares to 527 thousand hectares in the period of thirteen years. Though there was increase in irrigated area but the irrigated area for maize and wheat and some non- food crops is decreasing. It is only area under rice and other food crops which has high percentage of irrigated area from total irrigated area of the state while as rest of the crops has low magnitude of irrigated area.

The percentage of irrigated area from total area of a crop has increased in the study period while for some crops it has decreased especially of non-food crops. As shown in below table 5.12.

Table 7: Percentage of irrigated area of various crops as share of total irrigated area.(000 hect)

SN.O	Year	rice	Maize	Wheat	Other pulses cereals &millets	Other food crops	Non-food crops	% area Irrigated to gross sown area
1	1999-00	90	8.83	25.30	27.90	11.25	66.14	40.69
2	2000-01	90.16	9.96	26.42	8.5	10.65	67.21	40.30
3	2001-02	89.55	8.69	26.64	39.13	9.75	62.20	40.59
4	2002-03	93.22	8.89	27.01	33.33	10.51	63.11	40.29
5	2003-04	89.55	8.20	27.82	38.46	11.56	65.22	40.41
6	2004-05	90.22	7.16	27.95	47.61	12.81	66.66	41.10
7	2005-06	90.96	8.07	28.96	27.90	16.52	67.76	41.14
8	2006-07	91.80	8.43	27.87	27.56	26.11	62.48	41.63
9	2007-08	97.34	6.81	27.69	27.50	32.60	66.14	41.76
10	2008-09	85.02	7.28	28.36	26.42	28.14	62.08	40.86
11	2009-10	97.07	7.25	29.39	24.96	31.60	51.01	42.47
12	2010-11	100.0	5.03	34.01	22.10	36.21	43.54	43.08
13	2011-12	100.0	3.28	32.03	25.23	39.11	39.50	43.09

Sources: calculated from table 6.8 and 6.11

Out of total gross sown area of 1223 thousand hectares 527 thousand hectares are irrigated in 2011-12 respectively. From total gross cropped area 43.09 percent of land or area was irrigated in this period. The table also shows that in the state there is enough potential of irrigation for food crops except wheat and maize. Rice is largely consumed in the state than wheat and maize thus whole area under it is irrigated. However in case of non-food crops the irrigated area under them is declining from total cultivated area under non-food crops. The most important reason for this is that, the non-food crops cultivated in the state like fruits, saffron, walnuts, almonds and other dry fruits etc. needs irrigation upto some time in their earlier cultivation times till they become fruit bearable plants and after that the irrigation needs become low, that is why the area irrigated of all non-food crops was 66.14 percent in 1999-00 which decreases to 39 50 percent in 2011-12.

Chemical fertilizers:- Agriculture production to a large extent depends upon fertilizers consumption per hectare in current times. Increased use of fertilizers is the signal most important indicator of

industrial output used in agriculture. It is an important source of growth in agriculture production. Use of chemical fertilizers seems to have increased crop output in Jammu and Kashmir. The use of chemical fertilizers has increased the total production and the yield of per hectare in Jammu and Kashmir by increase in use of chemical fertilizers in per hectare over the years as shown below.

Table 8: Distribution of fertilizers in Jammu and Kashmir with index numbers.

SN.O	Year	Distribution of fertilizers		Fertilizer intensity	
		In 000/tonns	Index no. 1999-00= 100	Kg's per Hectare	Index no. 1999-00= 100
1	1999-00	34.311	100.0	31.82	100.0
2	2000-01	46.585	135.0	41.81	120.4
3	2001-02	40.584	118.2	36.69	93.9
4	2002-03	42.401	123.5	39.36	118.7
5	2003-04	66.520	193.8	60.36	193.9
6	2004-05	60.563	176.4	54.97	174.5
7	2005-06	93.900	273.7	85.29	274.9
8	2006-07	97.279	283.5	86.35	287.4
9	2007-08	129.132	378.1	113.88	364.6
10	2008-09	133.703	391.1	112.29	361.5
11	2009-10	156.860	457.1	131.05	422.5
12	2010-11	163.281	479.4	135.24	435.4
13	2011-12	177.510	520.5	145.14	467.7

Sources: Economic Survey 2007-08 and 2012-13 of Jammu and Kashmir economy

we have try to analyze the total intensity of chemical fertilizers in the Jammu and Kashmir it is because there was no data available in crop wise consumption of fertilizers. The above table reveals that the consumption of chemical fertilizers has increased in the state. The consumption of fertilizers has increased 5 times during 1999-00 to 2011-12 of reference period in the state. The use of fertilizers has increased rapidly after 2003-04 from 34.311 thousand tones in 1999-00 to 66.520 thousand tones. After 2003-04 the use of fertilizers have increased to 129.132, 133.703, 156.860, 163.281 and 177.510 thousand tones in period 2007-08.2008-09, 2009-10, 2010-11, 2011-12respectively. Thus in the study period of thirteen years the use of fertilizers have increased at least 5 times in the period. This shows that the fertilizers have laid important effect on the growth of agriculture production in this study period. The table also reveals that the per hectare consumption of the fertilizers was only 31.82 kg's/ hectare in 1999-00 which doubled in 2005-04 to 63.30 kg's /hectare. While as in the upcoming years the per hectare consumption of fertilizers become 113.88 kg's /hectare which ultimately increases to 145.14 kg's / hectare In 2011-12. In the study period per hectare consumption of fertilizers has increased 4 times from 31.82 kg's / hectare to 145.14 kg's// hectare as shown in fertilizer intensity indices which have increased to 467.7 points in 2011-12. It implies that not only consumption of fertilizers has increased but intensity of fertilizers in gross sown area has also increased.

The production relationship between industry and Agriculture can be analyzed by having distinct analysis of agricultural

transformation in the state agriculture by way of industrial output for intensive cropping and higher productivity of crops it is required that input structure is reoriented by way of greater interaction of the agriculture sector with modern industrial sector. The use of industrial output in agriculture sector increase the level of soil nutrients, plant protection besides replacement o traditional biological sources of energy with modern mechanical sources of energy. As shown below table 9.

Table 9: **Growth of Agricultural machinery and implements in Jammu and Kashmir.**

SN.O	Items	Iron Plough	chaff Cutters	Pruning scissors	Orchard Leaders	Diesel spry pumps	Paddy thrashers	Wheat thrashers	Maize thrashers	Tractors	Others
1	1999-2000	1075454	103963	23477	10163	7915	556	987	81	7725	597665
2	2000-2001	760457	109981	26960	18112	11218	664	1001	101	8366	921911
3	2001-2002	825587	112182	32104	22940	17385	682	1061	149	9292	1319800
4	2002-2003	987311	108211	45012	24140	20697	697	1859	295	10149	2117974
5	2003-2004	809773	990255	50501	36149	23591	728	2302	423	10964	3417744
6	2004-2005	652592	985281	59821	40122	28911	735	2891	491	11881	4259110
7	2005-2006	638942	962630	63121	51999	33051	749	3325	518	12818	5651439
8	2006-2007	617191	941113	69920	59010	38692	769	3690	589	14109	6214341
9	2007-2008	601881	932000	72010	62159	39901	791	4128	621	16615	6912333
10	2008-2009	596728	918992	78528	71536	42811	801	4190	628	18919	7353126
11	2009-2010	590411	901215	81891	799538	50512	819	4201	639	22436	7921059
12	2010-2011	574285	892114	86721	88102	59611	822	4278	649	28002	8154211
13	2011-2012	510720	869475	90455	39951	69223	828	4299	651	28732	8604929

Sources: Economic Survey 2007-08 and 2012-13 of Jammu and Kashmir economy

It was found from the table 9 that the use of modern mechanical implements are increasing in the state and the most rapid growth took place in implements using in horticulture like diesel, spray, electric and water pumps used for spraying, irrigation, pesticides and other purposes. After 2003-04 there has been rapid increase these pumps from 23591 to 69223 in 2011-12. The use of iron plough and chaff cutters is decreasing and of pruning scissors and orchard ladders is increasing because old methods of farming with plugging has shifted by tractors and other implements. With the result it fallowed by improving sowing technique and tractors, their number has also increased in the state. The number of tractors has also increased from 7725 in

1999-00 to 28732 in 2011-12 for study period. In agricultural development of the state, tractors have brought structural transformation since it has been used in the agriculture operation of the state. It is because tractors serve multiple purposes like plugging, sowing operation, transportation, pump irrigation etc. Tractors also fetch cash income to owner in off season as it is used to carry out other rural assignments. Though due to change in cropping pattern from food crops like rice, wheat and maize to fruits and other n0n-food crops like saffron and pulses, cereals &millets the use of modern tools and techniques have increased but only in one form and rest is still not developing. Thus good thing for modernization of agriculture of Jammu and Kashmir is that the modern implements have started to influence the agriculture production of the state.

Conclusion

The agricultural sector of the state has widened the doors of Industrial development in the state since 1999-00. The production and yield of fruits and other cash crops has increased very much which generate high income to people and as well as state economy by exporting and create Agriculture diversification in the state from food crops to non-food /cash crops. Modern equipments for cultivation, sowing and for other agriculture activities are increasing at rapid rate. The old technique of agriculture is reducing in the state which results growth in agriculture as well. Thus growth and modernization in the state agriculture has increased over the period. Thus by changing trend from food grains production to commercial crops, fruits, saffron Pulses flowers and vegetables etc and utilization of modern industrial tools in Jammu and Kashmir agriculture, we can predict the possibility of improving the agriculture-Industry linkages in the Economy of Jammu and Kashmir.

Acknowledgements

We would like to thank Asif Ali Malik, Rouf Ali Malik and Imtiyaz Ali for their valuable comments during the research period. We are also grateful to Liyakat Ali for his help in analyzing and summarizing data, At last we are thankful to different government authorities of Jammu and Kashmir for giving accurate data.

References

[1] Bahaduri, A. (2003). Effective Demand and Terms of Trade in a Dual Economy: A Kaldoriian Prospective. *Cambridge Journal of Economic*, 27, 583-595.

[2] Bharadwaj, K. (1987). Analytics of Agricultural-Industry Relations. *Economic and Political Weekly*, 22(19/21), 15-20.

[3] Binswanger, H.P. (1980). Income distribution effects of technical change: Some analytical issues. *South East Asian Economic Review*, 1, 179-218.

[4] Chadha, G.K. (1986). *The state and Rural Economic Transformation-The Case of Punjab 1950-85.* Saga Publication, New Delhi, India.

[5] Dhangaree, D. N. and Satya, P. (1989). Green Revolution and

Income Distribution Among Farm Families in Haruama 1969-70 to 1982-83. *Economic and Political Weekly***,** 24(51-52), 23-30.

[6] Dholakia, H. B. and. Dholakia, H. R. (1987) Modernization of Agriculture and Economic Development: The Indian Experience, *Indian Institute of Management*, Ahmedabad, India.

[7] Directorate of Economics and Statistics Jammu and Kashmir economic reports, 2007-08, 2010-11 and 2011-12

[8] Economic survey of Jammu and Kashmir: 2007-08, 2009-10 and 2011-12

[9] Fei, J.C. and Ranis, G. (1961). A Theory of Economic Development. *American Economic Review*, 514, 533-65.

[10] Gupta, N. (1999). *Small Industry in Jammu and Kashmir: Challenges and Perspectives.* Anmol Publications, New Delhi.

[11] Hayami, Y. and Herdt, R.W. (1977). Market price effects of technological change on income distribution in semi-subsistence agriculture. *American Journal of Agricultural Economics*, 59, 245-256.

[12] Hazell, P. and Haggeblade, S. (1993). *Farm-nonfarm growth linkages and the welfare of the poor*, In: Lipton, M. and van de Gaag, J. (Eds.), Including the poor. The World Bank, Washington, D.C.

[13] Hirschman, A.O. (1958). *The Strategy of Economic Development in Developing Countries*. Yale University Press, New Haven, Connecticut, USA.

[14] Jha, R. (2010). The Analytics of Agriculture-Industry Relationship in a Closed Economy: A case study of India. *Economic and Political Weekly*, 45(17), 94-98.

[15] Jorgenson, D.G. (1961). The development of a dual Economy. *Economic Journal*, 71, 309-334.

[16] Kapila, U. & Krishna, K.L. (2009). *Readings in Indian Agriculture and Industry*. Academic Foundation, New Delhi.

[17] Kogel, T. and Prskawetz, A. (2001). Agricultural productivity growth and escape from the Malthusian trap. *Journal of Economic Growth*, 6, 337–357.

[18] Lewis, W.A. (1954). Economic development with unlimited supplies of labour. Manchester *School of Economics*, 20, 139-191.

[19] Lindberg, G. Midmore, P. & Surry, Y. (2012). Agriculture's Inter-industry Linkages, Aggregation Bias and Rural Policy Reforms. *Journal of Agricultural Economics.* 15(21), 231-252.

[20] Mahendradev, S. (1987). Growth and Instability in Food Grains Production: An Inter-State Analysis. *Economic and Political Weekly*, 22(39), 121-145.

[21] Massodi, M.A. (2008). *Agriculture in Jammu & Kashmir*. Mamta Publication, Srinagar, Jammu and Kashmir.

[22] Mruthyunjaya, and Kumar, P. (1989). Crop Economics and Cropping Pattern Changes. *Economic and Political Weekly*, 24(51-52), 23-30.

[23] Pinstrup-Andersen, P. Ruiz de Londaño, N. and Hoover, E. (1976). The impact of increasing food supply on human nutrition: Implications for commodity priorities in agricultural research. *American Journal of Agricultural Economics*, 58, 131-142.

[24] Ramachandran, M.K. (2009). *Economics of Agro-based Industries: A Study of Kerala*. Mittal Publication, New Delhi

[25] Saikia, D. (2011). Analyzing inter-sectoral linkages in India. *African Journal of Agricultural Research*, 6(33), 6766-6775.

[26] Satyasai, and Baidyanathan. (1997). Inter-Dependence between Industry and Agriculture in India's Growth. *Indian Journal of Agricultural Economics*, 23, 132-141.

[27] Schultz, T. W. (1964). *Transforming Traditional Agriculture*. University of Chicago Press, Chicago.

[28] Scitovsky, T. (1954). Two concepts of external Economies. *Journal of Political Economy*, 62, 143-51.

[29] Self, S. and Grabowski, R. (2006). Agricultural Development, State Effectiveness and long-run Economic Development. *Journal OF Economic Development*. 31(2) 73-90.

[30] Singh, B. Sasrty, D.V. Bhatacharya, K. & Unnikrishna, N.K. (2003). Sectoral Linkages and Growth Prospects. *Economic and Political weekly*, 38(24), 2390-2397.

[31] Yang, T. D. and Zhu, X. (2013). Modernization of agriculture and long-term growth. *Journal of Monetary Economics*, 60, 367–382.