Changes in Land Use and Cropping Pattern in Indian Agriculture: A Regional Perspective

Sandeep K. Thakur*
*Assistant Professor, Department of Economics, Govt. Degree College, Rampur, Distt. Shimla HP172001

I

Introduction

During the course of any development programme of natural resources, land utilization occupies special attention. At any particular time, it is determined by temperature, moisture, topography, soil and physical structure. Obviously, land has the characteristics of its fixity in supply and scarcity. Therefore, land use pattern is directly concerned with the problem arising in the process of deciding upon and carrying out into action the optimum use.

In the dynamic world, certain modifications can occur in the existing pattern of land utilization. It deals with the process of putting various types of land to the optimum use. In brief, a close look of the present land use pattern and its trends will go a long way to recommend the scope of systematic and planned shift in the pattern (Lekhi & Singh, 1996).

The aim of the research paper is to Study the Growth in Land Use and Cropping Pattern in India.

II

Data and Methodology

Data

The present study is mainly based on secondary sources of data. Data on various categories of land use in Indian agriculture has been obtained from Directorate of Agriculture and Statistics, Government of India, Ministry of Agriculture, Government of India, Planning Commission, Government of India, Reserve Bank of India (RBI) and Centre for Monitoring Indian Economy (CMIE), Report on Agriculture (Various Issues), www.indiastat.com, www.agricoop.nic.in, Agricultural Statistics at a Glance-An Annual Publication of the Directorate of Statistics, Government of India, and Ministry of Agriculture. State wise and region wise data for area, production and yield of various crops have been compiled from official website of Government Reports and Journals. These data have been categorized for different regions of India for further analysis (Bhalla & Singh).

Methodology

Compound Annual Growth Rate

Concept that has been used maximum number of times during the past four decades or so in research papers published, particularly in the discipline of agricultural economics, it is undoubtedly the ‘computation

of compound growth rates' (see, for example, Panse, 1964; Dey, 1975; Reddy, 1978; Narain et al., 1982; Kumar and Rosegrant, 1994; Kumar, 1997; Joshi and Saxena, 2002; Singh and Srivastava, 2003).

If yt denotes the observation (e.g. agricultural production, productivity, or area) at time t and r is the compound growth rate, model employed for estimating r is based on Eq. (1): $y_t = y_0 (1 + r)^t$ …….(1)

The usual practice is to assume a multiplicative error-term exp (ε) in Eq. (1) so that the model may be linearized by means of logarithmic transformation, giving

Eq. (2): $\ln (y_t) = A + Bt + \varepsilon$ …(2)

where, $A = \ln (y_0)$, and $B = \ln (1 + r)$. Eq. (2) is then fitted to data using "method of least squares" and goodness of fit is assessed by the coefficient of determination R^2 . Finally, the compound growth rate is estimated by

Eq. (3): $\hat{r} = \exp (\hat{B}) - 1$ …..(3)

Compound Growth Rate:

$$Y = AB^t$$

Where y = acreage, production, yield and contribution of value of output.

A = Constant

B = 1+r

r = Compound Growth Rate

t = Time Variable in Years. (1,2,…….n)

Besides, the standard error of the compound growth rate will be worked out by using the following formula

$$SE(r) = {}^{100B}\sqrt{\frac{\frac{1}{(\log 10^e)^2}\left(\Sigma \log y^2 - \frac{(\log y^2)}{N}\right) - (\log 10^B)^2 \Sigma x^2}{(N-2)\Sigma x^2}}$$

Where $x = x - \bar{x}$.

III

Result and Discussion

It is a process which "assigns each tract of land in its proper class in a system of classes. The classes in the system are defined in terms of the qualities of characteristics with which the classifications are concerned. In India the classification of land has had its roots in agriculture statistics. The collection of such statistics in 19th century started when in view of the famines and local shortage of food that were then

confronting the country and also with a view to furthering the economic exploitation of the country's resources, it become necessary to know how the available land was utilized. Till 1950, land was classified into following five broad classes:

1. Area under forests
2. Area not available for cultivation
3. Uncultivated lands excluding current fallows
4. Area under current fallows
5. Net area sown

This type of classification continued almost intact all these years, the definitional changes made in one or two states being minor; later on, it was realized that the above classification afforded only a broad outline of land utilization in the country; and did not give a very clear picture of the actual area under different categories of land use. Moreover the data given in respect of different states of India were also not comparable in certain cases due to lack of uniformity in the methods of classification. The Government of India, therefore, appointed a committee on the co-ordination of Agriculture Statistics in India to work out the details of the annual and periodical inquires to be organized in pursuance of the recommendations of the committee. In March 1950, the following classification of areas for each district of the country was given:

1. Forests
2. Barren and uncultivable lands
3. Land put to non-agricultural uses
4. Permanent pastures and other grazing lands
5. Culturable wastes
6. Miscellaneous tree crops and grooves not included in the net area sown
7. Current fallows
8. Other fallows
9. Net area sown

The total of these nine classes would be equal to the geographical area according to village records (Dutt & Pugh, 1940).

In the present chapter the general land use pattern, sub categories of land use in India is given along with the analysis of cropping pattern of major farm crops in four regions between the periods 2003-04 to 2013-14.

Land Use Pattern in North Western Region

Table 1: Land Use Pattern in North Western Region of India (2003-04 and 2013-14)

(Area in 000 Hectares)

Regions	North Western Region				Growth Rate
	2003-04	% to Total Area	2013-14	% to Total Area	
forest area	5161	12.30	5109	12.18	-0.0011
Land Not Available for Cultivation	5834	13.91	6198	14.78	0.0067

Other Uncultivable Land excluding Fallow Land	3021	7.20	2981	7.10	-0.0015
Total Fallow Land	2106	5.02	2129	5.07	0.0012
Net Sown Area	25812	61.55	25515	60.84	-0.0013
Total Area	41934	100.00	41932	100.00	0.0000

Source: *Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2003-04 and 2014-15.*

The area under forest includes all lands which are under forest, whether private or state owned, and whether wooded or maintained as potential forest land. The area of crops raised in the forest and grazing lands or areas open for grazing within the forest remain included under the "forest area"(Lekhi,1996).

The area under forest which stood 5161 thousand hectares (12.307 percent of total area) in the year 2003-04 falls to 5109 thousand hectares (12.184 percent of total area) in the year 2012-13 accounting for -0.0011 percent rate of fall during the period under study in North Western Region.

As far as the Land not Available for cultivation is concerned it includes the area under settlements, roads, railways, embankments, canals, tank etc. was 5834 thousand hectares (13.912 percent of total area) in the year 2003-04 increases to 6198 thousand hectares (14.781 percent of total area) in the year 2012-13 registering 0.0067 percent growth rate during the period from 2002-03 to 2012-13 in North Western Region.

The other Uncultivated Land excluding Fallow Land includes the culturable waste land, permanent pastures land and land under miscellaneous tree crops and groves are considered as other uncultivated land. These are the lands which are put to some agricultures use but the not included in the category of net area sown. The area under it was 3021 thousand hectares (7.204 percent of total area) in the year 2003-04 falls to 2981 thousand hectares (7.109 percent of total area) in the year 2013-14 accounting for -0.0015 percent rate of fall during the period under study in North Western Region.

The total Fallow Land is regular part of the cultivated land on which cultivation has been temporarily suspended due to some reasons like unfavourable weather (ICAR, 1980). Total area in this land use category was 2106 thousand hectares (5.022 percent of total area) in the year 2003-04 falls to 2129 thousand hectares (5.077 percent of total area) in the year 2013-14 accounting for 0.0012 percent rate of growth rate during the period under study in North Western Region.

The Net Sown Area is the actual area under crops in the same year occupied 25812 thousand hectares (61.554 percent of total area) in the year 2003-04 falls to 25515 thousand hectares (60.849 percent of total area) in the year 2013-14 accounting for -0.0013 percent rate of fall during the period under study in North Western Region.

The total area under all these categories was 41934 thousand hectares (100.00 percent of total area) in the year 2003-04 falls to 41932 thousand hectares (100.00 percent of total area) in the year 2013-14 accounting for 0.0012 percent rate of growth rate during the period under study in North Western Region (Table 1)

Land Use Pattern in Eastern Region

Table 2: Land Use Pattern Eastern Region of India (2003-04 and 2013-14)

(Area in 000 Hectares)

Regions	Eastern Region				Growth Rate
	2003-04	% to Total Area	2013-14	% to Total Area	
forest area	9559	23.05	9436	22.79	-0.0014
Land Not Available for Cultivation	8071	19.46	9043	21.84	0.0127
Other Uncultivable Land excluding Fallow Land	2161	5.21	2102	5.07	-0.0031
Total Fallow Land	1988	4.79	3023	7.30	0.0477
Net Sown Area	19688	47.47	17801	42.99	-0.0111
Total Area	41467	100.00	41405	100.00	-0.0002

Source: Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2003-04 and 2014-15.

The area under forest which stood 9559 thousand hectares (23.052 percent of total area) in the year 2003-04 falls to 9043 thousand hectares (22.790 percent of total area) in the year 2012-13 accounting for -0.0014 percent rate of fall during the period under study in Eastern Region.

As far as the Land not Available for cultivation is concerned it includes the area under settlements, roads, railways, embankments, canals, tank etc. was 8071 thousand hectares (19.464 percent of total area) in the year 2003-04 increases to 9043 thousand hectares (21.840 percent of total area) in the year 2012-13 registering 0.0127 percent growth rate during the period from 2002-03 to 2012-13 in Eastern Region.

The other Uncultivated Land excluding Fallow Land includes the culturable waste land, permanent pastures land and land under miscellaneous tree crops and groves are considered as other uncultivated land. These are the lands which are put to some agricultures use but the not included in the category of net area sown. The area under it was 2161 thousand hectares (5.211 percent of total area) in the year 2003-04 falls to 2102 thousand hectares (5.077 percent of total area) in the year 2013-14 accounting for -0.0031 percent rate of fall during the period under study in Eastern Region.

The total Fallow Land is regular part of the cultivated land on which cultivation has been temporarily suspended due to some reasons like unfavourable weather (ICAR, 1980). Total area in this land use category was 1988 thousand hectares (4.794 percent of total area) in the year 2003-04 falls to 3023 thousand hectares (7.301 percent of total area) in the year 2013-14 accounting for 0.0477 percent rate of growth rate during the period under study in Eastern Region.

The Net Sown Area is the actual area under crops in the same year occupied 19688 thousand hectares (47.479 percent of total area) in the year 2003-04 falls to 17801 thousand hectares (42.992 percent of total area) in the year 2013-14 accounting for -0.0111 percent rate of fall during the period under study in Eastern Region.

The total area under all these categories was 41467 thousand hectares (100.00 percent of total area) in the year 2003-04 falls to 41405 thousand hectares (100.00 percent of total area) in the year 2013-14 accounting for -0.0002 percent rate of growth rate during the period under study in Eastern Region (Table 2)

Land Use Pattern in Central Region

Table: 3 Land Use Pattern in Central Region of India (2003-04 and 2013-14)

(Area in 000 Hectares)

Regions	Central Region				Growth Rate
	2003-04	% to Total Area	2012-13	% to Total Area	
forest area	18412	16.06	18484	16.09	0.0004
Land Not Available for Cultivation	14477	12.62	14688	12.78	0.0016
Other Uncultivable Land excluding Fallow Land	14055	12.26	13428	11.69	-0.0051
Total Fallow Land	8062	7.03	7774	6.76	-0.0040
Net Sown Area	59623	52.01	60477	52.65	0.0016
Total Area	114629	100.00	114851	100.00	0.0002

Source: Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2003-04 and 2014-15.

The area under forest which stood 18412 thousand hectares (16.062 percent of total area) in the year 2003-04 increases to 18484 thousand hectares (16.094 percent of total area) in the year 2012-13 accounting for 0.0004 percent rate of increase during the period under study in Central Region.

As far as the Land not Available for cultivation is concerned it includes the area under settlements, roads, railways, embankments, canals, tank etc. was 14477 thousand hectares (12.629 percent of total area) in the year 2003-04 increases to 14688 thousand hectares (12.789 percent of total area) in the year 2012-13 registering 0.0016 percent growth rate during the period from 2002-03 to 2012-13 in Central Region.

The other Uncultivated Land excluding Fallow Land includes the culturable waste land, permanent pastures land and land under miscellaneous tree crops and groves are considered as other uncultivated land. These are the lands which are put to some agricultures use but not included in the category of net area sown. The area under it was 14055 thousand hectares (12.261 percent of total area) in the year 2003-04 falls to 13428 thousand hectares (11.692 percent of total area) in the year 2013-14 accounting for -0.0051 percent rate of fall during the period under study in Central Region .

The total Fallow Land is regular part of the cultivated land on which cultivation has been temporarily suspended due to some reasons like unfavourable weather (ICAR, 1980). Total area in this land use category was 8062 thousand hectares (7.033 percent of total area) in the year 2003-04 falls to 7774 thousand hectares (6.769 percent of total area) in the year 2013-14 accounting for -0.0040 percent rate of growth rate during the period under study in Central Region .

The Net Sown Area is the actual area under crops in the same year occupied 59623 thousand hectares (52.014 percent of total area) in the year 2003-04 rose to 60477 thousand hectares (52.657 percent of total area) in the year 2013-14 accounting for 0.0016 percent rate of growth during the period under study in Central Region .

The total area under all these categories was 114629 thousand hectares (100.00 percent of total area) in the year 2003-04 increases to 114851 thousand hectares (100.00 percent of total area) in the year 2013-14 accounting for 0.0002 percent rate of growth rate during the period under study in Central Region (Table 3).

Land Use Pattern in Southern Region

Table 4: Land Use Pattern in Southern Region of India (2003-04 and 2013-14)

(Area in 000 Hectares)

Regions	Southern Region				Growth Rate
	2003-04	% to Total Area	2012-13	% to Total Area	
forest area	12474	19.66	12507	19.70	0.0003
Land Not Available for Cultivation	9947	15.68	10252	16.15	0.0034
Other Uncultivable Land excluding Fallow Land	4196	6.61	3771	5.94	-0.0118
Total Fallow Land	9961	15.70	9442	14.87	-0.0059
Net Sown Area	26844	42.32	27502	43.32	0.0027
Total Area	63422	100.00	63474	100.00	0.0001

Source: *Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2003-04 and 2014-15.*

The area under forest which stood 12474 thousand hectares (19.668 percent of total area) in the year 2003-04 rose to 12507 thousand hectares (19.704 percent of total area) in the year 2012-13 accounting for 0.0003 percent rate of growth during the period under study in Southern Region.

As far as the Land not Available for cultivation is concerned it includes the area under settlements, roads, railways, embankments, canals, tank etc. was 9947 thousand hectares (15.684 percent of total area) in the year 2003-04 increases to 10252 thousand hectares (16.151 percent of total area) in the year 2012-13 registering 0.0034 percent growth rate during the period from 2002-03 to 2012-13 in Southern Region.

The other Uncultivated Land excluding Fallow Land includes the culturable waste land, permanent pastures land and land under miscellaneous tree crops and groves are considered as other uncultivated land. These are the lands which are put to some agricultures use but the not included in the category of net area sown. The area under it was 4196 thousand hectares (6.616 percent of total area) in the year 2003-04 falls to 3771 thousand hectares (5.941 percent of total area) in the year 2013-14 accounting for -0.0118 percent rate of fall during the period under study in Southern Region.

The total Fallow Land is regular part of the cultivated land on which cultivation has been temporarily suspended due to some reasons like unfavourable weather (ICAR, 1980). Total area in this land use category was 9961 thousand hectares (15.706 percent of total area) in the year 2003-04 falls to 9442 thousand hectares (14.875 percent of total area) in the year 2013-14 accounting for -0.0059 percent rate of fall during the period under study in Southern Region.

The Net Sown Area is the actual area under crops in the same year occupied 26844 thousand hectares (42.326 percent of total area) in the year 2003-04 increases to 27502 thousand hectares (43.328 percent of total area) in the year 2013-14 accounting for 0.0027 percent rate of growth during the period under study in Southern Region .

The total area under all these categories was 63422 thousand hectares (100.00 percent of total area) in the year 2003-04 rose to 63474 thousand hectares (100.00 percent of total area) in the year 2013-14 accounting for 0.0001 percent rate of growth rate during the period under study in Southern Region (Table 4).

Regional Pattern of Land Use of sub categories

Regional Land Use Pattern of Net Area Sown

Table 5 Region Wise Net Area Sown In India (2003-04 and 2013-14)

(Area in thousand Hectares)

Regions	States fall in the Region	Net Area Sown		ACGR
		2003-04	2013-14	
North Western Region	Haryana	3534	3513	-0.0007
	Himachal Pradesh	541	543	0.0004
	Punjab	4240	4150	-0.0024
	Jammu & Kashmir	747	745	-0.0003
	Uttar Pradesh	16750	16564	-0.0012
	Average	5162.4	5103	-0.0013
Eastern Region	Assam	2753	2811	0.0023
	Bihar	5712	5402	-0.0062
	Orissa	5795	4386	-0.0305
	West Bengal	5428	5202	-0.0047
	Average	4922.0	4450.3	-0.0111
Central Region	Gujarat	9852	10302	0.0050
	Madhya Pradesh	14945	15352	0.0030
	Maharashtra	17432	17344	-0.0006
	Rajasthan	17394	17479	0.0005
	Average	14905.8	15119.3	0.0016
Southern Region	Andhra Pradesh	10118	11117	0.0105
	Karnataka	9847	9793	-0.0006
	Kerala	2190	2048	-0.0074
	Tamil Nadu	4689	4544	-0.0035
	Average	6711.0	6875.5	0.0027
Total	**Mean**	**7847.85**	**7798.37**	
	S D	**5663.23**	**5798.28**	
	CV	**72.16**	**74.35**	

Source: *Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2003-04 and 2014-15.*

The region wise Average Net area Sown in North Western Region was 5162.4 thousand hectares in 2003-04 which falls to 5103 thousand hectares in 2012-13 showing a negative Annual Compound Growth Rate of -0.0013 percent in the period of study (Table 5). The Average Net area Sown in Eastern Region was 4922.0 thousand hectares in 2003-04 which falls to 4450.3 thousand hectares in 2012-13 also showing a negative Annual Compound Growth Rate of -0.0111 percent in the period of study At the same time the Average Net area Sown in Central Region was 14905.8 thousand hectares in 2003-04 which rose to15119.3 thousand hectares in 2012-13 with a positive Annual Compound Growth Rate of 0.0016 percent during the period under study.

The Average Net area Sown in Southern Region was 6711.0 thousand hectares in 2003-04 which rose to6875.5 thousand hectares in 2012-13 with a positive Annual Compound Growth Rate of 0.0027 percent during the period under study (Table 5).

Regional Land Use Pattern of Total Cropped area

Table: 6 Region Wise Total Cropped Area in India 2003-04 and 2013-14

(Area in thousand Hectares)

Regions	States fall in the Region	Total Cropped Area		ACGR
		2003-04	2013-14	
North Western Region	Haryana	6388	6376	-0.0002
	Himachal Pradesh	956	947	-0.0011
	Punjab	7907	7870	-0.0005

	Jammu & Kashmir	1102	1162	0.0059
	Uttar Pradesh	24425	25821	0.0062
	Average	8155.6	8435.2	0.0038
Eastern Region	Assam	3957	4197	0.0066
	Bihar	7882	7778	-0.0015
	Orissa	8637	5069	-0.0575
	West Bengal	9661	9678	0.0002
	Average	7534.3	6680.5	-0.0133
Central Region	Gujarat	11421	12600	0.0110
	Madhya Pradesh	19788	23130	0.0175
	Maharashtra	22190	21874	-0.0016
	Rajasthan	21664	23954	0.0112
	Average	18765.8	20389.5	0.0093
Southern Region	Andhra Pradesh	12366	13650	0.0110
	Karnataka	11450	11748	0.0029
	Kerala	2954	2592	-0.0144
	Tamil Nadu	5316	5140	-0.0037
	Average	7474.3	8282.5	0.0115
Total	**Mean**	**10516.53**	**10954.56**	
	S D	**7283.11**	**7960.41**	
	CV	**69.25**	**72.67**	

Source: *Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2003-04 and 2014-15.*

The region wise Average of Total Cropped Area in North Western Region was 8155.6 thousand hectares in 2003-04 which grows to 8435.2 thousand hectares in 2012-13 showing a positive Annual Compound Growth Rate of 0.0038 percent in the period of study (Table 6). The Average of Total Cropped Area in Eastern Region was 7534.3 thousand hectares in 2003-04 which falls to 6680.5 thousand hectares in 2012-13 also showing a negative Annual Compound Growth Rate of -0.0133 percent in the period of study.

At the same time the Average of Total Cropped Area in Central Region was 18765.8 thousand hectares in 2003-04 which rose to20389.5 thousand hectares in 2012-13 with a positive Annual Compound Growth Rate of 0.0093 percent in the period of study.

The Average of Total Cropped Area in Southern Region was 7474.3 thousand hectares in 2003-04 which rose to 8282.5 thousand hectares in 2012-13 with a positive Annual Compound Growth Rate of 0.0115 percent in the period of study (Table 6).

Regional Land Use Pattern of Area Sown More than once

Table: 7 Regional Land Use Pattern in India 2003-04 to 2013-14

(Area in thousand Hectares)

Regions	States fall in the Region	Area Sown More than Once		ACGR
		2003-04	2013-14	
North Western Region	Haryana	2854	2863	0.0003
	Himachal Pradesh	415	403	-0.0033
	Punjab	3666	3720	0.0016
	Jammu & Kashmir	355	417	0.0180
	Uttar Pradesh	8675	9257	0.0072
	Average	3193	3332	0.0047
Eastern Region	Assam	1204	1386	0.0158
	Bihar	2170	2375	0.0101
	Orissa	2842	682	-0.1466
	West Bengal	4234	4473	0.0061

	Average	2612.5	2229.0	-0.0175
Central Region	Gujarat	1570	2298	0.0432
	Madhya Pradesh	4843	7778	0.0541
	Maharashtra	4758	4530	-0.0054
	Rajasthan	4270	6475	0.0473
	Average	3860.3	5270.3	0.0352
Southern Region	Andhra Pradesh	2248	2533	0.0134
	Karnataka	1604	1955	0.0222
	Kerala	765	544	-0.0372
	Tamil Nadu	627	596	-0.0056
	Average	1311.0	1407.0	0.0079
Total	**Mean**	**2838.288**	**3155.813**	
	S D	**1993.425**	**2511.814**	
	CV	**70.23**	**79.59**	

Source: *Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2003-04 and 2014-15.*

The region wise Average of Area Sown More than Once in North Western Region was 3193 thousand hectares in 2003-04 which rose to 3332 thousand hectares in 2012-13 showing a positive Annual Compound Growth Rate of 0.0047 percent in the period of study.

The region wise Average of Area Sown More than Once in Eastern Region was 2612.5 thousand hectares in 2003-04 which falls to 2229.0 thousand hectares in 2012-13 also showing a negative Annual Compound Growth Rate of -0.0175 percent in the period of study.

At the same time the Average of Area Sown More than Once in Central Region was 3860.3 thousand hectares in 2003-04 which rose to 5270.3 thousand hectares in 2012-13 with a positive Annual Compound Growth Rate of 0.352 percent in the period of study .

The Average of Area Sown More than Once in Southern Region was 1311.0 thousand hectares in 2003-04 which rose to 1407.0 thousand hectares in 2012-13 with a positive Annual Compound Growth Rate of 0.0079 percent in the period of study (Table 7).

Regional Land Use Pattern of Net Irrigated area

Table: 8 Regional Land Use Pattern in India 2003-04 to 2013-14

(Area in thousand Hectares)

Regions	States fall in the Region	Net Irrigated Area		ACGR
		2003-04	2013-14	
North Western Region	Haryana	2969	3102	0.0049
	Himachal Pradesh	105	110	0.0052
	Punjab	4097	4112	0.0004
	Jammu & Kashmir	307	325	0.0064
	Uttar Pradesh	13227	13929	0.0058
	Average	4141	4315.6	0.0046
Eastern Region	Assam	140	161	0.0157
	Bihar	3433	3053	-0.0129
	Orissa	1737	1248	-0.0361
	West Bengal	3006	3082	0.0028
	Average	2079.0	1886.0	-0.0108
Central Region	Gujarat	3388	4233	0.0250
	Madhya Pradesh	5631	8550	0.0475
	Maharashtra	3260	3244	-0.0005
	Rajasthan	5239	7499	0.0407

	Average	4379.5	5881.5	0.0333
Southern Region	Andhra Pradesh	3634	4575	0.0259
	Karnataka	2384	3421	0.0409
	Kerla	384	396	0.0034
	Tamil Nadu	2148	2643	0.0233
	Average	2137.5	2758.8	0.0288
Total	**Mean**	**3284.42**	**3788.30**	
	S D	**2850.03**	**3311.64**	
	CV	**86.77**	**87.42**	

Source: Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2003-04 and 2014-15.

The region wise Average of Net Irrigated Area in North Western Region was 4141 thousand hectares in 2003-04 which rose to 43.15.6 thousand hectares in 2012-13 showing a positive Annual Compound Growth Rate of 0.0046 percent in the period of study (Table 8). The Average of Net Irrigated Area in Eastern Region was 2079.0 thousand hectares in 2003-04 which falls to 1886.0 thousand hectares in 2012-13 also showing a negative Annual Compound Growth Rate of -0.0108 percent in the period of study.

At the same time the Average of Net Irrigated Area in Central Region was 4379.5 thousand hectares in 2003-04 which rose to 5881.5 thousand hectares in 2012-13 with a positive Annual Compound Growth Rate of 0.0333 percent in the period of study.

The Average of Net Irrigated Area in Southern Region was 2137.5 thousand hectares in 2003-04 which rose to 2758.8 thousand hectares in 2012-13 with a positive Annual Compound Growth Rate of 0.0028 percent in the period of study (Table 8).

Regional Land Use Pattern of Net Un-Irrigated Area

Table: 9 Regional Land Use Pattern in India 2003-04 to 2013-14

(Area in thousand Hectares)

Regions	States fall in the Region	Net Un-irrigated Area		ACGR
		2003-04	2013-14	
North Western Region	Haryana	564	410	-0.0348
	Himachal Pradesh	435	433	-0.0005
	Punjab	144	36	-0.1428
	Jammu & Kashmir	440	420	-0.0052
	Uttar Pradesh	3522	2635	-0.0317
	Average	1021	786.8	-0.0285
Eastern Region	Assam	2613	2649	0.0015
	Bihar	2279	2349	0.0034
	Orissa	4058	3139	-0.0281
	West Bengal	2421	2123	-0.0145
	Average	2842.8	2565.0	-0.0114
Central Region	Gujarat	6464	6069	-0.0070
	Madhya Pradesh	9315	6802	-0.0343
	Maharashtra	14172	14100	-0.0006
	Rajasthan	12155	9980	-0.0217
	Average	10526.5	9237.8	-0.0144
Southern Region	Andhra Pradesh	6484	6541	0.0010
	Karnataka	7463	6373	-0.0174
	Kerala	1806	1652	-0.0099
	Tamil Nadu	2541	1902	-0.0317
	Average	4573.5	4117.0	-0.0116

Total	**Mean**	**4563.31**	**4010.12**	
	S D	**4202.31**	**3815.07**	
	CV	**92.09**	**95.14**	

Source: *Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2003-04 and 2014-15.*

The region wise Average of Net Un-irrigated Area in North Western Region was 1021.0 thousand hectares in 2003-04 which falls to 786.8 thousand hectares in 2012-13 showing a negative Annual Compound Growth Rate of -0.0285 percent in the period of study (Table 9). The Average of Net Un-irrigated Area in Eastern Region was 2842.8 thousand hectares in 2003-04 which falls to 2565.0 thousand hectares in 2012-13 also showing a negative Annual Compound Growth Rate of -0.0114 percent in the period of study.

At the same time the Average of Net Un-irrigated Area in Central Region was 10526.5 thousand hectares in 2003-04 which falls to 9237.8 thousand hectares in 2012-13 with a negative Annual Compound Growth Rate of -0.0144 percent in the period of study .The Average of Net Un-irrigated Area in Southern Region was 4573.5 thousand hectares in 2003-04 which falls to 4117.0 thousand hectares in 2013-14 with a negative Annual Compound Growth Rate of -0.0116 (Table 9).

Regional Land Use Pattern of Total Area

Table: 10 Regional Land Use Pattern in India 2003-04 to 2013-14

(Area in thousand Hectares)

Regions	States fall in the Region	Total Area		ACGR
		2003-04	2013-14	
North Western Region	Haryana	3533	3512	-0.0007
	Himachal Pradesh	540	543	0.0006
	Punjab	4241	4148	-0.0025
	Jammu & Kashmir	747	745	-0.0003
	Uttar Pradesh	16749	16564	-0.0012
	Average	5162	5102.4	-0.0013
Eastern Region	Assam	2753	2810	0.0023
	Bihar	5712	5402	-0.0062
	Orissa	5795	4387	-0.0305
	West Bengal	5427	5205	-0.0046
	Average	4921.8	4451.0	-0.0111
Central Region	Gujarat	9852	10302	0.0050
	Madhya Pradesh	14946	15352	0.0030
	Maharashtra	17432	17344	-0.0006
	Rajasthan	17394	17479	0.0005
	Average	14906.0	15119.3	0.0016
Southern Region	Andhra Pradesh	10118	11116	0.0105
	Karnataka	9847	9794	-0.0006
	Kerala	2190	2048	-0.0074
	Tamil Nadu	4689	4545	-0.0035
	Average	6711.0	6875.8	0.0027
Total	**Mean**	**7847.738**	**7798.433**	
	S D	**5663.349**	**5798.286**	
	CV	**72.17**	**74.35**	

Source: *Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2003-04 and 2014-15.*

The region wise Average of Total Area in North Western Region was 5162.4 thousand hectares in 2003-04 which falls to 5103 thousand hectares in 2012-13 showing a negative Annual Compound Growth

Rate of -0.0013 in the period of study (Table10). The region wise Average of Total Area in Eastern Region was 4922.0 thousand hectares in 2003-04 which falls to 4450.3 thousand hectares in 2012-13 also showing a negative Annual Compound Growth Rate of -0.0111 in the period of study.

At the same time the region wise Average of Total Area in Central Region was 14905.8 thousand hectares in 2003-04 which rose to15119.3 thousand hectares in 2012-13 with a positive Annual Compound Growth Rate of 0.0105.

The region wise Average of Total Area in Southern Region was 6711.0 thousand hectares in 2003-04 which rose to6875.5 thousand hectares in 2012-13 with a positive Annual Compound Growth Rate of 0.0027 (Table10).

Regional Land Use Cropping Pattern Major Farm Crops in India 2003-04 to 2013-14

Cropping pattern refers to the proportion of area under different crops at a point of time. A change in the cropping pattern means a change in the proportion of area under different crops. Cropping pattern in India is determined by natural factors like climate, soil conditions and rainfall etc (Tiwari, 1943).

It has been observed that it is also affected by the physical factors such as soil and climate; Technological factors such as Irrigation, Improved seeds, Fertilizers and Plant protection chemical; and Institutional factors such as Land reforms, Consolidation of holdings and Credit facilities (Hussain, Majid (1996).

It is clear that all these factors plays a crucial role in determining the cropping pattern, from the time crops are sown to the produce is harvested and stored. Land use cropping pattern are different from region to region due to the variation in all these factors. Whereas change in cropping pattern refers to change in proportion of area under various crops between the two different time periods(Shafi & Mohammad, 2006).

Regional Cropping Pattern of Major farm crops In North Western Region

Table:11 Regional area wise Cropping Pattern of Major Crops in India 2003-04-2013-14

(Area in 000' hectares)

Crops	North Western Region				**% change**
	2003-04		2013-14		
	Area in 0000 ha	Per cent	Area in 0000 ha	Per cent	
Rice	9698	27.40	10317	28.82	**1.42**
Wheat	15820	44.70	16455	45.96	**1.26**
Jowar	401	1.13	235	0.66	**-0.48**
Bajra	1574	4.45	1358	3.79	**-0.65**
Maize	1634	4.62	1490	4.16	**-0.46**
Ragi	7	0.02	12	0.03	**0.01**
Barley	323	0.91	260	0.73	**-0.19**
Pulses	3120	8.82	2564	7.16	**-1.65**
Fruit & Vegetable	1376	3.89	1555	4.34	**0.46**
Oilseeds	1575	4.45	1804	5.04	**0.59**
Gross Cropped Area	**35390**	**100.00**	**35800**	**100.00**	**0.00**

Source: Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2003-04 and 2014-15.

Rice is the main kharif crop in the country. It is transplanted in June and July and matures between October and November. Due to high water requirements; it is grown in the high rainfall areas. Moreover if it

has to depend barely on rainfall, it requires not less than 30cm rainfall per month. In India, only 9 percent of the area enjoys 30 cm rainfall per month in the months of July and August.

In the view of this, the states like West Bengal, Punjab, UP, Coastal Andhra Pradesh, Bihar, Orissa, Tamil Nadu and Assam have become most important states producing Rice. In the North Western Region rice occupies the 9698 thousand hectares (27.40 percent) in the years of 2003-04 increases to 10317 thousand hectares (28.82 percent) in the year of 2012-13, which shows a change of 1.42 percent during the study period in the region.

At the same time in this region Wheat occupies the 15820 thousand hectares (44.70 percent) in the years of 2003-04 increases to 16455 thousand hectares (45.96 percent) in the year of 2012-13, which shows a change of 1.26 percent during the study period in the region.

In North Western Region area under Jowar was 401 thousand hectares (1.13 percent) in the years of 2003-04 decreases to 235 thousand hectares (0.68 percent) in the year of 2012-13, which shows a change of -0.48 percent during the study period in the region.

At the same time in this region Bajra occupies the 1574 thousand hectares (4.45 percent) in the years of 2003-04 decreases to 1358 thousand hectares (3.79 percent) in the year of 2012-13, which shows a change of -0.65 percent during the study period in the region.

In this region Maize occupies the 1634 thousand hectares (4.62 percent) in the years of 2003-04 decreases to 1490 thousand hectares (4.16 percent) in the year of 2012-13, which shows a change of -0.46 percent during the study period in the region.

In North Western Region area under Ragi was 7 thousand hectares (0.02 percent) in the years of 2003-04 increases to 12 thousand hectares (0.03 percent) in the year of 2012-13, which shows a change of 0.01 percent during the study period in the region.

In this Region area under Barley was 323 thousand hectares (0.91 percent) in the years of 2003-04 decreases to 260 thousand hectares (0.73 percent) in the year of 2012-13, which shows a change of -0.19 percent during the study period in the region.

During the study period the area under Pulses was 3120 thousand hectares (8.82 percent) in the years of 2003-04 decreases to 2564 thousand hectares (7.16 percent) in the year of 2012-13, which shows a change of -1.65 percent during the study period in the region.

In this Region area under Fruit and Vegetable was 1376 thousand hectares (3.89 percent) in the years of 2003-04 increases to 1555 thousand hectares (4.34 percent) in the year of 2012-13, which shows a change of 0.46 percent during the study period in the region.

In this Region area under Oilseeds was 1575 thousand hectares (4.45 percent) in the years of 2003-04 increases to 1804 thousand hectares (5.04 percent) in the year of 2012-13, which shows a change of 0.59 percent during the study period in the region.

While the Gross Cropped Area in North Western Region was 35390 thousand hectares in the year of 2003-04 increases to 35800 thousand hectares registered a slow growth in this region under the major crops (Table 11).

Regional Cropping Pattern of Major farm crops In Eastern Region

Table:12 Regional area wise Cropping Pattern of Major Farm Crops in India2003-04-2013-14

(Area in 000' hectares)

Crops	Eastern Region				**Change in Percent**
	2003-04		2013-14		
	Area in 000 ha	Per cent	Area in 000 ha	Per cent	
Rice	16466	54.64	15254	57.08	**2.45**
Wheat	2592	8.60	2565	9.60	**1.00**
Jowar	14	0.05	5	0.02	**-0.03**
Bajra	5	0.02	4	0.01	**0.00**
Maize	867	2.88	917	3.43	**0.55**
Ragi	219	0.73	75	0.28	**-0.45**
Barley	24	0.08	12	0.04	**-0.03**
Pulses	2691	8.93	1393	5.21	**-3.72**
Fruit & Vegetable	2975	9.87	2678	10.02	**0.15**
Oilseeds	2024	6.72	1448	5.42	**-1.30**
Gross Cropped Area	**30137**	**100.00**	**26722**	**100.00**	**0.00**

Source: Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2003-04 and 2014-15.

In the Eastern Region rice occupies the 16466 thousand hectares (54.64 percent) in the years of 2003-04 decreases to 15254 thousand hectares (57.08 percent) in the year of 2012-13, which shows a change of 2.45 percent during the study period in the region. At the same time in this region Wheat occupies the 2592 thousand hectares (8.60 percent) in the years of 2003-04 decreases to 2565 thousand hectares (9.60 percent) in the year of 2012-13, which shows a change of 1.00 percent during the study period in this region.

In Eastern Region area under Jowar was 14 thousand hectares (0.05 percent) in the years of 2003-04 decreases to 5 thousand hectares (0.02 percent) in the year of 2012-13, which shows a change of -0.03 percent during the study period in the region.

At the same time in this region Bajra occupies the 5 thousand hectares (0.02 percent) in the years of 2003-04 decreases to 4 thousand hectares (0.01 percent) in the year of 2012-13, which shows a change of -0.00 percent during the study period in the region.

In this region Maize occupies the 867 thousand hectares (2.88 percent) in the years of 2003-04 increases to 917 thousand hectares (3.43 percent) in the year of 2012-13, which shows a change of 0.55 percent during the study period in the region.

In Eastern Region area under Ragi was 219 thousand hectares (0.73 percent) in the years of 2003-04 decreases to 75 thousand hectares (0.28 percent) in the year of 2012-13, which shows a change of -0.45 percent during the study period in the region.

In this Region area under Barley was 24 thousand hectares (0.08 percent) in the years of 2003-04 decreases to 12 thousand hectares (0.04 percent) in the year of 2012-13, which shows a change of -0.03 percent during the study period in the region.

During the study period the area under Pulses was 2691 thousand hectares (8.93 percent) in the years of 2003-04 decreases to 1393 thousand hectares (5.21 percent) in the year of 2012-13, which shows a change of -3.72 percent during the study period in the region. In this Region area under Fruit and Vegetable was 2975 thousand hectares (9.87 percent) in the years of 2003-04 decreases to 2678 thousand hectares (10.02 percent) in the year of 2012-13, which shows a change of 0.15 percent during the study period in the region.

Area under oilseeds in this Region was 2024 thousand hectares (6.72 percent) in the years of 2003-04 decreases to 1448 thousand hectares (5.42 percent) in the year of 2012-13, which shows a change of -1.30 percent during the study period in the region.

While the Gross Cropped Area in Eastern Region was 30137 thousand hectares in the year of 2003-04 decreases to 26722 thousand hectares registered a decline in this region area under the major crops (Table 12).

Regional Cropping Pattern of Major farm crops in Central Region

Table:13 Regional area wise Cropping Pattern of Major Farm Crops in India 2003-04-2013-14

(Area in 000' hectares)

Crops	Central Region				Change in Percent
	2003-04		2013-14		
	Area in 000 ha	Per cent	Area in 000 ha	Per cent	
Rice	4058	5.41	4278	5.25	-0.16
Wheat	7717	10.28	10690	13.11	2.83
Jowar	6217	8.28	4287	5.26	-3.03
Bajra	8756	11.66	5917	7.25	-4.41
Maize	2919	3.89	3149	3.86	-0.03
Ragi	179	0.24	146	0.18	-0.06
Barley	281	0.37	401	0.49	0.12
Pulses	12820	17.08	12040	14.76	-2.32
Fruit & Vagetable	1982	2.64	2060	2.53	-0.11
Oilseeds	14847	19.78	19721	24.18	4.40
Gross Cropped Area	75063	100.00	81558	100.00	0.00

Source: *Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2003-04 and 2014-15.*

In the Central Region rice occupies the 4058 thousand hectares (5.41 percent) in the years of 2003-04 increases to 4278 thousand hectares (5.25 percent) in the year of 2012-13, which shows a change of -0.16 percent during the study period in the region. At the same time in this region Wheat occupies the 7717 thousand hectares (10.28 percent) in the years of 2003-04 increases to 10690 thousand hectares (13.11 percent) in the year of 2012-13, which shows a change of 2.83 percent during the study period in the region.

In Central Region area under Jowar was 6217 thousand hectares (8.28 percent) in the years of 2003-04 decreases to 4287 thousand hectares (5.26 percent) in the year of 2012-13, which shows a change of -3.03 percent during the study period in the region. At the same time in this region Bajra occupies the 8756 thousand hectares (11.66 percent) in the years of 2003-04 decreases to 5917 thousand hectares (7.25 percent) in the year of 2012-13, which shows a change of -4.41 percent during the study period in the region

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In this region Maize occupies the 2919 thousand hectares (3.89 percent) in the years of 2003-04 increases to 3149 thousand hectares (3.86 percent) in the year of 2012-13, which shows a change of -0.03 percent during the study period in the region .

In Central Region area under Ragi was 179 thousand hectares (0.24 percent) in the years of 2003-04 decreases to 146 thousand hectares (0.18 percent) in the year of 2012-13, which shows a change of -0.06 percent during the study period in the region (Table 4.13). In this Region area under Barley was 281 thousand hectares (0.37 percent) in the years of 2003-04 increases to 401 thousand hectares (0.49 percent) in the year of 2012-13, which shows a change of -0.12 percent during the study period in the region.

During the study period the area under Pulses was 12820 thousand hectares (17.08 percent) in the years of 2003-04 decreases to 12040 thousand hectares (14.76 percent) in the year of 2012-13, which shows a change of -2.32 percent during the study period in the region. In this Region area under Fruit and Vegetable was 1982 thousand hectares (2.64 percent) in the years of 2003-04 increases to 2060 thousand hectares (2.53 percent) in the year of 2012-13, which shows a change of -0.11 percent during the study period in the region.

In this Region area under Oilseeds was 14847 thousand hectares (19.78 percent) in the years of 2003-04 increases to 19721 thousand hectares (24.18 percent) in the year of 2012-13, which shows a change of 4.40 percent during the study period in the region .While the Gross Cropped Area in Central Region was 75.63 thousand hectares in the year of 2003-04 increases to 81558 thousand hectares registered growth in this region under the major crops (Table 13).

Regional Cropping Pattern of Major farm crops In Southern Region

Table: 14 Region area wise Cropping Pattern of Major Farm Crops in India 2003-04-2013-14

(Area in 000' hectares)

Crops	Southern Region				Change in Percent
	2003-04		2013-14		
	Area in 000 ha	Per cent	Area in 000 ha	Per cent	
Rice	5726	17.85	6591	19.89	2.05
Wheat	244	0.76	233	0.70	-0.06
Jowar	2748	8.56	1759	5.31	-3.26
Bajra	616	1.92	385	1.16	-0.76
Maize	1487	4.63	2567	7.75	3.11
Ragi	1173	3.66	739	2.23	-1.43
Barley	0	0.00	0	0.00	0.00
Pulses	4593	14.31	4423	13.35	-0.96
Fruit & Vegetable	2480	7.73	2680	8.09	0.36
Oilseeds	7252	22.60	5548	16.75	-5.86
Gross Cropped Area	32086	100.00	33130	100.00	0.00

Source: *Agriculture Statistics of India, Directorate of Economics and Statistics Government of India, 2003-04 and 2014-15.*

In the Southern Region rice occupies the 5726 thousand hectares (17.85 percent) in the years of 2003-04 increases to 6591 thousand hectares (19.89 percent) in the year of 2012-13, which shows a change of 2.05 percent during the study period in the region (Table 14). At the same time in this region Wheat occupies the 244 thousand hectares (0.76 percent) in the years of 2003-04 decreases to 233 thousand hectares (0.70 percent) in the year of 2012-13, which shows a change of -0.06 percent during the study

period in the region . In Southern Region area under Jowar was 2748 thousand hectares (8.56 percent) in the years of 2003-04 decreases to 1759 thousand hectares (5.31 percent) in the year of 2012-13, which shows a change of -3.26 percent during the study period in the region .

At the same time in this region Bajra occupies the 616 thousand hectares (1.92 percent) in the years of 2003-04 decreases to 385 thousand hectares (1.16 percent) in the year of 2012-13, which shows a change of -0.76 percent during the study period in the region . In this region Maize occupies the 1487 thousand hectares (4.63 percent) in the years of 2003-04 increases to 2567 thousand hectares (7.75 percent) in the year of 2012-13, which shows a change of 3.11 percent during the study period in the region .

In Southern Region area under Ragi was 1173 thousand hectares (3.66 percent) in the years of 2003-04 decreases to 739 thousand hectares (2.23 percent) in the year of 2012-13, which shows a change of -1.43 percent during the study period in the region .

During the study period the area under Pulses was 4593 thousand hectares (14.31 percent) in the years of 2003-04 decreases to 4423 thousand hectares (13.35 percent) in the year of 2012-13, which shows a change of -0.96 percent during the study period in the region.

In this Region area under Fruit and Vegetable was 2480 thousand hectares (7.73 percent) in the years of 2003-04 increases to 2680 thousand hectares (8.09 percent) in the year of 2012-13, which shows a change of 0.36 percent during the study period in the region . In this Region area under Oilseeds was 7252 thousand hectares (22.60 percent) in the years of 2003-04 decreases to 5548 thousand hectares (16.75 percent) in the year of 2012-13, which shows a change of -5.86 percent during the study period in the region .

While the Gross Cropped Area in Southern Region was 32086 thousand hectares in the year of 2003-04 increases to 33130 thousand hectares registered a slow growth in this region under the major crops (Table 14).

Conclusions:

The general land use cropping pattern in the study period is the reflection of the various factors affecting the land use pattern in India. Whereas the general land use is concerned 60.84 percent of net sown area out of total area was highest, and it was 5.07 percent lowest under total fallow land in North Western Region. In the Eastern Region 42.99 percent of net sown area out of total area was highest, and it was 5.07 percent lowest under Other Uncultivable Land excluding Fallow Land. Central Region shows highest 52.65 percent in the land category of Net Sown Area whereas it was 6.769 percent lowest in Total Fallow Land. Whereas in the Southern Region 43.32 percent was highest in Net Sown Area and it was 5.941 percent lowest in Other Uncultivable Land excluding Fallow Land.

Growth rate of Regional Land Use Cropping Pattern of Net Sown Area was negative in North Western Region -0.0013, Eastern Region -0.0111 and it found positive in Central Region 0.0016 and 0.0027 in Southern Region. AT the same time Growth rate of Regional Land Use Cropping Pattern of Total Cropped Area was positive in North Western Region 0.0038, Central Region 0.0093, Southern Region

0.0115 and it was negative in Eastern Region -0.0133.Growth rate of Regional Land Use Cropping Pattern of Area Sown More than Once was positive in North Western Region 0.0047, Central Region 0.0352, Southern Region 0.0079 and it was negative in Eastern Region -0.0175.In the category of Net Irrigated Area Positive growth rate was found in North Western Region 0.0046, Central Region 0.0333, Southern Region 0.0028 and it was negative in Eastern Region -0.0108. Growth rate found negative in the land use pattern category of Net Un-irrigated Area, in North western region -0.0285, Eastern Region -0.0114, Central Region -0.0144 and in Southern Region it was -0.0116.

Growth rate of Major farm crops in North Western Region was positive in Rice, Wheat, Ragi, Fruits and Vegetable and Oilseeds while it was negative in Jowar, Bajra, Maize, Barley and in Pulses. Eastern Region, growth rate of these crops was positive in Rice, Wheat, Bajra, Maize and in fruits & Vegetable. But in the crop of Jowar, Ragi, Barley, Pulses and in Oilseed it was found negative. Central region, growth rate on major crops like Wheat, Barley and Oilseeds was positive and it was negative in the all other crops of study. Southern Region, growth rate of Rice, Maize, Barley and Fruits and Vegetable was found positive and it was negative in in all other crops.

India is blessed with a large amount of recourses. But the supply of these resources is to be reviewed against their need on the one hand and possible utilisation within the given range of technology on the other. But the present utilisation of almost all resources falls short of the requirements.

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