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Agricultural Production and Cropping Intensity of Assam

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Abstract

Assam is basically an agricultural state and situated north-eastern part of India. About 86 percent of its total population lives in the rural areas (2011 census) with 70 percent directly or indirectly dependent on agriculture and 55 per cent of the workforce actually engaged in agricultural activities. The state is comprised of three broad natural (physical) divisions, namely the Brahmaputra valley, the Barak valley and the Hill range. The alluvial soils are extensively found distributed over the Brahmaputra and Barak plain and extremely favourable for agricultural crops. Agriculture of Assam is mainly dependent on rainfall. The state receives maximum rainfall during the monsoon period and least rainfall in the winter season. Though the average annual rainfall in Assam is 2311.10 mm but there is a period of distinct drought. The state produced food crops as well non-food crops. Food crops are recognised as major crops produced in the state as it covers more than 90 percent of the cultivated area of the state. Among the all types' food crops produced in Assam, rice is marked as an important food crops. It occupied a dominant position within the all food crops. However, cropping intensity extremely important for any agricultural state.. The change in cropping intensity reflects the sensitivity of agricultural activities to Socio-economic, agro-biological condition and climatic aberration from time to time such as drought, floods etc The study found't' test value which is 30.19 and considered as significant at 5% level of significant. Further development of the agricultural status of the state, study suggested making sufficient arrangement in order to raise cropping intensity of the state.

Key words: dependent, produced, major, cropping intensity, dominant

1. Introduction:

Assam is basically an agricultural state and situated north-eastern part of India. The geographical area of the state is 78,438 sq. km which is about 2.39 percent of India. About 86 percent of its total population lives in the rural areas (2011 census) with 70 percent directly or indirectly dependent on agriculture and 55 per cent of the workforce actually engaged in agricultural activities. As per 2011 census, the literacy rate of state is 72.19 percent with the male literacy 77.85 percent and female 66.27 percent. Brahmaputra and Barak are the two biggest rivers in the state. The state is comprised of three broad natural

(physical) divisions, namely the Brahmaputra valley, the Barak valley and the Hill range. The Brahmaputra valley being the largest is a long strip of plain land extending from west to north- east in the northern part of the State. The valley runs from north-east to west through a distance of 450 kms, splitting the valley in to two long strips. The valley is an alluvial plain, 725 km long and about 80 km broad on the average and consists of an area of 56,339 Sq.km. representing 72 percent of the total area of the State and about 85 percent of the total population of the State reside in this region (Das, 1984). But the Barak Valley is relatively small accounting for only about 9 percent of the area of the State and accommodating about 12 percent of the State's population.

In Assam under varying geographical conditions, topographical characteristics and agro-climatic situations different types of soils are found in the hills piedmonts, plateaus and plains. The soil found in Assam may generally be divided in to four type's viz. alluvial soils, piedmonts soils, hill soils and lateritic soils. The alluvial soils are extensively found distributed over the Brahmaputra and Barak plain and extremely favourable for agricultural crops. The state lies in the regime of monsoon climate of the sub-tropical belt and enjoys heavy summer rainfall, winter drought, high humidity and relatively low temperature during a year. Agriculture of Assam is mainly dependent on rainfall. The state receives maximum rainfall during the monsoon period and least rainfall in the winter season. Though the average annual rainfall in Assam is 2311.10 mm but there is a period of distinct drought. The state depicts marked spatial variation in the climatic pattern mainly because of its location and physiographic. On the basis of these characteristics the state can be broadly divided into six Agro-climatic zones. They are- Upper Brahmaputra Valley (North), Upper Brahmaputra Valley (South), Central Brahmaputra Valley, Lower Brahmaputra Valley, Barak Valley and Hills zone . Out of six zones mentioned in the above, cropping activities and process of cultivation almost same in all the zones except the hill zone.

2. Review of literature:

Few literature are reviewed for the purpose of the study: Study conducted by Gayen et.al (2014) Murshidabad, an agriculturally advanced district of West Bengal (India) during the years between 1984-85 and 2001-02 demonstrated that production of some important crops have increased as a result of increase in the cropping intensity. Average yield (t/ha) of paddies has increased 1.38 to 2.58 during the period of 1984-85 to 2001-02.

Study carried out by khan et al (2017) in Bangladesh on four crops (Boro-T.Aus-T.Aman-Mustard) pattern for increasing cropping intensity and productivity as compared with existing farmers' pattern. Two years average results showed that the highest rice equivalent yield (20.63 t ha-1) was obtained from four crops pattern. The highest average gross return and gross margin of the four crops pattern were obtained Tk.359570 and Tk. 170162 ha-1 which were 80 and 207 percent higher over farmers' pattern.

Kalaiselvi et al (2011) in their study on Interstate disparity in cropping intensity in India found that cropping intensity determine the number of crops availed from net area sown in a

particular agricultural year. Higher cropping intensity indicates that larger part of sown area is cropped more than once.

Mondal et al (2015) in their study shows that more cropping intensity make possible to grow four crops in year in the same piece of land more employment opportunity for male and female labours could be created and at the same time due to increase in the production of rice, potato and mugbean, food security and nutritional security could be ascertained for the farmers.

3. Methodology:

The proposed study is conducted on the basis of secondary data. The secondary data is collected from the various published and unpublished sources. Data collected from the various sources is analysed using various statistical tools. Cropping intensity is calculated dividing the Gross cropped area by Net cropped area multiplying with one hundred (Gross cropped area / Net cropped area × 100).

4. Objective of the study:

The specific objectives of the study are

I. To analyse the production of important agricultural crops in Assam

ii. To analyse cropping intensity of Assam.

5. Hypothesis:

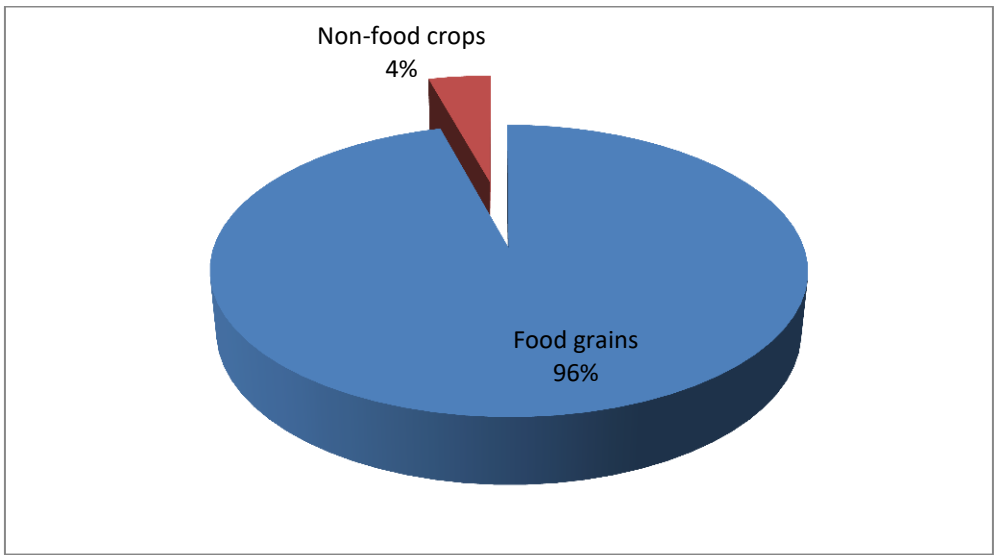
Agricultural production is independent of cropping intensity.

In Assam total land area under cultivation was increased from 23.01 lakh hectare in 1950-51 to 27.04 lakh hectares in 1970-71 and then to 27.73 lakh hectares in 2016-17. The average size of land holding per household was only 1.10 hectares during the year 2014-15 and more than 85 percent of farmer families are either small or marginal farmers with average land holding of only 0.63 hectare. However, agriculture as a sector still continues to support more than 75 percent of its population, either directly or indirectly, providing employment and support to more than 50 percent of its total workforce.

Soil, topography, rainfall and climate in general are very conducive for agricultural activity, mainly for the cultivation of paddy in the state. As a result of that concentration of area under paddy production and cultivation is high both from the side of farmers as well as the Agriculture Department. The state produced food crops as well non-food crops. Food crops are recognised as major crops produced in the state because maximum portion of cultivated area is covered by the food crops. It covers more than 90 percent of total cultivated area. Rice, wheat, pulses, potato, and Mesta etc. are considered as main food crops produced in the state. In 1975-76 the area under food crops was 27 lakh hectares but in 2011-12 it was increased to 27.14 lakh hectares. Thus, marginal increment of the area under food crops was observed during this period. Among the all types' food crops produced in Assam, rice is marked as an important food crops. It occupied a dominant position within the all food crops.as per final estimate total area under rice cultivation during the year 2016-17 was 28.67 lakh hectares and it is 92.50 percent of total area under

food grains in the state. In 2015-16, area occupied by the paddy was 88.72 percent of the net cropped area and 66.13 of the gross cropped area in the state. However, total area under paddy has slightly declined 26.25 lakh hectares to 24.84 lakh hectares in 2015-16 in the state. Although total area under paddy showed a decline in the state, due to decline in area covered under Autumn rice and summer rice. This is also due to choice of farmers to switch over to Winter Rice. According to the final forecast estimates, the area under autumn rice has declined from 4.36 lakh hectares in 2004-05 to 1.96 lakh hectares in 2014-15 and further declined to 1.91 lakh hectares in 2015-16. The area under Summer rice has declined from 4.16 lakh hectares in 2014-15 to 4.05 lakh hectares in 2015-16, both of which led to the decline of total rice area to 24.85 lakh hectares from 24.95 lakh hectares in its previous year of rice area cultivation in the state. However, the area under Winter Rice, the principal kharif crop of the State, has slightly increased from 18.83 lakh hectares in 2014-15 to 18-89 lakh hectares in 2015-16. The area under Wheat and Pulses has both declined in the year 2015-16 from its previous year 2014-15. In 2014-15, the area under wheat was 0.24 lakh hectares but in 2015-16, it became 0.21 lakh hectares. Thus, 0.3 lakh hectares cultivated area of wheat was reduced in 2015-16 from the previous year 2014-15. Similarly, the area covered by pulses also declined from 1.48 lakh hectares in 2014-15 to 1.42 lakh hectares in 2015-16 and consequently 0.6 lakh hectares cultivated area of pulse was reduced in 2015-16 compare to 2014-15. . In 2015-16, food grains covered 95.79 percent of net cropped area and 66.08 percent of the gross cropped area of Assam. But at the same time non-food crops covers only 4.21 percent of the net cropped area and 33.92 percent of the gross cropped area in the state. The area covered by food grains and non-food crops in the year 2015-16 is shown in the following figure-1

Figure-1
Area covered by food grains and non-food crops in the year 2015-16



But the cultivated area of Oilseeds has increased from 3.07lakh hectares in 2014-15 to 3.11 lakh hectares in 2015-16. Paddy is the prominent food crops in Assam. The state produces Autumn, Winter and Summer paddy. Winter paddy is regarded the major paddy of the state as its production is highest in comparison to Autumn and Summer paddy. During the period of 2006-07 to 2017-18,the production of winter paddy increased from 1950 thousand tonnes to 3883 thousand tonnes but exception is found only in 2011-12,where its production slightly reduced (351 thousand tonnes) from the previous year 2010-11.However, during the last 12 years additional winter paddy production increased to 1993 thousand tonnes in Assam. Summer paddy is another important paddy in Assam and it occupied second position in the production of all paddies of the state. The production of summer paddy is continuously increased from 630 thousand tonnes in 2006-07 to 1224 thousand tonnes in 2014-15 but in 2016-17, its production slightly came down and reached to 1131 thousand tonnes but in 2017-18, production slightly increased and reached 1191 thousand tonnes. During the period of 2006-07 to 2017-18, net summer paddy production in the state increased to 561 thousand tonnes. The trend of paddy production during the last 12 years and percentage of each paddy in the total paddy production in Assam is displayed in the table-1.

Table-1

Trend of paddy production in Assam during the period of 2006-07 to 2017-18

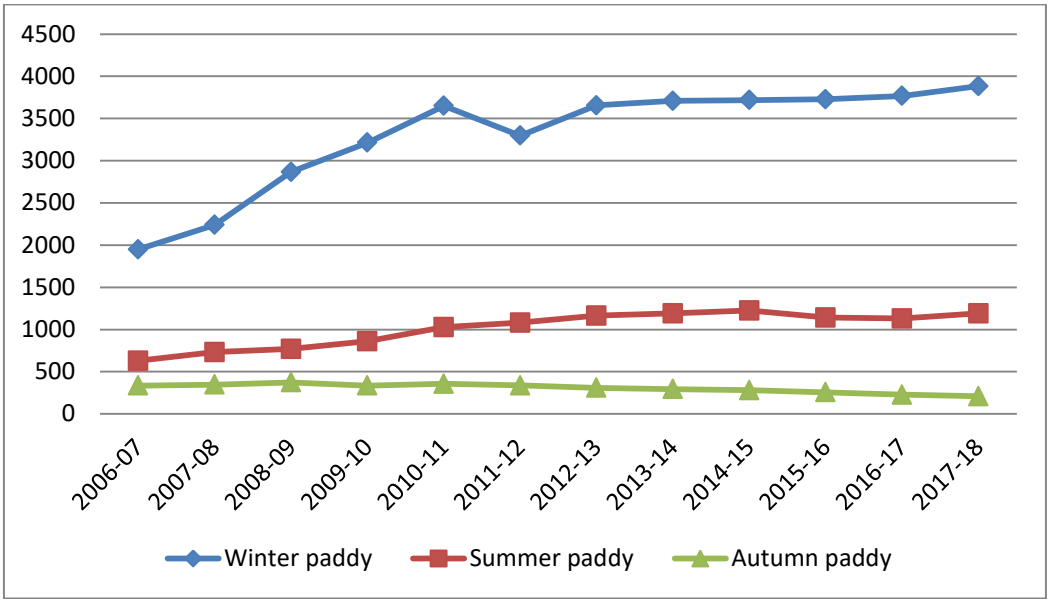
Year	Paddy Production (in '000 tonnes)			Total Production	Percentage with respect to total Paddy production		
	Winter	Summer	Autumn		Winter	Summer	Autumn
2006-07	1950	630	336	2916	66.87	21.60	11.52
2007-08	2239	732	348	3319	67.46	22.05	10.49
2008-09	2866	769	374	4009	71.49	19.18	9.33
2009-10	3214	860	335	4409	72.93	19.55	7.60
2010-11	3649	1028	356	5033	72.50	20.43	7.07
2011-12	3298	1080	338	4716	69.93	22.90	7.17
2012-13	3655	1164	309	5128	71.28	22.71	6.04
2013-14	3709	1190	294	5193	71.42	22.92	5.66
2014-15	3718	1224	281	5223	71.19	23.43	5.38
2015-16	3727	1141	257	5125	72.72	22.26	5.01
2016-17	3767	1131	228	5126	73.89	22.06	4.46
2017-18(p)	3883	1191	209	5283	73.51	22.54	3.96

Source: Statistical Hand Book of Assam, 2009 to 2018

Autumn paddy occupied last position in the production among all categories of paddy produced in the state in period of 2006-07 to 2017-18.In recent years the production of autumn is continuously going down due to change of choice of the farmers in the state. In 2006-07, the production of autumn paddy was 336 thousand tonnes and in 2008-09, it

reached to 374. Consequently, 26 thousand tonnes additional production of autumn was found in 2008-09 in comparison to 2006-07.But after 2008-09, the production of autumn was continuously decreased in the state and in 2017-18, it reached to 209 thousand tonnes. However, total production of paddy in the state is not stable during 2006-07 to 2017-18. During the period of 2006-07 to 2010-11, total production of paddy increased from 2916 thousand tonnes to 5033 thousand tonnes but in 2011-12, production decreased to 4716 thousand tonnes. Total paddy production in 2011-12 became low due to low production of winter paddy in the state. In 2011-12, 351 thousand tonnes less paddy produced in the state comparison to 2010-11. Again in 2012-13, paddy production increased to 5128 thousand tonnes and up to the 2014-15, it reached to 5223 thousand tonnes but in 2015-16, it decreased to 5125 and again production started to increase and reached 5283 thousand tonnes in 2017-18.Thus, the state produced additional 2367 thousand tonnes of paddy in 2017-18 in comparison to 2006-07.The share of winter paddy in the total paddy production of the state is gradually improving from 66.87 percent in 2006-07 to 73.51 percent in 2017-18(Table-1).The share of winter paddy in the total paddy production in Assam lies between 66.87 percent to 73.51 percent during 2006-07 to 2017-18 and witnessed that winter paddy is major paddy in the state. The second major paddy after winter paddy in the state is summer paddy. A little improvement is seen (Table-1) in the share of summer paddy in the total paddy production in the state during the period of 2006-07 to 2017-18. In 2006-07, the share of summer paddy in the total paddy production in the state was 21.60 percent but in 2017-18 it became 22.54 percent. Thus, the share of summer paddy in the total paddy production lies between 19.18 (2008-09) percent to 23.43 (2014-15) percent during the same period in the state. But the share of autumn paddy in total paddy production in Assam is continuously decreased from 11.12 percent in 2006-07 to 3.96 percent in 2017-18, except in 2011-12 where slight improvement was found, reference to the table-1.

Figure-2:
Production trend of different types of paddy in Assam during 2006-07 to 2017-18



Besides, paddy the state produces food crops like Maize, Wheat, Gram, Tur, Pulses, other cereals and Millets. Rape & Mustard, Oil seeds, Cotton, Jute, Mesta, different types of fruits and vegetables are also produced in the state. Some of the important food crops and non-food crops produced in Assam during the period 2006-07 to 2015-16 are revealed in the following table-2.Cereals as shown in the above table-2, composed of Maize, wheat, other cereals and Millets. In 2006-07, cereals were produced to 85 thousand tonnes and in the next year it increased to 88 thousand tonnes. But after 2007-08, cereal production started to reduce and in 2012-13, it reached to 67 thousand tonnes in Assam. Decreased in the production of cereals during 2008-09 to 2012-13, mainly due decreased in the production of wheat. But in 2013-14, the production of cereals jumped and reached 120 thousand tonnes from the previous year's mainly because of rapid increased in the production of Maize, although the production of Wheat was reduced from the previous year by 4 thousand tonnes in the state. As, in 2014-15, the composite production of cereals increased to 125 thousand tonnes from 120 thousand tonnes in 2013-14 but the amount of production decreased to 115 thousand tonnes in 2015-16. Again from 2016-17 to 2017-18, the production of cereal increased 118 thousand tonnes to 126 thousand tonnes in the state. Thus, some variations were observed in the production, Maize, Wheat, Other cereals and small millets during the period of 2006-07 to 2017-18 in Assam. Production of pulses in the state continuously increased from 59 thousand tonnes in 2006-07 to 111 thousand tonnes in 2014-15 but in 2015-16, it decreased to 109 thousand tonnes. In 2016-17, the production of Pulses again decreased to 108 thousand tonnes and in 2017-18, production increased and reached to 117 thousand tonnes. Pulses as shown the table-2, comprises with Gram, Tur and Rabi pulses. Rabi pulses are regarded as the major pulses in the state as its production is highest in comparison to all other pulses produced in the state. In 2006-07, Rabi pulses produced 89.83 percent of total pulses produced in Assam and in 2010-11, it was 92 percent and again in 2017-18, the share stood 94.87 percent. Jute production in the state is not consistent as revealed in the table-2, during the period of 2006-07 to 2017-18.

Table-2

Important crops produced in Assam during the period of 2006-07 to 2017-18 ('000 tonnes)

Year	Cereals (Excluding paddy)	Pulses	Jute (c)	Oil seeds (Excluding coconut)	Sugarcane	Fruits and Vegetables
2006-07	85	59	559	129	1055	1547
2007-08	88	61	657	135	980	1551
2008-09	71	62	647	157	1100	1673
2009-10	82	66	713	143	1149	1745
2010-11	73	72	626	155	1169	1877
2011-12	68	73	608	152	1144	2031
2012-13	67	84	558	187	1120	2126
2013-14	120	104	717	186	1075	2271
2014-15	125	111	767	206	1099	2377
2015-16	115	109	866	215	1038	2356
2016-17	118	108	803	204	1207	2389
2017-18(P)	126	117	841	203	1144	2420

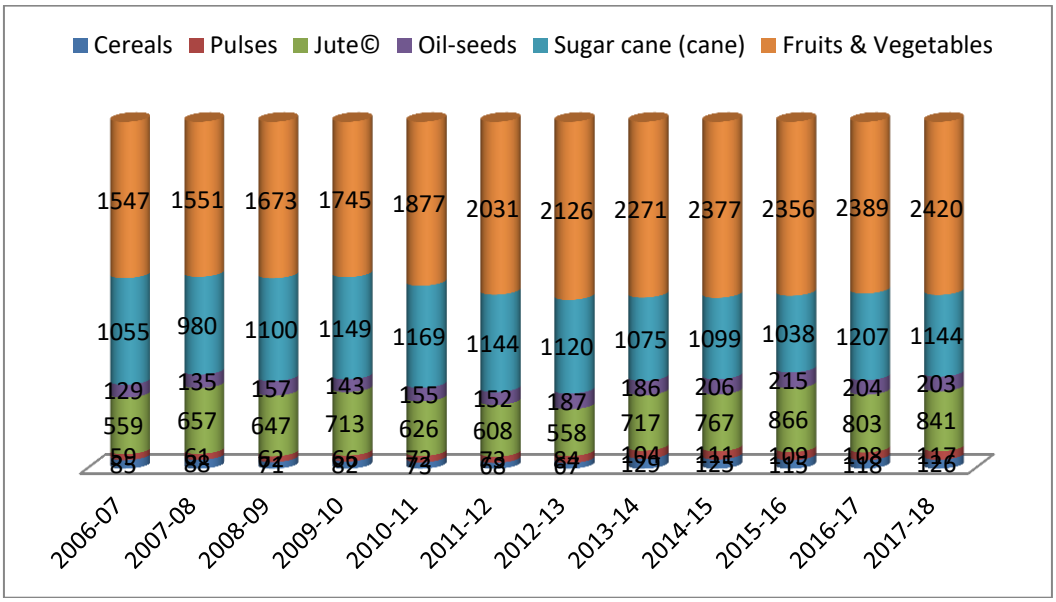
Source: Statistical Hand Book of Assam, 2009 to 2018

N.B. –(c) '000 bales of each 180 kgs

Lots of ups and downs are found in the production of jute in the state during the period of 2006-07 to 2017-18.However during 2006-07 to 2017-18, highest production is found in 2015-16 (866 thousand bales) and lowest production is found in 2012-13 (558 thousand bales) in the state (Table-2). Oil seeds production in the state is also not stable, which includes Sesamum, Rape & Mustard, Linseed, Castor, Nizer and Coconut as reflected in the table-2.In 2006-07, the production of oilseeds was 129 thousand tonnes and in 2007-08, it reached 135 thousand tonnes and again in 2008-09, it increased to 157 thousand tonnes but in 2009-10, it decreased to 143 thousand tonnes in the state. In 2012-13, the oilseeds production increased to 187 thousand tonnes but in 2013-14, it decreased to 186 thousand tonnes and again in 2015-16, it increased to 215 thousand tonnes and thus, variations were found in the production of oil seeds in the state. Rape & Mustard occupied major position in production of oilseeds in the state. In 2006-07, the share of Rape & and Mustard in the total oilseeds production in the state was 89.92 percent and in 2010-11, the share was 92.26 percent and again in 2017-18, the share stood 92.11 percent. The production of sugarcane in the state was not stable during 2006-07 to 2017-18 (Table-2). In recent years, the production of sugarcane in the state has reduced. In 2006-07, the production of sugarcane was 1053 thousand tonnes but in 2007-08, it decreased to 980 thousand tonnes but after that it continuously increased up to the year 2011-12 and reached 1143 thousand tonnes. Again from 2012-13, sugarcane production started to reduced and reached 1038 thousand tonnes in 2015-16 only with a little improvement in 2014-15 in the state. Improvement in the

production of Fruits and vegetables in Assam was found from 1547 thousand tonnes in 2006-07 to 2377 thousand tonnes in 2014-15 but in 2015-16, its production slightly decreased and reached to 2356 thousand tonnes, as shown in the table-2.Reference to the table-2, following figure-2 is drown, where production ('000 tonnes) of some important crops in during 2006-07 to 2017-18 are shown.

Figure-2: Important crops produced in Assam during the period of 2006-07 to 2017-18



Cropping intensity is one of the most important indicators of agricultural development of any agricultural region. Cropping intensity index is a ratio of gross cropped area to the net cropped area. It measures the extent of land utilization by taking in to account the area planted more than once (twice or thrice depending on climatic situation). The change in cropping intensity reflects the sensitivity of agricultural activities to Socio-economic, agro-biological condition and climatic aberration from time to time such as drought, floods etc. The level of cropping intensity is determined by several factors such as provision of irrigation, availability of labour, pressure of population on land, use of fertilizer, use of mechanical implements, adoption of HYV seeds, credit facility, educational level, tradition and attitude of the cultivators, and so on. However, the cropping intensity in the Assam is not satisfactory as compared to the states like Punjab, Haryana, and west Bengal. The traditional habit of keeping the paddy fields fallow till the next winter paddy crops still persists. Inadequate availability of the required factors for cropping intensity is mainly responsible of this unfortunate event. The factors like the provision of irrigation facilities, use of chemical fertiliser and pesticides, illiterate farmers, unsuitable price of crops, etc. are mainly responsible for unsatisfactory cropping intensity in the state. The following table-3 depicts the scenario of cropping intensity in Assam during the period of 2006-07 to 2016-17.

Table: 3
Scenario of cropping intensity in Assam from 2006-07 to 2016-17

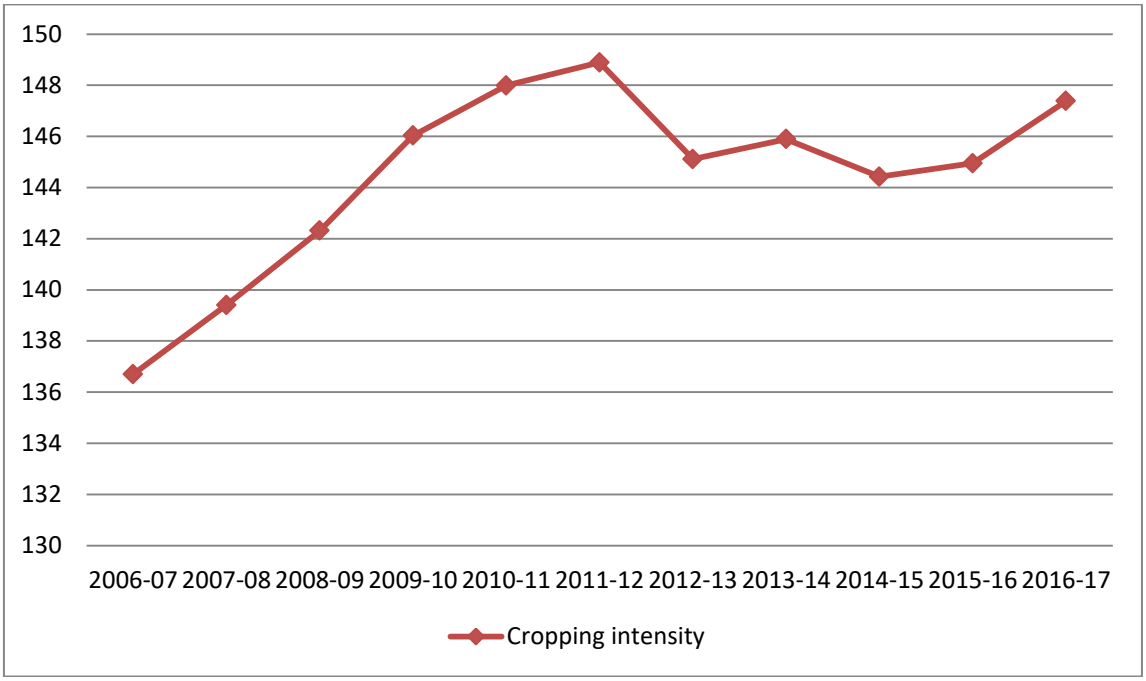
year	Gross cropped area	Net cropped area	Cropping intensity

	(‘000 ha.)	(‘000 ha.)	
2006-07	3840	2809	136.7
2007-08	3917	2810	139.4
2008-09	3999	2810	142.31
2009-10	4105	2811	146.03
2010-11	4160	2811	147.99
2011-12	4174	2811	148.89
2012-13	4076	2809	145.11
2013-14	4100	2811	145.89
2014-15	4083	2827	144.42
2015-16	4060	2801	144.95
2016-17	4087	2773	147.38

Source: Economic Survey of Assam, 2007-08 to 2015-16, Statistical Hand Book of Assam, 2018

In 2006-07, the cropping intensity was 136.7 percent but after that it was continuously increased up to 2011-12 where it was reached 148.89 percent, as revealed in table-3.Thus, during the six years (2006-07 to 2011-12) cropping intensity of Assam was increased 12.19 percent. But in 2012-13, cropping intensity in the state decreased to 145,11 percent and in 2014-15, it further decreased and reached 144.42 percent again in 2015-16,with negligible improvement(.53 percent) from the previous year, it becomes 144.95 percent. In 2016-17, cropping intensity of the state reached 147.38 percent with the additional increment of 2.43 percent compared to 2015-16.The trend of cropping intensity in Assam is reflected in figure-3

Figure: 3:
Trend of cropping intensity in Assam during the period of 2006-07 to 2016-17



6. Result and discussion:

The hypothesis as assumed for the purpose of the present study is tested using 't' statistic at 5% level of significant. Accordingly, 't' value is calculated and compared it tabulated value at 5% level of significance. Thus, 't' value at 5% level of significance is found 30.19 which considered as significant. So, it rejects the null hypothesis that agricultural production is independent of cropping intensity and accepts the alternative hypothesis that agricultural production is not independent of cropping intensity. It indicates that agricultural production varies with the variation of cropping intensity. Besides, r^2= 0.59, demonestrated that 59 percent variation in the agricultural production is explained by the cropping intensity.

7. Conclusion and Suggestions:

Development of agricultural sector is essential in order to develop the economy of Assam. Adequate infrastructure is out most important for the development of agricultural sector in the state. According to 2011 census 85.30 percent famers are small and marginal farmers and only 29 percent of the net cropped area possessed assured irrigation facility in Assam. Cropping intensity can play defiantly important role to enhance the agricultural status as't' value is found significant between agricultural production and cropping intensity in the study. But in order to raise cropping intensity, the provision of available irrigation facility in all agricultural field, easy and available supply of fertiliser at concessional rate for small and marginal farmers, suitable price of agricultural produce, training facility for every farmer in the modern method of cultivation, easy and available short term loan at minimum interest rate for the small and marginal farmer, encouragement of for cultivation of HYV seeds, easy selling point of agricultural produce are the most important. At least, sufficient arrangement of these provisions would increase the cropping intensity and make agricultural sector healthily in Assam.

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