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Transformation of Agriculture in Jharkhand

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ABSTRACT

The study on "Transformation in agriculture in Jharkhand" revealed that the cropping pattern has shifted from lower value crop to high value crops in the state. The area under paddy crop is declining continuously, but acreage under wheat crop is increasing in the state. The study further shows that the minor millets crops area is declining in the state continuously and reached to a negligible level. The performance of pulses and oil seeds crops are improving year after year as indicated by increase in area, production and productivity in the state. The vegetable crop's area has contributed significant in cropping pattern showing nearly 11% during 2012-13 which was near about 7% in year 2000. The fruit acreage has also increased during 2000 to 2012 in the state. The rate of growth was near about three times in the state during this period. It was also found that there have been significant changes in consumption of chemical fertilizers (NPK) in the state showing near about three times higher from the base year 2001. The consumption of NPK was about 85 Kg, 30 Kg., and about 9.0 Kg. per hectare of cropped area making total 124 kg. The farmers also prefer high yielding varieties and hybrid varieties of any crop in the state. The milk production has also increased from about 9.5 lakh ton to near about 18 lakh tons during 2002-03 to 2012-13. Similarly, the fish production has strongly increased during 2001-02 to 2013-14 which is nearly more than five times from the base period (2001-02). The improved technology in agriculture has considerably increased the total food grain production in the state. On the whole, it is clearly indicated that technology transformation in agriculture has been taken place in the state.

Keywords: Cropping pattern, production, productivity

Jharkhand state was born on 15th November, 2000 with near about 80 lakh hectare of geographical area consisting of 23% of net shown area, 29% forest area and about 48% area under pasture and grazing land, unculturable land and other fallow land. Rainfed agriculture is the predominant feature in Jharkhand. The irrigation facility is very low covering only about 10-12% of net cultivated area. The cropping intensity is just above 100%. The productivity of the crops (cereals, pulses, and oil seeds) is lower than the national average and far lower than the agricultural developed states in the country. These phenomenon's in the agriculture resulting big deficiency of food grain in the state. At the time of establishment of the state, the deficiency in rice, wheat, and other cereals was 49%, 91% and 47%, respectively. Similarly in the case of pulses and oil seed it was 48% and 71%. The situation was also grim in case of milk, fish, and fruits (38%, 42%, and 60%).

Not only the production and productivity levels are low but also the degree of temporal as well as spatial variability in the area and production of all the crops are very high. The problems get further aggravated during drought years. Considering the backward nature of agricultural scenario in Jharkhand, a large number of schemes have been started by

central government, state government and several other organizations to increase the production and productivity of crops and allied activities in the state.

Thakur (1988) made an attempt to analyze the trends and growth of oilseeds in Bihar and found that through the yield of oilseed crops per unit of area in the state has increased during the last 25 years but this increase in yield has failed to boost the area under the crop, probably because of the shifting of more fertile land under the crop which gave a comparatively higher return.

Singh *et al*. (1993) in their study 'An analysis of compound growth rates and factors affecting area, production and productivity of gram in Bihar' concluded that the compound growth rate of area in case of gram declined over the period except Ranchi district area (0.04 %) and production of gram in Hazaribagh (1.95%), Dhanbad (1.35%), Ranchi (1.50%) and Singhbhum (0.11%). Productivity of the crop showed positive compound growth rate in all the districts. This could be due to the fact that special emphasis has been laid by the Govt. of India and the State Govt. toward increasing the productivity of pulses crops in general and gram in particular. They also concluded that though the areas under pulses in general (and gram in particular) are mostly pre-determined and as the area under irrigation increase, it is gradually substituted by cereal or cash crops. The production can be increased either by motivating the farmers of non-traditional pulses growing area of by introducing pulses crops in non-traditional crop season.

Singh and Bodra (2008) in their study found that the area under food grain crops were considerably higher on all categories of farmers. However the share of vegetable crops in total cropped area was significantly high on marginal farmers in respect to medium farmers. There was no significant change in average yield per hectare of food grain of various farm sizes. Marginal and small farmers were more efficient than medium farmers on producing quantities of vegetables per hectare. They also found that gross income per hectare of vegetable crops was more than 2.5 – 3 times higher than gross income per hectare of food grain crops. Among vegetable crops maximum net return was returned by all categories of farmers in potato cultivations, while in cereals crops net return was obtained to be high in case of wheat crop. They concluded that through crop diversification from food grain to vegetable and also be in position to create effective aggregate demand and employment opportunity in crop production.

Keeping the importance of agriculture in the state in mind, the present study attempts to examine the growth pattern and diversification in Jharkhand Agriculture.

Objectives

The main objectives are:

- To examined changes in area, production and productivity of cereals, pulses and oilseed crops.
- To find out changes in area, production and productivity of fruits and vegetables over periods
- To analyze changes in milk and fish production in the state.

Research methodology

This study is based on secondary data collected from different sources (Indian Journal of Fertilizer, National Horticulture Board Bulletin, Economic Survey of Jharkhand 2013-14, Jharkhand at a glance, Department of Agriculture and Sugar cane, SAMETI) from the period of inception of state (2000-01 to 2012-13). The data were collected on the aspects of area, production, productivity of different crops; fish and milk production; fertilizer consumption; adoption of hybrid seeds. The tabular analysis technique, compound growth rate, Simpson Indices were used to explain the changing scenario of agriculture in the state after its formation.

RESULTS AND DISCUSSION

Transformation in agriculture and allied sector includes cropping pattern, area, production, and productivity of crops like paddy wheat, other cereals, pulses, oilseeds, fruits, vegetables, milk production, fish production, and fertilizer application per unit of area in the state. The detailed analyses are presented below:

1. Changes in cropping pattern: Cropping patter is most important indicator of transformation in agriculture. The changing scenario of cropped area under different crops since inception of Jharkhand

Table 1: Cropping pattern of Jharkhand (1999-2013)

	1999-00		2004-05		2009-10		2012-13	
Particulars	**000's Hec**	**%**	**000's Hec**	**%**	**000's Hec**	**%**	**000's Hec**	**%**
Paddy	1420.24	71.53	1276.42	58.67	982.00	50.38	1414.00	46.98
Wheat	57.21	2.88	64.50	2.96	99.66	5.11	164.30	5.46
Bajra	4.20	0.21	0.31	0.01	0.05	0.00	NA	NA
Maize	118.12	5.95	191.25	8.79	163.24	8.37	249.33	8.28
Ragi	41.32	2.08	17.36	0.80	10.42	0.53	2.14	0.07
Jowar	3.86	0.19	0.35	0.02	0.20	0.01	NA	NA
Total cereals	1632.10	82.20	1549.79	71.24	1255.52	64.41	1843.00	61.24
Gram	26.71	1.35	33.17	1.52	63.01	3.23	31.38	1.04
Lentil	6.71	0.34	15.47	0.71	18.63	0.96	10.10	0.34
Arhar	27.00	1.36	88.64	4.07	61.18	3.14	18.84	0.63
Peas	4.27	0.22	19.33	0.89	24.10	1.24	NA	NA
Total Pulse	144.65	7.29	290.91	13.37	296.71	15.22	586.97	19.50
Groundnut	5.03	0.25	18.34	0.84	14.22	0.73	NA	NA
Sesamum	14.78	0.74	9.57	0.44	4.28	0.22	NA	NA
Rapeseed and Mustard	8.20	0.41	44.81	2.06	96.26	4.94	21.35	0.71
Linseed	7.22	0.36	16.15	0.74	19.84	1.02	NA	NA
Sunflower	0.12	0.01	0.29	0.01	0.94	0.05	NA	NA
Total Oil seed	58.96	2.97	94.27	4.33	149.11	7.65	250.59	8.33
Vegetables	149.80	7.54	223.60	10.28	229.63	11.78	321.50	10.68
Spices	NA	NA	16.97	0.78	18.19	0.93	7.61	0.25
Fruits	29.90	—	33.20	—	43.95	—	93.00	—
Gross Cropped Area	2015.41	—	2208.74	—	1993.11	—	3102.67	—
Gross Cropped Area excluding fruit	1985.51	100.00	2175.54	100.00	1949.16	100.00	3009.67	100.00

Sources:

i. Agricultural resource database of Jharkhand 2011-12

ii. Directorate of Agriculture and Sugar cane Development

state has been presented in the table 1. It revealed from the figure of cropping pattern, the transition in crop production has been started in the state which can be seen from the main crop i.e. paddy in the state. The continuous decrease in the area of this crop has been observed (from 71.53 to 47.0%). Against this, increasing trend was observed in case of wheat crop. The minor millet crops (Ragi, Bajra, Jowar) have been observed on the vanishing stage. The total cereals crops area has also shown declining trend in the state. The area under pulses crop have shown a tremendous increase during the period in the state from 144.65 thousand hectare to 586.97 thousand hectare showing near about 19.5% increase in cropped area against 7.29% recorded in 2000. The area under oil seed crops has also shown a significant change in the state from 58.96 thousand hectare to 250.59 thousand hectare. The similar trend has also been observed in case of vegetable crops indicating near about 11% share in the cropped area. Besides crops, fruit acreage has been considerably increased in the state (30.0 to 93.0 thousand hectare). This analysis indicates that transformation in agriculture has been taken place in favors of more remunerative crops in the state.

CROPPING PATTER OF JHARKHAND

2. Changes in modern input use

(a) Fertilizer consumption per unit area

The improved/hybrid varieties require higher dose of fertilizer as compared to local variety. Farmers in the state are very traditional in adoption of improved technology particularly seed and fertilizer which are the responsible for low yield of crops. The consumption fertilizer data indicates the changing choices of farmers in adoption of improved technology. In the beginning (2000-01) the fertilizer consumption was merely 47.29 Kg/ hectare, increased to 65.5 Kg/ hectare in 2006-07 and further increased to 124.40 Kg/ hectare in 2011-12 (Table 2a). This trend shows that now farmers are adopting high technology for increasing production and productivity in the state.

Table 2a: Consumption of plant nutrient of gross cropped area (2000-01 to 2011-12)

(Kg./ hec.)

Year	N	P	K	Total
2000-01	30.70	12.10	1.30	44.10
2001-02	35.30	19.40	1.10	55.80
2002-03	30.10	17.90	1.90	49.90
2003-04	30.44	19.20	2.20	51.84
2004-05	34.10	19.20	2.00	55.30
2005-06	38.60	18.40	3.20	60.20
2006-07	43.60	19.80	2.00	65.40
2007-08	42.30	21.70	4.60	68.60

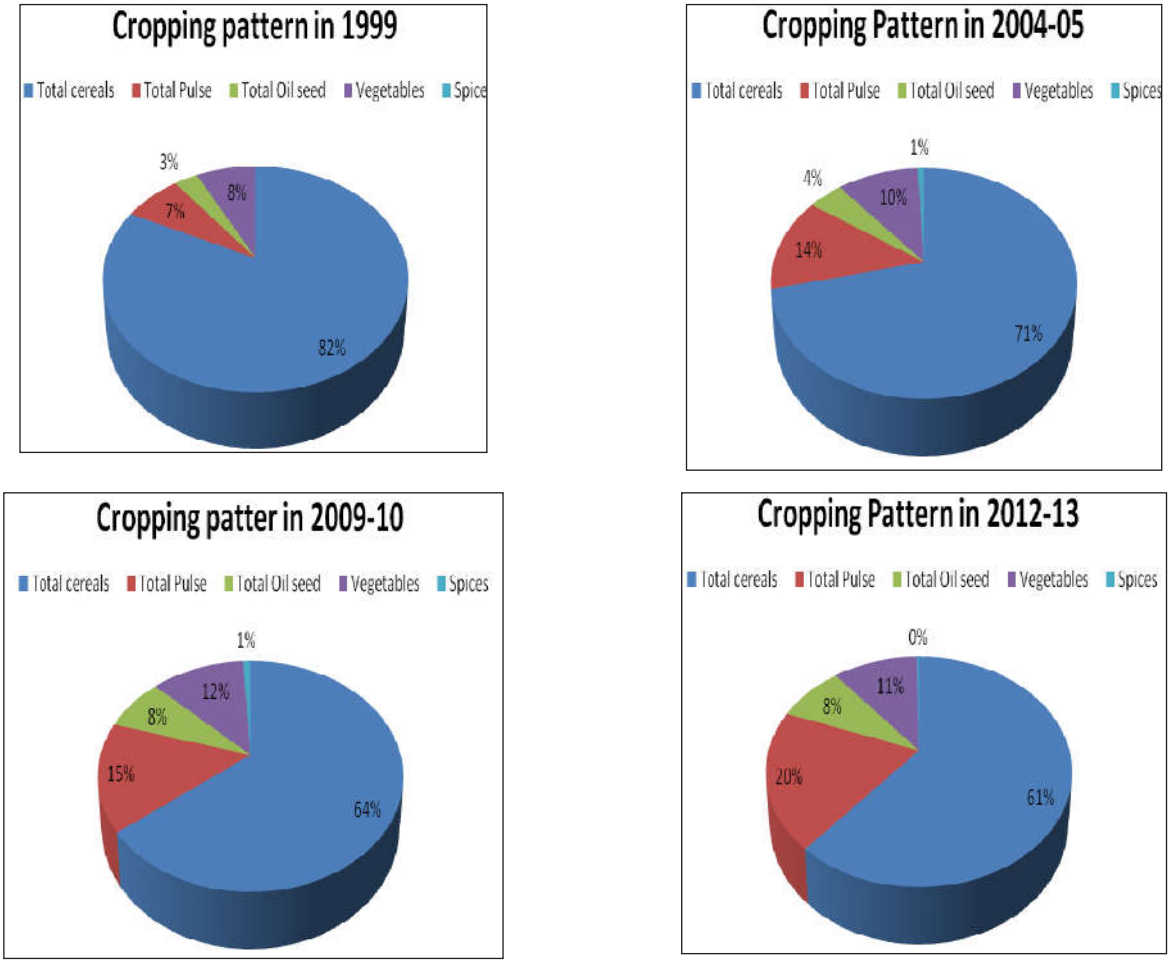

Fig. 1.

2008-09	61.17	33.03	5.65	99.85
2009-10	67.20	38.50	13.90	119.60
2010-11	56.50	27.20	6.40	90.10
2011-12	85.30	30.40	8.70	124.40

Sources:

i. Agricultural resource database of Jharkhand 2011-12

ii. Economic Survey of Jharkhand 2013-14

iii.Indian Journal of Fertilizers 2011-12

(b) Adoption of hybrid/ improved paddy

Primary data were collected from 50 farmers consisting 33 marginal and 17 small from five villages in Kanke block of Ranchi district during 2012-13. It was found that 85 to 90% paddy area under hybrid rice variety on these farms. Among the different hybrid paddy varieties RH -401 and PHB -71 were the most popular varieties contributing about 52% cultivated paddy area.

The next important variety of Hybrid Paddy was 6444 shared nearly 16% in paddy area. The IR -64 paddy variety covered 16% area of the farmers. Altogether six paddy varieties (RH -401, F Gold, Champion, PHB -71, 6444 and IR -64) were prominent in the cropping pattern. It was also found that 18% farmers grown one verity, 66% of farmers two variety, 12% farmers adopted 3 high yielding verities and 4% 4 varieties, respectively on their farms.

3. Area, Production and Productivity

(a) Paddy

It has been seen from the Table 3a that area under rice shown fluctuating trend which increased to 1521 (2001-02) thousand hectare from 1325 (1999-00), declined in 2005-06 (1355 thousand hectare) but further raised in 2008-09 and again reduced to a level of 1414 thousand hectare.

The productivity is the main indicator of any changes which has been significantly improved in the state i.e. near about 3 times (from 1090 to 2833 Kg/ hectare). This change has contributed significant increase in the total production of this crop in the state (from 1446 to 3991 thousand tones) during period 1999-2000 to 2012-13.

Table 2a: Area, Production and Productivity of paddy (1999-00 to 2012-13)

Years	Area	Production	Productivity
	000's ha	000's tons	Kg./ Ha.
1999-2000	1325	1446	1090
2000-2001	1466	2279	1550
2001-2002	1521	2733	1790
2002-2003	1383	2071	1510
2003-2004	1364	2143	1590
2004-2005	1276	1908	1490
2005-2006	1355	1558	1150
2006-2007	1604	2938	1832
2007-2008	1634	3616	2213
2008-2009	1670	3400	2055
2009-2010	982	1518	1546
2010-2011	717	1176	1557
2011-2012	1469	4696	3197
2012-2013	1414	3991	2833

Sources:

i. Agricultural resource database of Jharkhand 2011-12

ii. Economic Survey of Jharkhand 2013-14

(b) Wheat

It observed from the table 3b that there has been markedly increased in the acreage of wheat in the state (near about 3 times). This is mainly due to strengthening irrigation facility at the farm level by providing facilities either by government on the basis of subsidy or credit provided by banking facility by this purposes. The government has also initiated water harvesting technology in the different area of the state.

The significant increase in production of wheat has been observed in the state due to increase in productivity and acreage in the state. The absolute changes have been found in the productivity of wheat i.e. from 1622 to 2100 Kg per hectare.

Table 3b: Area, Production and Productivity of Wheat (1999-00 to 2013-14)

Years	Area	Production	Productivity
	000's ha	000's tons	Kg./ Ha.
1999-2000	62.9	112.04	1622
2000-2001	65.94	108.48	1742
2001-2002	65.38	115.6	1811
2002-2003	68.19	113.69	1706
2003-2004	74.55	128.14	1410
2004-2005	64.50	104.14	1610
2005-2006	58.00	77.69	1330
2006-2007	84.32	128.88	1528
2007-2008	86.34	139.94	1621
2008-2009	99.88	153.88	1741
2009-2010	99.66	154.47	1550
2010-2011	101.1	151.39	1500
2011-2012	158.57	302.61	1908
2012-2013	164.3	319.45	1944
2013-2014	166.91	350.51	2100

Sources:

i. Agricultural resource database of Jharkhand 2011-12

ii. Economic Survey of Jharkhand 2013-14

(c) Maize

Maize is the second most important crop of *Kharif* season in the state. The overall positive trend has been observed in this crop. There has been changing situation observed in the area of this crop during study period. The area under crop increased from 183.47 thousand hectare to 211.11 thousand 2006-07, which increased further to 249.33 thousand hectare in 2012-13.

The productivity analysis has shown a significant growth in the state from 1384 to 1908 Kg per hectare during 1999-2000 to 2013-14. The increase in productivity and acreage have changed the total tonnage of maize in the state (from 253.4 to 2458.14 thousand tones).

Table 3c: Area, Production and Productivity of Maize (1999-00 to 2012-13)

Years	Area	Production	Productivity
	000's ha	000's tons	Kg./ Ha.
1999-2000	183.47	253.42	1384
2000-2001	156.91	247.17	1575
2001-2002	139.88	209.18	1495
2002-2003	157.63	269.18	1715
2003-2004	179.93	269.19	1646
2004-2005	191.25	278.59	1457
2005-2006	181.24	229.5	1266
2006-2007	211.11	276.83	1311
2007-2008	237.41	361.52	1523
2008-2009	216.06	304.08	1407
2009-2010	163.24	190.7	1168
2010-2011	216.31	263.19	1216
2011-2012	215.52	321.54	1446
2012-2013	249.33	451.69	1812
2013-2014	240.15	458.14	1908

Sources:

i. Agricultural resource database of Jharkhand 2011-12

ii. Economic Survey of Jharkhand 2013-14

(d) Total Cereals

The cereal crops include paddy, maize, wheat, and minor millets etc. The area, production and productivity are presented in table no. 5. It was observed from the table that area under cereal crops has shown slightly changing pattern i.e. increased from cropped period 1999- 2000 to 2002-03, further declined in 2005-06, again raised upto 2008-09 and shown a declining trend from 2009-10 to 2012-013. In spite of changing in acreage, the total production of cereal in the state has shown an increasing trend during period except in one or two cropping year.

This is mainly due to increase in productivity of cereals in the state. During the period the productivity has increased near about 2 times in the state (from 1139 to 2142 Kg per hectare).

Table 3d: Area, Production and Productivity of Cereals (1999-00 to 2012-13)

Years	Area	Production	Productivity
	000's ha	000's tons	Kg./ Ha.
1999-2000	1632.10	1859.92	1139.00
2000-2001	1737.37	2664.75	1534.00
2001-2002	1775.16	3087.32	1730.00
2002-2003	1722.76	2463.67	1510.00
2003-2004	1639.56	2554.72	1550.00
2004-2005	1549.79	2301.40	1480.00
2005-2006	1607.82	1873.86	1165.00
2006-2007	1919.33	3369.97	1756.00
2007-2008	1972.59	3800.31	1927.00
2008-2009	1999.00	3867.00	1934.00
2009-2010	1255.52	1887.72	1504.00
2012-2013	1843.00	3948.20	2142

Sources:

i. Agricultural resource database of Jharkhand 2011-12

ii. Economic Survey of Jharkhand 2013-14

(e) Pulses

Area, production and productivity under pulse includes crops like Pigeon pea, Black Gram, Lentil, Gram, Pea and other pulses in the state and is presented in the table 3e. It has been seen that there has been strongly increase in the area of pulses crop showing near about 4 times increase from the establishment of the state (from 144.65 to 555.01 thousand hectare). In case of productivity, the situation has also been changed after introduction of government programmes for improvement of pulses production in the state.

The productivity varied from 810 to 1169 Kg/ hectare except in few cropping years. The productivity of pulses crop is very sensitive to climate change and pest and diseases. The resultant increase in acreage as well as productivity have jointly effect the total production of pulses crop (from 152.33 to 507.61 thousand tones) in the state showing nearly three times increase in total production.

Table 3e: Area, Production and Productivity of Pulses (1999-00 to 2013-14)

Years	Area	Production	Productivity
	000's ha	000's tons	Kg./ Ha.
1999-2000	144.65	11.37	810
2000-2001	190.94	152.33	790
2001-2002	211.64	165.82	784
2002-2003	242.95	148.94	613
2003-2004	301.9	167.77	556
2004-2005	290.91	190.1	653
2005-2006	291.07	170.31	585
2006-2007	366.45	249.86	682
2007-2008	390.35	312.84	799
2008-2009	387.54	300.85	776
2009-2010	296.71	219.94	741
2010-2011	406.99	267.09	656
2011-2012	591.53	494.67	921
2012-2013	586.97	686.21	1169
2013-2014	555.01	507.61	915

Sources:

i. Agricultural resource database of Jharkhand 2011-12

ii. Economic Survey of Jharkhand 2013-14

(f) Oilseed

The oil seeds crops includes ground nut, sesamum, rape seed and mustard, linseed, sunflower etc. and is presented in the table 3f. The area under oil seed has been considerably increased in the state. In the year 1999-2000 the area under oil seed was merely about 59 thousand which increased to 157.18 in 2006-07, slightly decline in 2009-10 and further shown an increasing trend and reached to a level of about 260 thousand hectare (2013-14). The productivity has shown fluctuating trend and it has been marked mostly as a constant in the productivity of oil seed crops except in few cropping year. However, the average productivity was observed to be 790 Kg per hectare during 2013-14. The acreage has contributed a significant change in the total production of the oil seed in the state, while the productivity has also contributed but very limited extent.

Table 3f: Area, Production and Productivity of Oil Seeds (1999-00 to 2013-14)

Years	Area	Production	Productivity
	000's ha	000's tons	Kg./ Ha.
1999-2000	58.96	40.9	694
2000-2001	78.68	44.91	571
2001-2002	30.04	19.34	645
2002-2003	94.61	53.67	567
2003-2004	99.66	56.5	567
2004-2005	94.27	53.17	564
2005-2006	102.66	62.7	611
2006-2007	157.18	80.1	510
2007-2008	122.93	71.43	581
2008-2009	129.38	72.33	559
2009-2010	149.11	74.8	502
2010-2011	186.43	88.51	475
2011-2012	228.87	155.52	679
2012-2013	250.59	197.24	783
2013-2014	257.68	203.51	790

Sources:

i. Agricultural resource database of Jharkhand 2011-12

ii. Economic Survey of Jharkhand 2013-14.

(g) Total food grains

Area, production and productivity of food grain crops are shown in table 3g. There has been fluctuating trend in the area of total food grain and this was mainly due to characteristics of agriculture in the state i.e. rainfed area and mono cropping system and other climatic reasons. The acreage under food grain crop varied from 1552 to 2430 thousand hectare during 1999-2000 to 2012-13. The productivity has considerably increased in the state in these crops but fluctuation in the yield was also observed due to climatic reasons. The productivity was observed to be maximum near about 1876 Kg per hectare in 2012-13 while lowest was also recorded at 1077 Kg per hectare in 2005-06. In spite of fluctuation in the acreage and productivity of food grain crops, total production of food grain has reached to a maximum level in the year 2012-13 (4558 thousand tons) which was nearer to sufficient for the state.

Table 3g: Area, Production and Productivity of Food Grains (1999-00 to 2012-13)

Years	Area	Production	Productivity
	000's ha	000's tons	Kg./ Ha.
1999-2000	1776.81	1977.29	1113
2000-2001	1928.31	2817.08	1461
2001-2002	1986.8	3253.14	1637
2002-2003	1865.71	2612.61	1400
2003-2004	1941.46	2722.49	1403
2004-2005	1840.7	2491.5	1353
2005-2006	1898.89	2044.17	1077
2006-2007	2285.78	3619.83	1584
2007-2008	2362.96	4113.15	1741
2008-2009	2387.00	4168.00	1768
2009-2010	1552.23	2107.66	1358
2012-2013	2430.00	4558.00	1876

Sources:

i. Agricultural resource database of Jharkhand 2011-12.

ii. Economic Survey of Jharkhand 2013-14.

(h) Fruits

Area under fruits is showing an increasing trend in the state during 2000-01 to 2012-13 except minor decreased in 2003-04 (table 3h). This increase is mainly due to introduction of National Horticulture Mission (NHM) in the state in that the main focus is given for expansion of area under fruit plant. The resultant growth of area has positively increased production of fruits in the state. The quantity of fruits during 2000-01 was about 265 million tons which reached to a maximum level of about 890 million ton during 2012-13 (near about 3 times). The productivity has definitely increased in the state but it remains to be constant during the period.

Table 3h: Area, Production and Productivity of Fruits (2000-01 to 2012-13)

Years	Area	Production	Productivity
	000's ha	Million tons	ton / hec.
2000-2001	29.90	265.10	8.87
2001-2002	31.50	321.10	10.19
2002-2003	32.70	321.20	9.82

2003-2004	31.80	296.30	9.31
2004-2005	33.20	403.40	12.15
2005-2006	33.30	388.60	11.67
2006-2007	32.90	382.00	11.61
2007-2008	37.60	382.60	10.17
2008-2009	43.25	512.80	11.97
2009-2010	43.95	519.81	11.82
2010-2011	72.00	779.60	10.80
2011-2012	83.80	850.20	10.10
2012-2013	93.00	889.70	9.57

Sources:

i. Agricultural resource database of Jharkhand 2011-12
ii. Economic Survey of Jharkhand 2013-14
iii.Indian Horticulture Database 2013

(i) Vegetable

Vegetable cultivation has shown a special choice of marginal, small and medium farmers in the state, which is clearly seen in cropping pattern (Table 3i). The area under this crop has significantly increased in the state and the rate of change was quit high (more than two times). The productivity has definitely increased but remains to be constant during study period. The production has increased double from the base year (2000-01) in the state (Table 3i). This was mainly because of increase in area as well as increase in productivity.

Table 3i: Area, Production and Productivity of Vegetable (2000-01 to 2012-13)

Years	Area	Production	Productivity
	000's ha	Million tons	Ton / Ha.
2000-2001	149.80	2109.50	14.00
2001-2002	158.50	1736.30	10.95
2002-2003	118.20	1300.10	11.00
2003-2004	110.60	1197.20	10.82
2004-2005	223.60	3394.90	15.18
2005-2006	224.20	3401.30	15.17
2006-2007	223.60	3394.90	15.18
2007-2008	238.90	3639.70	15.24
2009-2010	229.63	3727.01	16.23
2010-2011	259.50	4112.40	15.80
2011-2012	261.20	3902.60	14.90
2012-2013	321.50	4325.40	13.50

Sources:

i. Agricultural resource database of Jharkhand 2011-12
ii. Economic Survey of Jharkhand 2013-14
iii.Indian Horticulture Database 2013

(j) Milk and Fish production in the state

Milk production and fish production has been shown in table 3j, revealed that the production of milk in the state has significantly increased, indicating near about two times in total production in 2012-13. This increase is mainly due to increase in the population of cross bred cow and indigenous cattle population also increases in productivity of cattle in the state through better management. The availability of milk has definitely reduced the deficiency of per capita milk in the state.

The fish enterprise is increasing constantly in the state which can be seen from the data (table 3j) that in year 2001-02 fish production was about 14000 million tons which increased to 67980 million tons in 2007-08 further improved to 91676 million tons in 2011-12 and reached to maximum level of 99660 million tons in 2012-13. This remarkable change in fish production was mainly due to interest of the producers in this enterprise and also facility provided by governments for this enterprise.

Table 3j: Milk and Fish production (2000-01 to 2013-**14)**

Year	Milk Production (In lakh tonnes)	Fish Production (In lakh tonnes)
2001-02	NA	140000.00
2002-03	9.51	150000.00
2003-04	9.54	180000.00
2004-05	13.30	271250.00
2005-06	13.35	349200.00
2006-07	14.01	540800.00
2007-08	14.42	679800.00
2008-09	14.66	758500.00

2009-10	14.63	701570.00
2010-11	15.56	718860.00
2011-12	16.13	916760.00
2012-13	17.90	996600.00
2013-14	NA	816650.00

Sources:

i. *Economic Survey of Jharkhand 2013-14*

ii. *Department of Animal Husbandry and Fisheries, Jharkhand*

4. Magnitude of Crop diversification

Table 4 shows the values of Simpson Indices, and per hectare fertilizer consumption. A close perusal of the table reveals that the level of crop diversification in Jharkhand, as measured through Simpson Index, is very low. This is mainly because of rainfed nature of agriculture in the state leading to rainfed rice based production system. However, with the increase in the use of modern farm inputs particularly, chemical fertilizer and assured irrigation, Jharkhand agriculture is slowly diversifying towards high value crops like vegetables, oilseeds, irrigated maize, etc.

Table 4: Simpson Index of agricultural production in the state

Year	Simpson Index	Fertilizer Consumption (Kg/Ha)
2000	0.39	42.54
2001	0.38	44.10
2002	0.44	55.80
2003	0.40	49.90
2004	0.39	51.84
2005	0.41	55.30
2006	0.42	60.20
2007	0.41	65.40
2008	0.41	68.60
2009	0.52	99.85
2010	0.69	119.60
2011	0.56	90.10
2012	0.61	124.40

CONCLUSION

This study reveals that there has been shifting in agriculture in respect to area, production and productivity of all cereals, pulses and oil seeds crops in the state. A significant changing is observed in case of high value crops i.e. vegetable crops, pulses crops and oil seed crops in the state. The farmers prefer high value crops through adoption of improved technology i.e. increase in fertilizer consumption per unit of area and also adopting hybrid paddy/ improved paddy and other varieties on their farm. The availability of milk and fish product has also changing in the state as observed from the data. Overall there is significant transformation has been taken place in the state after implementation of different government programmes in agriculture.

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