



## Research Article

# PRELIMINARY STUDY ON THE IMPACT OF IRRIGATION ON CROPPING INTENSITY IN MANIPUR

SUJATHA K.\*, BHATTACHARYYA B. AND CHIPHANG D.Y.

Department of Agricultural Statistics, Bidhan Chandra Krishi Vishwavidyalaya, Mohanpur, Nadia, 741252, West Bengal, India

\*Corresponding Author: Email - sujathakuppan@gmail.com

Received: August 30, 2019; Revised: September 25, 2019; Accepted: September 26, 2019; Published: September 30, 2019

**Abstract:** Irrigation is a very important non-physical input in agriculture as the crop production of an area largely depends on the existing irrigation facility. Crop production can be amplified from boosting the arable land, cropping intensity and yield per unit area of cropped land. Hence an attempt has been made in this paper to analyse district wise performance in the intensity of cropping in Manipur and the impact of irrigation on cropping intensity. The data is taken from various issues of Statistical Abstracts of Manipur for the period 1990 to 2017. Appropriate statistical tools i.e. average; compound growth rate, coefficient of variation and simple linear regression are used for the analysis of data. Variations were found among the districts in terms of cropping intensity; compound growth rate (CGR) for cropping intensity is higher in Bishnupur, Ukhrul, Chandel and Senapati, medium in Imphal West, Thoubal and Churachandpur and Imphal East and Tamenglong have a low level. The growth rate of cropping intensity for the overall state is only 1.1 and the total Coefficient of Variation in cropping intensity was 17.94 % which reveals that there exists variation in the net sown area and total cropped area in Manipur.

**Keywords:** Irrigation, Cropping intensity, CGR, Coefficient of variation, Simple linear regression

**Citation:** Sujatha K., et al., (2019) Preliminary Study on the Impact of Irrigation on Cropping Intensity in Manipur. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 11, Issue 18, pp.- 9042-9044.

**Copyright:** Copyright©2019 Sujatha K., et al., This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

## Introduction

In a State like Manipur where more than 53 percent of the domestic product is generated from the agricultural sector, assured water supply for irrigation is of utmost importance. Agricultural development of a state can be obtained through intensifying the crops at a limited area. Cropping intensity determine the number of crops availed from net area sown in a particular agricultural year. Higher cropping intensity indicates that a larger part of the sown area is cropped more than once [1,2]. Adoption of improved seeds, fertilizers and mechanization are the important factors which increase cropping intensity. In order to accelerate the cropping intensity, the available resources should be utilised in best possible way by changing and modifying spatial and temporal crop or cropping activities. The enhancement in cropping intensity is possible due to the availability of better irrigation facilities and increased use of new agricultural technologies [3,4]. Study on disparities in cropping intensity among different districts will provide a clearer view of variations within regions. The present paper will identify the inter-district disparities in cropping intensity in Manipur. Increase in cropping intensity indicates increased agricultural development of the region [5]. Kalaiselvi and Sundar (2011) analysed the variations in cropping intensity in India and concluded that highest cropping intensity was found in states of northern region while lower cropping intensity was observed in dry regions depending on rainfall. Karunakaran and Palanisami (1998) found that cropping intensity had a significant relationship with irrigation intensity in Tamil Nadu. Irrigation through dug well and tube well were found to have more positive relationships with cropping intensity. Authors concluded that the state should make more investment in irrigation facilities. The present study is conducted with the following objectives; 1. To know district wise performance in an intensification of cropping in Manipur. 2. To study the impact of irrigation facility on cropping intensity in Manipur.

## Material and Methods

The present study is based on secondary data collected from various issues of the

statistical abstract of Manipur from 1990 to 2017. Cropping intensity is calculated for all the districts in Manipur from 2000 to 2017. Collected data was tested by different statistical test. Different descriptive statistical tools would be used to describe the series [1]. Cropping intensity refers to raising of a number of crops from the same field during one agriculture year. It can be expressed through a formula

$$\text{Cropping intensity} = (\text{Total or gross cropped area} / \text{Net sown area}) \times 100$$

To calculate the irrigation intensity the following formula is used.

$$\text{Irrigation Intensity} = (\text{Net Irrigated Area} / \text{Net Sown Area}) \times 100$$

Simple linear regression has been used to find the impact of irrigation on cropping intensity.

The model is  $X_{1i} = \alpha + \beta \cdot X_{2i} + \epsilon$

Where  $X_{1i}$  = Cropping Intensity in the  $i^{\text{th}}$  year;  $X_{2i}$  = Irrigation Ratio in the  $i^{\text{th}}$  year;

$i$  = Years from 1990 to 2017;  $\alpha$  = Intercept;  $\beta$  = Regression Coefficient;

$\epsilon$  = Error term

## Results and Discussion

The collected data have been analysed with the help of suitable statistical techniques. [Table-1] reveals that the cropping intensity of Manipur from 1990 to 2017. From the year 1990 to 2017 net sown area and gross cropped area were 140 thousand hectares and 201 thousand hectares to 226.18 thousand hectares and 355.93 thousand hectares respectively which shows that there is an increasing trend year by year. In the year 1990, the cropping intensity is 143.57 which become decreasing gradually and then increasing continuously i.e. 157.37 in 2017. Cropping intensity is taken as the ratio of the gross area under all crops grown on the farm over the crop year. The table indicates that the Compound Growth Rate in cropping intensity is 1.1.

Table-2 District wise Cropping Intensity in Manipur and Related Measures

Year/Districts	Imphal East	Imphal West	Thoubal	Bishnupur	Chandel	Churachandpur	Tamenglon	Senapati	Ukhrul
2000	110.63	134.93	162.09	147.06	120.98	101.81	102.94	115.95	113.84
2001	113.8	132.57	143.71	140.44	104.58	98.9	112.4	106.89	128.58
2002	112.12	130.29	204.23	147.67	122.19	101.74	104.1	117.54	116.31
2003	116.35	135.2	149.35	149.51	104.28	96.38	111.26	110.06	133.08
2004	115.19	133.21	146.09	148.55	118.73	98.91	108.86	108.37	132.61
2005	116.71	129.8	147.14	148.01	128.08	109.94	115.1	127.59	145.39
2006	117.61	133.4	159.84	154.35	130.92	113.53	117.48	128.05	143.39
2007	118.28	134.51	161.33	154.5	137.92	115.57	119.27	133.89	152.8
2008	119.25	136.27	162.42	156.71	139.31	116.96	121.17	134.47	153.02
2009	238.64	188.04	222.39	259.69	251.12	187.21	163.32	243.23	255.65
2010	120.78	139.77	162.09	164.9	139.67	118.36	122.4	137.13	156.07
2011	126.9	152.21	175.56	175.3	141.39	119.14	123.43	138.84	157.88
2012	61.06	180.01	221.77	233.16	170.14	138.1	148.61	174.43	185.38
2013	131.74	151.77	175.56	175.51	144.6	120.09	124.85	141.28	159.44
2014	131.82	153.43	176.29	180.05	144.86	120.18	124.94	141.46	159.51
2015	134.41	168.22	191.85	194.2	146.13	120.74	125.61	142.51	161.23
2016	148.51	174.28	192.19	194.43	146.83	120.8	125.73	142.74	161.41
2017	152.41	178.69	202.88	202.14	146.64	120.97	125.89	142.84	161.82
CGR	1.10	1.90	1.50	2.30	2.00	1.50	1.30	2.00	2.10
CV	26.53	13.34	14.37	18.80	22.62	17.29	11.95	22.38	20.08
Mean	127.01	149.26	175.38	173.68	141.02	117.74	122.08	138.18	154.30

Table-1 Cropping Intensity in Manipur and Related Measures

Year	Net Sown Area ('000 ha)	Gross Area ('000 ha)	Cropping Intensity (%)
1990	140	201	143.57
1991	140	192	137.14
1992	140	187	133.57
1993	226	276	122.12
1994	140	189	135
1995	140	187	133.57
1996	220	220	100
1997	207	207	100
1998	216	216	100
1999	199	199	100
2000	221.6	269.48	121.61
2001	219.95	262.68	119.43
2002	188.14	228.24	121.31
2003	222.51	270.83	121.72
2004	224.26	272.88	121.68
2005	221.86	282.05	127.13
2006	229.22	299.73	130.76
2007	230.03	306.85	133.4
2008	231.03	311.62	134.88
2009	131.4	282.44	214.95
2010	231.19	317.47	137.32
2011	234	335.22	143.26
2012	136.28	239.43	175.69
2013	233.74	338.42	144.78
2014	233.62	340.29	145.66
2015	234.12	355.62	151.9
2016	234.14	362.96	155.02
2017	226.18	355.93	157.37
CGR	1.3	2.4	1.1
CV	19.25	21.78	17.94
Mean	201.83	268.08	134.39

Table-3 Irrigation Intensity in Manipur and Related Measures

Year	Net Sown Area ('000 ha)	Net Irrigated Area ('000 ha)	Irrigation Intensity (%)
1990	140.00	65	46.43
1991	140.00	65	46.43
1992	140.00	65	46.43
1993	226.00	65	28.76
1994	140.00	65	46.43
1995	140.00	65	46.43
1996	220.00	65	29.55
1997	207.00	65	31.40
1998	216.00	65	30.09
1999	199.00	38	19.10
2000	221.60	45	20.31
2001	219.95	40	18.19
2002	188.14	54	28.70
2003	222.51	40	17.98
2004	224.26	54	24.08
2005	221.86	51	22.99
2006	229.22	51	22.25
2007	230.03	51	22.17
2008	231.03	52	22.51
2009	131.40	52	39.57
2010	231.19	73	31.58
2011	234.00	69	29.49
2012	136.28	49	35.96
2013	233.74	69	29.52
2014	233.62	69	29.54
CGR	1.3	-0.3	-2.00
CV	20.01	17.96	31.49
Mean	198.2732	57.68	30.634088

The Compound Growth Rate shows that the net sown area is 1.3 and the gross cropped area is 2.4. The total Coefficient of Variation in cropping intensity was 17.94 % which shows that there exists variation in the net sown area and total cropped area in Manipur. This variability may exist due to rainfall, irrigation facilities, environmental and agro-climatic differences in the regions and adoption of modern agricultural techniques. [Table-2] indicate that district-wise cropping intensity in Manipur from 2000 to 2017. The table shows that the compound growth rate for cropping intensity is higher in Bishnupur, Ukhrul, Chandel and Senapati i.e. 2.3, 2.1, 2.0 and 2.0 respectively. The growth rate of cropping intensity is medium in Imphal West, Thoubal and Churachandpur i.e. 1.9, 1.5 and 1.5 respectively. Besides Imphal East and Tamenglon also have a low level. The cropping intensity shows dynamic spatial variation in Manipur.

[Table-3] shows that the irrigation intensity of Manipur from 1990 to 2014. During the study period irrigation intensity showing decreasing trends. Irrigation has played an important role in raising the cropping intensity. Irrigation helps raise the cropping intensity by enabling rising of crops during the dry season also. From the year 1990 to 1998 net irrigated areas become stable and it's continuously decreasing then gradually increased to 69 thousand hectares in 2014. From the table, it is clearly shown that Compound Growth Rate of irrigation intensity is negative (-2.0). The Coefficient of variation shows that the net sown area 20.01% and gross irrigated area 17.96%. The total Coefficient of Variation in irrigation intensity was 31.49%.

#### Relationship between Cropping Intensity and Irrigation

Cropping intensity is influenced by many factors such as irrigation, rainfall, use of fertilizers and availability of labour. But the present study is concerned to analyse the relation and impact of irrigation ratio on cropping intensity.

Simple linear regression  $y=101.665+0.988x$

$R^2=0.153$

Where y is cropping intensity, x is irrigation intensity.

The study also brings out the fact that there is not much correspondence between irrigation intensity and cropping intensity in the Manipur state which further indicates that the cropping intensity in the state is not solely dependent on the irrigation but on the other natural, socio-cultural, economic, political, technological and infrastructural factors. In the case of Manipur state, Farmers, by and large, are dependent on monsoon rain for the main Kharif crop of paddy. It is only when there is drought-like situation; farmers really feel the need for irrigation.

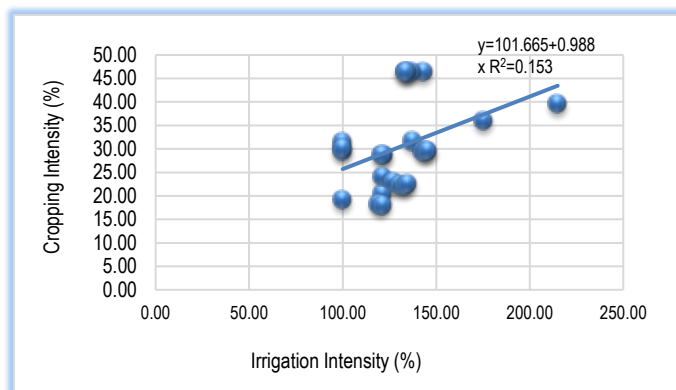


Fig-1 Relationship between Irrigation Intensity and Cropping Intensity in Manipur

## Conclusion

Increase in agricultural production and productivity depends to a large extent on the availability of water. Irrigation is, thus, the most important infrastructure need for the modernization of agriculture. The study reveals that the cropping intensity is low in the state Manipur and it is not solely dependent on the irrigation but on the other factors also. Most of the agricultural areas are under rainfed and major areas depend on rain for farming. However, enhancement of cropping intensity is possible by improved irrigation facilities, use of proper fertilizers, seeds and adoption of modern agricultural techniques and by improving the cropping pattern. The irrigation ratio has a positive impact on cropping intensity as supported by the results of the analysis in the study. So proper irrigation facility must be ensured to achieve and retain better cropping intensity.

**Application of research:** Prediction of Risk and performance in crop production

**Research Category:** Irrigation and cropping system

**Abbreviations:** CGR-Compound Growth Rate, CV- Coefficient of Variation

**Acknowledgement / Funding:** Authors are thankful to Department of Agricultural Statistics, Bidhan Chandra Krishi Vishwavidyalaya, Mohanpur, Nadia, 741252, West Bengal, India.

**\*Research Guide or Chairperson of research:** Dr Banjul Bhattacharyya

University: Bidhan Chandra Krishi Vishwavidyalaya, Nadia, 741252, West Bengal

Research project name or number: PhD Thesis

**Author Contributions:** All authors equally contributed

**Author statement:** All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

**Study area / Sample Collection:** Secondary data on gross cropped area, net sown area, and net irrigated area collected from various issues of the statistical abstract of Manipur from 1990 to 2017.

**Cultivar / Variety / Breed name:** Nil

**Conflict of Interest:** None declared

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

Ethical Committee Approval Number: Nil

## References

- [1] Deshmukh M.S. and Shinde V.T. (2017) *North Asian International Research Journal of Social Science & Humanities*, 3(2).
- [2] Kalaiselvi S. and Sundar, I. (2011) *International Journal of Business Management, Economics and Information Technology*, 3 (2), 269-273.
- [3] Karunakaran K. and Palanisami, K. (1998) *Indian Economic Review*, 33(2), 207-220.
- [4] Singh V. (1990) *Regional disparities in agricultural development*, New Delhi: Deep and Deep Publications.
- [5] Singh R. (2015) *Online International Interdisciplinary Research Journal*, 5 (6), 96-104.