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# Present Status of Jute Production and Technological and Social Interventions Needed for Making Jute Agriculture Sustainable and Remunerative in West Bengal

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## Abstract

For the last few years it was a serious concern and subject of debate/ discussion that jute area and production is declining due to several obvious reasons including non-remunerative productivity & price and farmers' inclination towards more remunerative other crops. As West Bengal shares the maximum area and production of India's jute scenario, the present analysis of the concerned matters is restricted to West Bengal. The very purpose of this paper is to relook the actual present status of jute production in West Bengal, to find out and listing of the region specific physical and social constraints restricting to attain higher productivity with better fibre quality, to reclassify jute productivity clusters of West Bengal based on geographical proximity and similarity in jute production features and to suggest technological and social interventions for achieving the goal of higher fibre production with better quality for making jute agriculture sustainable and remunerative.

**Key words:** Jute, *Corchorus olitorius*, Production Status, West Bengal, Technological and social intervention

## Introduction

Jute is not only an important commercial crop of West Bengal but also assimilated into the social life of rural Bengal. It is well known that about 33-35 lakh small and marginal farm families are involved in jute cultivation of about 6 lakh ha in West Bengal producing about 80-85 lakh bales of jute fibre. Jute production has physical, economic and social influence on West Bengal. In physical consideration, West Bengal occupies about 75.5% jute area of India with the highest productivity of 28 q ha<sup>-1</sup>. It may be noted that jute is sown in such a condition in pre-kharif season when no other better remunerative crop can be raised, it meets major raw material need of 70± jute mills operational in West Bengal (Anonymous, 2016b), meets the need of fibre/ ropes for binding purpose especially for rural Bengal. Although now a days, sesame (1.81 lakh ha) and maize (0.85 lakh ha) is also gaining importance in pre-kharif season in West Bengal. In economic factor, jute is the important commercial crop for Bangladesh adjoining districts of West Bengal as this crop provides hard cash to the farm families. Jute steadily gaining importance in the international market due to its bio-degradability and many other virtues. To be competitive with Bangladesh in the export oriented jute market, West Bengal surely need much more attention on this crop. It may be noted that positive residual effect of jute on yield and energy output of subsequently grown crops were observed as well as maintained or improvement of soil properties such as soil organic matter, available P etc. (Biswas et al. 2006). Jute cultivation has several social links with the rural milieu of West Bengal. In this state, jute is mainly cultivated by the small and marginal farmers and they deploy family labours which otherwise remain virtually idle (Chapke, 2013). The marketing season of raw jute fibre (September-October) coincides with the main festivals of both Hindus (Durgapuja) and Muslims (Id-u'l-Zuha) when both the Bengali communities need money for their festival, essential and entertainment needs (Chapke, 2012). Young jute leaf and tender twigs are a common leafy vegetable for Bengalis particularly during April-May as jute leaves are rich source of nutrients like protein (3.79%), iron (67.9 mg kg<sup>-1</sup>),  $\beta$ -carotene (51 mg kg<sup>-1</sup>) and potassium (4.4 g kg<sup>-1</sup>) (Choudhary et al. 2013). By-product of jute, the sticks are indispensable in rural household due to its use as side-walls of human house and for animal shed, fencing, support in vegetable fields, use in beetle vines, fuel wood (as such and as inner core with dry cow dung covering), for different religious use and

many more. Survey report revealed that besides the jute fibre, 77% farmers believe that jute sticks are the main fuel for their cooking and 70% farmers grow the crop as it keeps the field clean for the next crop in rotation (Chapke, 2013). Moreover, it is interesting to note that farmers who cultivate jute (and other crops) possessed high self-efficacy level which improve farmer's judgement of his capability to organize and execute course of action required to attain better agricultural performance (Dutta Roy, 2009).

### Area and Production of Jute in India and West Bengal

For the last decade the jute area in India remained between 7.5 to 8.0 lakh ha except in 2009-10 when it reaches to the lowest value of 6.93 lakh ha. Similarly the total jute production in the country also varied between 96.34 and 115.38 lakh bales. In case of West Bengal the jute area varied between 5.19 and 6.52 lakh ha with a mean area of 5.85 lakh ha during the last 16 years (2000-01 to 2015-16). The total jute production of the state was the lowest in 2001-02 (60.4 lakh bales) to a highest of 93.24 lakh bales in 2009-10 with an average production of 80.9 lakh bales during the concerned period (Fig. 1).

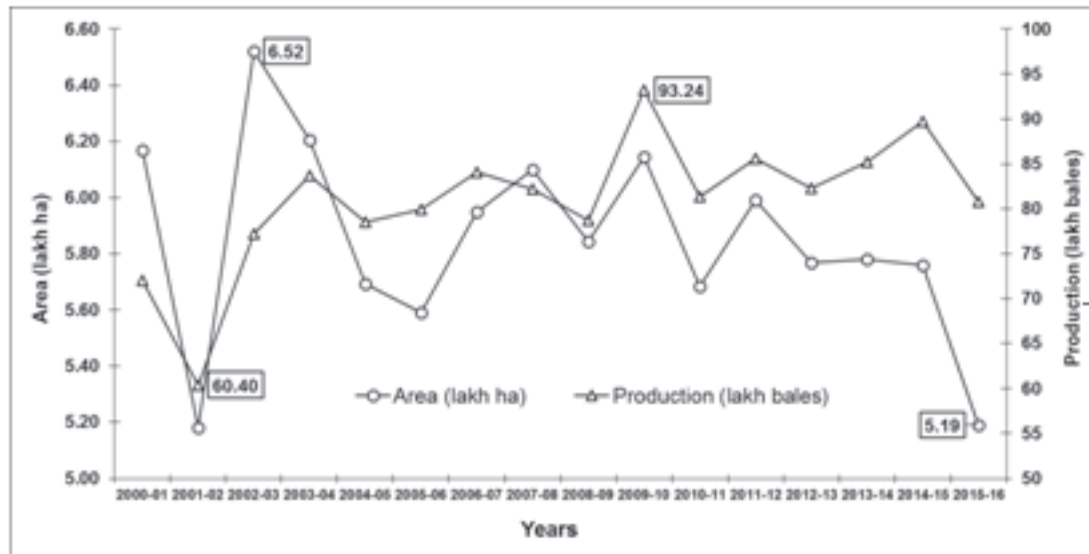


Fig. 1: Area and production of jute in West Bengal over years

(Source: <http://aps.dac.gov.in/LUS/Public/Reports.aspx>; accessed on 05.5.2016; and <http://www.jutecomm.gov.in>; accessed on 05.5.2016)

### Trend in Area and Productivity of Jute in West Bengal

Changes in area, production and productivity of jute over a considerable period are more important than the mean values. Percent change in jute area over 16 years (2000-01 to 2015-16) period is depicted in Fig. 2

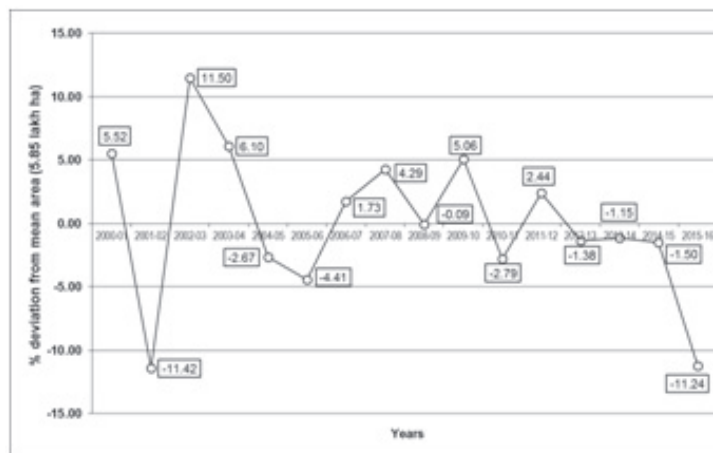
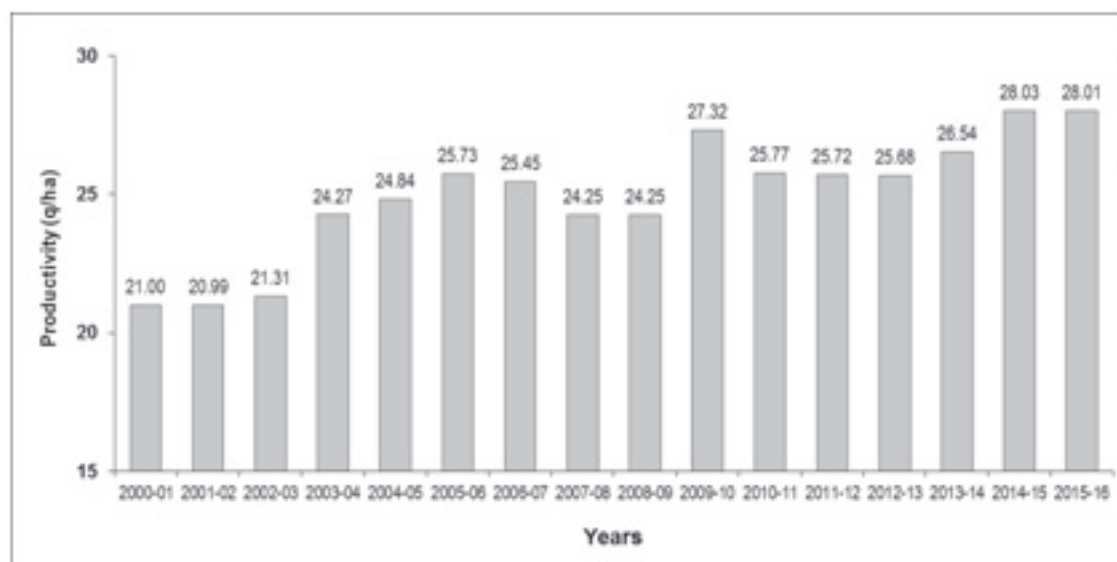


Fig. 2: Percent change of jute area as compared to the mean value in West Bengal

The highest percent positive change of jute area in West Bengal over the mean value (5.85 lakh ha) was recorded in 2002-03 (+11.50%) and the highest negative change of the same was noted in 2001-02 (-11.42%) for the last 16 years. Last year (2015-16) there was also sudden sharp fall in jute area (-11.24%) and the production deficit was about 9.97% as compared to the preceding year (89.69 lakh bales). Overall, the fluctuation in jute area of West Bengal varied between +11.5 and -11.5%. It is also interesting to note that there is a near regular rhythm of sine wave (with curve smoothening) like increase and decrease in jute area over time (Fig. 2).



**Fig. 3:** Trend of jute productivity (q ha<sup>-1</sup>) over years in West Bengal

(Source: <http://aps.dac.gov.in/LUS/Public/Reports.aspx>; accessed on 05.5.2016; and <http://www.jutecomm.gov.in>; accessed on 05.5.2016)

The present jute productivity of West Bengal is about 28 q/ha that is an increase by more than 33% as compared to 2000-01 productivity (21 q/ha) which might be attributed to technology generation, dissemination and farmers' awareness (Fig. 3).

### Jute Area Versus Other Competitive Crops Area

In recent years in term of area, jute is facing competition from pre-kharif crops like summer maize and sesame. In north Bengal districts, maize crop gaining area rapidly (Table 1).

**Table 1.** Comparative change of area of maize, sesame and jute in West Bengal

Districts	Maize area (ha)			Sesame area (ha)			Jute area (ha)		
	2007-08	2011-12	Change	2007-08	2011-12	Change	2007-08	2011-12	Change
Jalpaiguri	11735	13498	+1763	1198	1575	+377	41685	35685	-5481
Uttar Dinajpur	12203	29838	+17635	949	993	+44	50565	45019	-5637
Malda	11132	13597	+2465	63	298	+235	22480	21514	-966
Murshidabad	4188	3725	-463	13242	15726	+2484	153244	157571	+4327
Nadia	2889	2576	-314	19700	23906	+4206	127471	126755	-719
Hooghly	257	250	-7	26905	25488	-1417	28657	26897	-1760

(Source: <http://aps.dac.gov.in/LUS/Public/Reports.aspx>; accessed on 05.5.2016)

In Uttar Dinajpur, the maize area is 29,838 ha which is about 17,635 ha more as compared to 2007-08 maize area in the district. In Malda and Jalpaiguri districts the maize area are 13,597 and 13,498 ha respectively, which is an increase of 2,465 and 1,763 ha as compared to 2007-08 for Malda and Jalpaiguri. In South Bengal districts, maize area is not increased, rather decreased marginally, whereas, sesame area increased considerably. The sesame area is the maximum in Hooghly (25,488 ha) followed by Nadia (23,906 ha) and Murshidabad (15,726 ha). Within 4-5 years, the sesame area increased by 4206 ha in Nadia and 2484 ha in Murshidabad. There was reduction in jute area in the described 5 districts (except Murshidabad). The highest area reduction

of jute was recorded in Uttar Dinajpur (5,637 ha), followed by Jalpaiguri (5,481 ha) where farmers' preference for maize might be one of the important reasons for decrease of jute area. In South Bengal condition, although the sesame area increased considerably in Nadia and Murshidabad, but the change in jute area in those districts are not very prominent. The decrease in jute area in Hooghly (-1760 ha) might be the direct effect of increase in sesame area (+1417 ha). Favourable weather condition and more remunerative price of maize interested the North Bengal farmers to grow maize. Whereas, for South Bengal, the unusual occurrence of longer dry spell in pre-kharif season and sesame's ability to produce economic yield with less care and inputs as compared to jute are the main reasons for increase of sesame area resulting decline in jute area.

### Classification of Productivity Cluster for Jute in West Bengal

In the existing common classification, 3 production regions namely South Bengal, Semi northern and North Bengal are prevailing. In the South Bengal production regions, districts like North 24 Parganas, Hooghly, Nadia and Murshidabad are included, in the Semi northern region, Malda, Dakshin Dinajpur and Uttar Dinajpur are considered and Coochbehar and Jalpaiguri come under the North Bengal region. Earlier, based on crop yield index, three productivity region (high, medium and low) under cash crops (including jute) was suggested, where North 24 Parganas and Hooghly were kept under high region, Uttar Dinajpur, Dakshin Dinajpur, Malda, Murshidabad and Nadia were in medium region and Jalpaiguri & Coochbehar were considered under low productivity region (Aktar, 2015). The existing system of jute production regions has some loopholes which may be reconstituted with more rationality. In the existing system, the South Bengal region has wide geographical area, large variations in agro-ecological and climatological parameters. Burdwan in general and eastern blocks of Burdwan in particular, contribute to state's jute production not because of area but through higher productivity. In the existing system Burdwan district has not been considered. Other minor jute growing districts namely Paschim Medinipur, Howrah, Darjeeling, South 24 Parganas and Purba Medinipur where jute is produced in scattered areas are not find a place in the existing production region. Recently on 24th June, 2014 Alipurduar emerged as the 20th district of West Bengal carved out from the eastern part of Jalpaiguri district (<http://www.alipurduar.org>). In general, it may be noted that the existing production region classification has not fully considered agro-climatic and other physical constraints restricting to realize better productivity of jute. So, a new modified classification of jute production clusters of West Bengal is suggested.

### Revised / New Classification of Jute Production Cluster

Based on jute productivity level and geographical situation, the intensively jute growing districts of West Bengal can be classified into four Productivity Clusters (Fig. 4). The Clusters are (i) Northern Cluster, (ii) Semi-Northern Cluster, (iii) Semi-Southern Cluster and (iv) Southern cluster. The Northern Cluster consists of Jalpaiguri, Alipurduar and Coochbehar districts, the Semi-Northern Cluster consists of Uttar Dinajpur, Dakshin Dinajpur and Malda districts, the Semi-Southern Cluster comprises Murshidabad, Nadia and Burdwan, and the Southern Cluster contains North 24 Parganas and Hooghly districts. The remaining jute growing districts namely Paschim Medinipur, Howrah, Darjeeling, South 24 Parganas and Purba Midnapore have insignificant jute area (2.49%) and meagre production (2.54%) as compared to West Bengal, and these areas of 5 districts have only 10% jute area & production that of Murshidabad, hence termed as Scanty Cluster.

### Cluster-wise Area, Production and Productivity of Jute

#### *Northern Cluster*

The jute area in this cluster is about 115.84 thousand hectares which is 19.8% of total jute area of West Bengal. The total jute production of this cluster is 233.35 thousand tonnes with a productivity of only 20.14 q/ha. Jute is the second most important crop after paddy in Jalpaiguri. In Jalpaiguri district (including Alipurduar) the total jute area is 40.06 thousand ha with a total production of about 85.12 thousand tonnes and the productivity is 20.97 q/ha. As per crop concentration index, Maynaguri, Jalpaiguri and Dhupguri blocks are the main jute growing areas of the district. Although Rajganj, Alipurduar-I and Madarihata-Birpara blocks (now in Alipurduar district) have moderate jute concentration (Basu Roy and Barman, 2014). In Coochbehar district the total jute area is 75.78 thousand ha with total production of 148.23 thousand tonnes and the average yield is about 19.50 q/ha. During 1992-93, the jute area was 18.59% of net cropped area of Coochbehar & Jalpaiguri, which increased to 20.78% during 2002-03 and yield was also increased by 18.6% (Rudra and Kole, 2013). Mesta is another bast fibre crop (raw jute) grown in about 560 ha in the Jalpaiguri district with a total production of 824 t and the average yield is 15.26 q/ha (Anonymous, 2005b, 2005g).



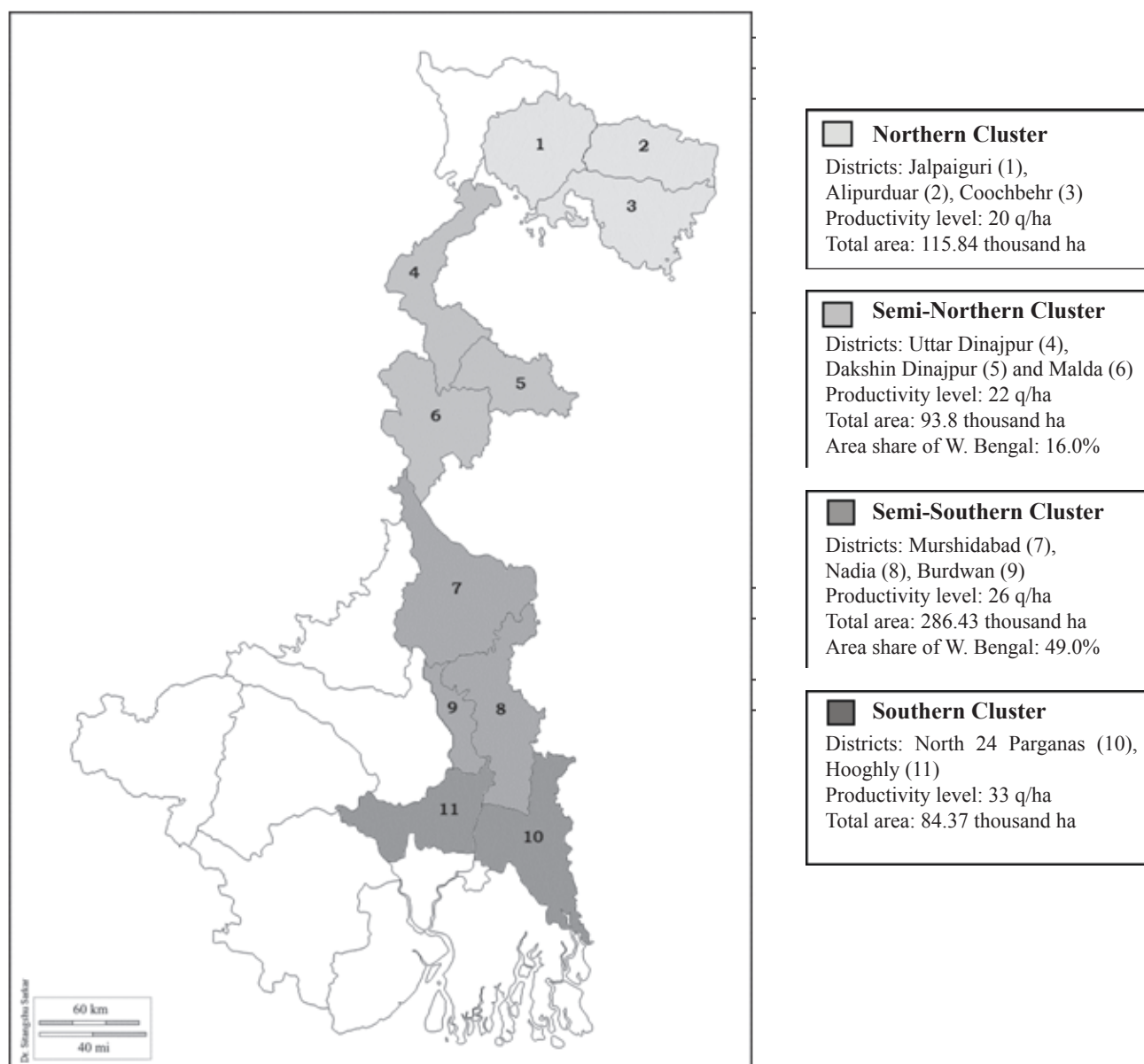


Fig. 4: Jute Productivity Cluster classification map of West Bengal

#### *Semi-Northern Cluster*

This cluster comprises of Uttar Dinajpur, Dakshin Dinajpur and Malda districts. The jute area is 93.8 thousand hectares, which is about 16% of total jute area of West Bengal. The total jute production is 206.9 thousand tonne with a low-medium productivity of 22.05 q/ha. In Uttar Dinajpur district the total jute area is 52.66 thousand ha with a total production of about 110.27 thousand tonnes and the productivity is 20.40 q/ha. In DakshinDinajpur district the total jute area is 18.48 thousand ha with total production of 39.14 thousand tonnes and the average yield is about 21.45 q/ha. In Dakshin Dinajpur the main jute producing blocks are Balurghat (3250 ha), Kushmandi (3220 ha), Tapan (2850 ha), Kumarganj (2810 ha) and Banshihari (2260 ha). Out of the intensively jute growing blocks the highest productivity is obtained inKumarganj (24.30 q/ha) and Tapan (23.58 q/ha), whereas, the jute productivity of Kushmandi is the lowest (17.46 q/ha). Malda is another important jute growing district of this cluster. The total jute area is 22.7 thousand ha. Total jute production of the district is 57.48 thousand tonne with a productivity of 24.77 q/ha. The important intensively jute producing blocks of Malda districts are Chanchal-I (4660 ha), Harishchandrapur-I (4280 ha), Ratua-I (3450 ha), Manikchak (2960 ha), Chanchal-II (2950 ha). In Malda district, the highest

jute productivity is in Gazole block (29.88 q/ha), although the jute area is limited there (1070 ha). Mesta (kenaf) is another important bast fibre crop (raw jute) of Dakshin Dinajpur and is grown in 1.70 thousand ha which is the highest mesta area (26.7%) of West Bengal and area under mesta is gradually expanding in the district as chances of crop failure for mesta is less than jute (Dutta, 2012). The total mesta production in the districts is 3870 tonne with a yield of 22.44 q/ha. Surprisingly, the mesta productivity in Dakshin Dinajpur (22.44 q/ha) is better than jute productivity (21.45 q/ha). Malda district has about 970 ha of mesta area with a production of 1584 tonne and the yield is quite low (16.32 q/ha) (Anonymous, 2005c, 2005h, 2005n).

#### *Semi-Southern Cluster*

Murshidabad, Nadia and Burdwan are the component districts of this cluster. Jute area in this cluster is the highest (286.43 thousand ha) and occupy about 49% of total jute area of West Bengal. The total production of semi-southern cluster is 738.9 thousand tonne with a high-medium productivity of 26 q/ha. Murshidabad basically has rice and jute based cropping system such as jute-rice-wheat and jute rice-vegetables and the soil types are clay loam to sandy loam (Naskar et al. 2011). Murshidabad ranks first for the highest jute area (147.97 thousand ha) in the state. The total jute production is about 365.08 thousand tonnes with a yield of 25.11 q/ha. The main jute growing blocks of the districts are Nowda, Beldanga-I & II, Raninagar I & II, Domkal, Jalangi, Hariharpara and Bhagawangola I & II. Earlier Nowda was growing only jute & paddy, but with the development of agricultural technology and farmers' awareness, the farmers of Nowda are following 4 crop combinations (paddy, jute, wheat, mustard); whereas, Raninagar-II block was growing only paddy, which was shifted more towards jute (Chakraborty, 2012). In Nadia district the total jute area is 125.34 thousand tonnes with a total production of 332.82 thousand tonnes and the yield is 26.34 q/ha. In Nadia the intensively jute growing blocks are Karimpur-II (16,110 ha), Tehatta-I (13,740 ha), Chapra (12,780 ha), Tehatta-II (12620 ha), Nakashipara (10,830 ha) etc. In Nadia, block wise, the highest jute productivity is at Santipur (31.86 q/ha), although the jute area is less (4050 ha). The lowest jute productivity of the district is found at Tehatta-I (20.52 q/ha). Eastern blocks of Burdwan district also come under this cluster. In this cluster only 4 blocks of Burdwan (Kalna-I & II and Purbasthali I & II), which are on the western bank of river Bhagirathi and adjacent to Nadia district are included because only that area of the district grows jute intensively. The total jute area of Burdwan district is about 13.12 thousand ha with total production of 40.95 thousand tonnes and the yield is 30.70 q/ha. The block-wise jute area in Burdwan are Purbasthali-II (6390 ha), Purbasthali-I (1690 ha), Kalna-I (1510 ha), Katwa-II (1200 ha) and Kalna-II (970 ha) (Anonymous, 2005a, 2005i, 2005j).

#### *Southern Cluster*

The total jute area in this cluster is 84.37 thousand ha which is about 14.5% of total jute area of West Bengal. Total jute production from this cluster is 278.04 thousand tonnes with a productivity of about 33 q/ha. North 24 Parganas and Hooghly are the main jute producing districts in this cluster. The total jute area of North 24 Parganas is 54.5 thousand ha, total fibre production is 174.7 thousand tonnes with a productivity of about 32 q/ha. The important jute producing blocks of the district are Swarnnagar, Baduria, Deganga, Gaighata, Bagdah, Bongaon, Amdanga and Habra. Another component district i.e., Hooghly has a total jute area of about 29.9 thousand ha with a total production of 103.4 thousand tonnes and the productivity is 33.7 q/ha. Important jute producing blocks of Hooghly are Khanakul-I (5410 ha), Balagarh (3740 ha), Polba-Dadpur (3380 ha), Pursurah (3040 ha), Arambagh (3010 ha), Tarakeswar (2990 ha), Singur (2840 ha) etc. As compared to the average productivity (33.7 q/ha) of the district, jute productivity in Singur and Balagarh blocks are comparatively lower (27.54 q/ha) (Anonymous, 2005e, 2005k).

#### *Other Districts or Scanty Cluster*

Over a period of 10 years mean data showed that jute is grown in scattered areas of Paschim Medinipur (4921 ha), Howrah (4275 ha), Darjeeling (2850 ha), South 24 Parganas (1724 ha) and Purba Medinipur (1037 ha) districts.

The total jute fibre production in Paschim Medinipur is 12,707 t with a mean productivity of 23.25 q/ha. The main jute growing blocks of Paschim Medinipur are Ghatal (1420 ha), Pingla (1390 ha), Sabong (1110 ha) and Daspur-I (1070 ha). The jute area in Daspur-II, Keshpur and Chandrakona-II are less than 500 ha. In the district, the highest jute productivity is at Daspur-I (31.68 q/ha) (Anonymous, 2005l). The yearly average jute production of Howrah is 13,754 t and the mean productivity is 31.7 q/ha. The jute growing blocks of Howrah are Jagatballavpur, Amta-II and Udaynarayanpur (Anonymous, 2005f). The yearly jute production of Darjeeling is about 5211 tonne with a productivity of 18.28 q/ha. The blocks adjacent to the districts of Jalpaiguri are the main jute producing areas of Darjeeling (Anonymous, 2005d). The total jute production of South 24 Parganas district is about 3633 tonne with a productivity of 23.72 q/ha. The two major jute producing blocks of South 24 Parganas are Bhargar-I (802 ha) and Bhargar-II (480 ha) (Anonymous, 2009). In fact, Bhargar blocks (I & II) are the northern part of the



district and adjacent to the jute producing areas of North 24 Parganas. In Purba Medinipur the average jute production is 3169 tonne and productivity is about 27.54 q/ha. Jute producing blocks of Purba Medinipur are Moyna (750 ha) and Panksura-I (200 ha) (Anonymous, 2005m). However, day by day jute area is decreasing rapidly in Purba Medinipur (671 ha in 2010-11 to 521 ha in 2011-12).

**Table 2.** Jute productivity and associated information of the jute producing districts of West Bengal

Cluster	Districts	Jute yield (q/ha)	Rural literacy (%)	Agril. Lab /ha	Fertilizer consumption (kg/ha/year)		Rainfall (mm)	
					Total	N fertilizer	Pre-Jute	During-Jute
Northern	Jalpaiguri	17.96	70.55	0.68	330.11	152.63	56.7	2105.8
	Coochbehar	18.27	73.87	1.13	186.34	84.59	43.3	1818.0
Semi-Northern	U. Dinajpur	22.79	57.15	1.34	355.21	179.79	27.4	1120.9
	D. Dinajpur	19.80	71.18	1.20	293.55	150.86	20.9	941.0
	Malda	22.14	60.42	1.89	454.62	249.10	21.8	739.1
Semi-Southern	Murshidabad	24.90	66.27	1.40	380.34	191.18	42.2	702.2
	Nadia	25.62	71.50	1.26	347.39	168.02	60.5	752.1
	Burdwan	33.88	73.39	1.56	363.57	151.61	52.7	675.1
Southern	North 24 Pgs	30.33	78.11	1.76	388.76	184.74	77.3	831.1
	Hooghly	34.14	79.22	2.08	726.91	256.58	65.1	740.9
Scanty	Howrah	30.70	80.82	1.75	717.48	383.42	63.0	669.0
	South 24 Pgs	23.72	76.78	1.61	172.12	87.88	57.0	807.0
	E. Medinipur	27.54	87.47	1.51	291.96	148.34	59.0	740.0
	W. Medinipur	23.25	70.40	1.32	138.34	76.24	59.0	740.0
	Darjeeling	18.28	66.00	-	227.27	112.58	57.0	1694.0

Source: Economic Review 2011-12, Govt. of West Bengal, Kolkata.

### Cluster-wise Physical Difficulties and Social Limitations

#### *Northern Cluster*

This is the cluster of lowest jute productivity (20 q/ha) in West Bengal, where productivity is about 39% lower in comparison to the highest productivity cluster (33 q/ha) of West Bengal. The reasons of lowest jute productivity in this cluster are mainly physical and social in nature. The soil texture of both the districts ranges from sandy to sandy loam (Rudra and Kole, 2013). The physical limitations like soil acidity, light textured soil, deficiency of micronutrients especially Zn and B, non-availability of quality certified seeds, often excess rainfall causing inundation of crop at mid to later phase of crop growth in the low-lying areas which restricts plant height etc. are the major causes for lower jute productivity. Soil acidity, coarse texture, poor water retention capacity are considered the major factors limiting the fibre yield of jute in Coochbehar and Jalpaiguri (Mitra and Samajdar, 2013). Heavy precipitation (3500 mm annually) and slow diagenetic changes of acidic parent materials cause the terai soil inherently acidic in character (Bandyopadhyay, 2003). Although it was reported (Saha et al. 2000) that the organic matter content of Coochbehar soil is quit high (7.19 g/kg). In addition to the physical reasons, several social factors are also responsible for lower jute productivity in this cluster. Jute crop, despite of its oddities with price, was more of agronomic compulsion which was evident in Terai and Old Alluvium tract (Chatterjee et al. 2013), hence affect the jute productivity in this cluster. Lack of knowledge of majority of farmers about modern jute production technology is the primary social reason for lower productivity. However, some farmers from adjacent areas to Uttar Banga Krishi Viswavidyalaya (UBKV), Coochbehar have access to information on modern jute production technology.

#### *Semi-Northern Cluster*

The physical reasons of lower productivity (22 q ha<sup>-1</sup>) in this cluster are soil acidity (Maji et al. 2012a), micronutrient deficiency (Maji et al. 2012b), deficiency of sulphur (Maji et al. 2013a), non-availability of certified seeds, scanty and lower rainfall. In social factors, the reasons go like - farmers are less informative especially in both the Dinajpurs, some farmers are more inclined

to other competitive crops like maize especially in Uttar Dinajpur and Malda (Table 1). In this cluster, several production constraints are observed. In Dakshin Dinajpur the soil is acidic in reaction. In Balurghat block the surface soil pH varies from 4.42 (Boaldar GP) to 5.37 (Danga GP) whereas, in Kumarganj block soil pH varies from 4.58 (Jakhirpur GP) to 5.66 (Bhomar GP). Lower soil pH was considered as one of the important limiting factor for lower jute fibre yield in this region (Maji et al. 2012a). In this region, particularly in Dakshin Dinajpur, deficiency of S has been recorded. Available sulphate sulphur in surface soil in Chakbhrigu GP of Balurghat was 16.1 kg/ha, whereas, in Deor GP of Kumarganj block the same value was 12 kg/ha. Sulphur deficiency was more pronounced in the sub-surface soil indicating the chances of high S fixation by Fe rich soils which are also light in texture facilitating greater leaching of sulphate down the horizon (Maji et al. 2013a). The available Zn content in some villages of Balurghat was as low as 0.35 mg/kg and the same for villages of Kumarganj block was 0.47 mg/kg. In Dakshin Dinajpur, the soils are also deficient in phosphate content, which might be attributed to low pH of soil (Maji et al. 2012b). Another important micronutrient, B was also deficient in Dakshin Dinajpur, as it ranged between 0.12 and 0.42 mg/kg (Maji et al. 2013b). Other important factor for lower productivity in Dakshin Dinajpur is that the farmers apply negligible quantity of plant protection chemicals as management practices of pest & diseases are neglected for jute and mesta crops (Dutta, 2012).

#### *Semi-Southern Cluster*

The jute productivity of this cluster (26 q/ha) is higher than the productivity of semi-northern cluster (22 q/ha) but 15% lower than southern-cluster yield (33 q ha<sup>-1</sup>). The jute producing areas of this cluster belongs to Gangetic alluvial zone and have better quality soil with good fertility. Among all the jute growing clusters of West Bengal, this cluster receives least rainfall throughout the jute season (Table 2) which might be a limiting factor for jute growth and lower quantum of rainfall during retting (269.4 mm in August) hampers fibre quality also. Regarding consumption of fertilizers, the main component districts of this cluster also lags behind as the values for Nadia (7th rank) and Murshidabad (4th rank) are only 347 and 380 kg/ha/yr, respectively (Anonymous, 2012). The rural literacy rate of the main component district of Murshidabad is only 66.27% which is far below the literacy rate of southern cluster (78.7%). Such lower rural literacy rate might have negatively influenced adoption of new technologies resulting comparatively lower productivity. The productivity level of Nadia is still low (25.6 q/ha), although the soil and climatic conditions are congenial for jute production there. Study revealed that majority of farmers are not aware of modern jute production technology and they are not very keen to modernize jute cultivation because they feel that they are continuing with jute cultivation because of lack of availability of better remunerative alternative crop for pre-kharif season, to get jute sticks as fuel, provision of use of family labour at the time of slack agricultural activity and possibility of earning liquid capital at the time of need (Mandal et al. 2012).

#### *Southern Cluster*

This is the highest productivity (33 q/ha) cluster of jute in West Bengal. In this cluster, higher productivity is obtained in Hooghly (33.7 q/ha). The reason for realizing higher jute productivity comprises of good quality fertile soil, use of highest amount of fertilizer for crops (726.9 kg/ha/yr), well distributed and adequate rainfall (Table 2). In Hooghly, jute is grown after potato which is highly fertilized and the fertilizer applied in a year is skewed towards potassium (202 kg/ha/yr), might be supporting higher productivity of jute through lesser disease incidence as reported earlier by Mondalet al., 2004. In case of North 24 Parganas also, the total fertilizer use is good (388.8 kg/ha/yr; 3<sup>rd</sup> rank among jute growing districts) and in general the N:P:K ratio followed is favourable for better agriculture (1.9:1.1:1.0). Chapke (2012) reported that farmers of North 24 Parganas continued almost balanced fertilizer use for jute (N:56, P<sub>2</sub>O<sub>5</sub>:29 and K<sub>2</sub>O:31 kg/ha). Some pocket areas of southern Bengal jute field are found to be S deficient (Saha et al. 1998). Non-availability of certified seeds of recent high yielding jute varieties was the limiting factor for achieving higher productivity (Chapke, 2012). The farmers of both the districts of this cluster are relatively advanced to adopt agricultural technologies might be due to highest rural literacy rate in Hooghly (79.2%) and North 24 Parganas (78.1%) among the jute producing districts of the state. Moreover, geographical proximity, easy & quick mode of communication to reach Kolkata (the state capital) for any newly available agri-inputs, machineries or information, presence of State Agricultural University (SAU) and CRIJAF nearby and farmers' approach & participation in jute related technology dissemination for quick adoption of improved jute production technologies resulting higher jute productivity in this cluster.

## Cluster-wise Technological and Socio-economic Interventions Required for Achieving Higher Productivity with Better Fibre Quality

### *Northern Cluster*

Correction of soil acidity and enhanced availability of Ca and Mg is beneficial for jute fibre productivity. It was reported that Ca and Mg greatly improve the development of fibre wood and also the yield and quality of jute fibre (Kumar and Borthakur, 1981; Chaudhury and Chattopadhyay, 1988). It was opined that application of LR based lime can increase jute fibre yield by 17.3% as compared to the fibre yield obtained with recommended dose of fertilizer (19.1 q/ha) in Coochbehar. Report indicated that lime (based on LR) and  $MgSO_4$  (10 kg/ha) alone or in combination have the highest ameliorative effect on soil acidity indices, produced higher jute fibre yield (+17.26% more) and sustained residual fertility of soil (Bandyopadhyay, 2003). It was reported that complete package including seed treatment, line sowing, liming based of LR, balanced fertilizer use (NPK @ 60:30:40 kg/ha),  $ZnSO_4$  @ 20 kg/ha, borax @ 10 kg/ha and S @ 30 kg/ha and weed management by quizalofop ethyl could able to increase jute fibre yield by 26% in Coochbehar and Jalpaiguri (Mitra and Samajdar, 2013). Like all other areas, availability of agricultural field labourers are decreasing day by day in this cluster also. To address such issue, new efforts have been started by Uttar Banga Krishi Viswavidyalaya (in association with State Department of Agriculture and local farmers' club) to sow jute with zero tillage under conservation agriculture in Coochbehar-I block during 2015 and 2016. It was reported that this method could able to reduce cost of cultivation, increased productivity up to 42 q/ha (Anonymous, 2016a).

### *Semi-Northern Cluster*

It was reported that solely lime requirement based lime application increased jute fibre yield at least by 20.9% in Balurghat and 41.7% in Kumarganj and it was suggested that productivity of jute in acidic soils of this region can be sustained through liming (Maji et al. 2012a).

It was proved that S is an important secondary nutrient element required for higher productivity and better quality fibre in jute. The critical limit for soil available S was estimated to be 8.5 ppm  $SO_4$ -S (Saha et al. 1998). The available S content of soils of this cluster is from low (12 kg/ha in Deor GP in Kumarganj and 16.1 kg/ha in Chakbhrigu GP in Balurghat) to medium (25.1 kg/ha in Nazirpur GP in Balurghat to 26 kg in Ramkrishnapur GP of Kumarganj). Sulphur deficiency was more pronounced in the sub-surface soils. Application of sulphur @ 30kg/ha (1½ months prior to cropping) for continuous 3 years of farmers' field experimentation, it was observed that S can increase the jute fibre yield by 31.7% in Balurghat and 21% in Kumarganj blocks as compared to the fibre yield obtained in FP. Application of S (along with balanced NPK fertilizer) decreased the disease incidence by 34 to 100% in this area (Maji et al., 2013a).

Zinc deficiency is another limiting factor for achieving higher productivity of jute in this cluster. It was reported that application of Zn as  $ZnSO_4$  @ 20 kg/ha (along with recommended doses of NPK) increased the fibre yield between 15.6% in Balurghat and 83% in Kumarganj as compared to the fibre yield obtained in farmers' practice (21.8 q/ha in Balurghat and 19.7 q/ha in Kumarganj). Zinc along with FYM could able to reduce disease incidence by >50% in Balurghat and >16% in Kumarganj. It was opined that application of Zn coupled with soil test based fertilizer application will certainly enhance the jute fibre productivity, resistance against disease and increase the benefit:cost ratio in the constrained Zn deficient soils of old alluvial tracts of this region (Maji et al. 2012b).

In some pocket areas of this cluster, boron deficiency was recorded (0.12 to 0.42 mg/kg) which sometimes affect fibre productivity and quality. Among the different limiting factors for sustaining higher jute fibre productivity in this cluster it was reported that higher Sustainability Index was obtained in the order of Balanced NPK+ Zn > LR based lime application + balanced NPK > Balanced NPK +S > Balanced NPK +B for Balurghat and for Kumarganj block the order is Balanced NPK +S > Balanced NPK +Zn. It was suggested that jute productivity in these acidic soils of this region are dependent on appropriate soil-fertilizer management. For sustainable production of quality jute fibre with acceptable level of profitability in these constrained soils, the soil acidity problems need to be addressed first and thereafter, balanced fertilizer application along with supply of deficient micro and secondary nutrients are to be ensured positively (Maji et al. 2013b).

### *Semi-Southern Cluster*

In spite of better soil condition, the jute productivity in this cluster is comparatively lower (26 q/ha) except in Burdwan (33 q/ha). Although the jute area of Burdwan is only 8% of Murshidabad and 10% of Nadia jute area, so exert little influence on overall jute productivity of this cluster. For increase in productivity, the fertilizer consumption of Nadia need to be increased from the present level of 347 kg/ha/year. The N fertilizer consumption of Nadia is only 168 kg/ha for 3 crops in a year, which is quite low to achieve better productivity level. Jute productivity in Murshidabad (24.9 q/ha) is quite lower which could be enhanced to 30 q/ha level by technological and sociological interventions. Balanced fertilizer use, at least moderate level of farm mechanization such as line sowing of jute by seed drill, weed management by nail weeder might be helpful to realize higher jute productivity. In general, the rural literacy in Murshidabad is low (66.2%) which negatively affect information collection, use and retrieval about the modern cultivation practice, which holds good for jute also. In spite of presence of State Agricultural University (SAU) and KVK in Nadia, the majority jute farmers of Nadia are not able to utilize its service due to far away physical location of both the institutions at the south-farthest end of the district, whereas, the intensively jute growing blocks are in mid and northern areas of the district. Although Murshidabad is gifted with a KVK, but the jute farmers of the district may be getting less importance in the activity of the KVK due to the unit's more attention towards paddy, vegetables, and animal & fishery activities. At the same time, the jute farmers of Murshidabad also not very enthusiastic to get contact with the KVK and ADA offices available at all the blocks, might be due to poor rural literacy rate. To get rid of the situation, the extension wings of KVK and ADA offices of the district may play proactive role to convince the jute farmers about modern jute cultivation techniques, so that the jute productivity of Murshidabad increases. Any amount of enhancement in jute productivity of Murshidabad and Nadia has greater impact on the state's jute production and productivity as the two districts occupy about 50% jute area of West Bengal.

### *Southern Cluster*

In this cluster Hooghly has higher productivity (33.7 q/ha), although the jute area of Hooghly is only 47% of the other component district of North 24 Parganas. The jute productivity of Hooghly already reached to 34 q/ha level which could be slightly increased (5-10%), but there is larger scope for the fibre quality improvement through deployment of improved microbial retting technology popularly known as 'CRIJAF Sona'. Technological and sociological interventions are required for increasing jute productivity in North 24 Parganas. It was reported that jute-rice-rapeseed (mustard) was the most suitable system for the small and marginal farmers of this region (Biswas et al., 2006). So, jute-rice-rapeseed (mustard) rotation may be recommended for this cluster to make jute production remunerative. In spite of better cropping intensity ( $\geq 205\%$ ), the fertilizer consumption in North 24 Parganas is lower (388.7 kg/ha/yr) which implies that any crop (including jute) receives smaller amount of fertilizer. Higher and balanced fertilizer use by the farmers of the district should be advised for achieving higher jute productivity. Development of location specific technology appears to be necessary to achieve the expected yields for different high yielding jute varieties (Chapke, 2014). Some of the pocket areas of North 24 Parganas are already deficient in S and micronutrients like Zn and B. Correction of such nutrient deficiencies are a pre-requisite for getting better productivity of jute. Some of the eastern and southern situated blocks like Gaighata, Baduria, Deganga, Swarupnagar often experience flood like situation in late June to early July which restricts elongation of jute stem and hence affect jute productivity in those intensively jute growing blocks of the district. Identification or development of jute varieties capable of early sowing to escape the later phase of flood like situation will be a positive step towards improving jute productivity in those areas. For one ha jute cultivation, from land preparation to fibre drying, 353 man-days (201 male and 152 female) are required (Biswas et al. 2006). In North 24 Parganas and Hooghly the ratio of family and hired labour used in jute cultivation is 40:60 which adds manual labour cost in cost of cultivation of jute. So it was suggested that there is urgent need of mechanization in jute cultivation, wherever possible (Chapke, 2012). In general, the farmers of North 24 Parganas are enthusiastic about adoption of newer technologies, but the farmers of remotest corner of the district have real difficulty for accessing the information points like block level ADA offices. Augmenting those ADA offices with more field level staffs (say Krishi Prayukti Sahayak or KPS) equipped with gadgets and knowledge on improved jute cultivation practice would surely help to disseminate the jute agricultural technologies resulting higher jute productivity as well as better fibre quality from this cluster. In this cluster, there is still higher extension gap (4.12 q/ha for JRO 524) which can be addressed by educating the farmers through various extension means so that farmers adopt and continue to follow complete package of practice for jute (Chapke, 2014).



## Initiatives Taken for Achieving Higher Productivity with Better Fibre Quality

### *Jute-ICARE*

National Jute Board (NJB) in collaboration with Jute Corporation of India (JCI) and Central Research Institute for Jute and Allied Fibres (CRIJAF) implemented the programme Jute-Intensive Cultivation and Advanced Retting Exercise (Jute-ICARE) during 2015-16 with an aim to increase productivity with better fibre quality from 11,856 ha area of Karimpur (I & II), Berhampur of West Bengal and Dhing area of Assam involving about 20,000 farmers. The main 4 technologies considered in this programme are improved variety (JRO 204), line sowing by jute seed drill, weed management by CRIJAF nail weeder and improve microbial retting by 'CRIJAF Sona'. This 1st phase of Jute-ICARE programme could achieve at least 7-10% yield increase with one grade fibre quality upgradation. In the 2nd phase of this programme during 2016-17 about 22,230 ha will be covered involving approximately 50,000 farmers of West Bengal, Assam, Bihar, Odisha and some other states (Anonymous, 2016b).

### *ICAR-CRIJAF*

Being the premier jute (and allied fibre) agricultural research institute of ICAR, Central Research Institute for Jute and Allied Fibres (CRIJAF) has given immense importance for development of improved jute production technologies. Moreover, the institute's concentrated efforts for timely dissemination of all the proven technologies to the jute farming communities of the country and special attention for the small and marginal farmers of West Bengal helped the farmers to realize higher fibre yield with better quality. The Agricultural Extension Section of the institute with active involvement of multidisciplinary team of Scientists and technical staffs regularly visit the Field Extension Centres located in major jute growing districts of West Bengal (except extreme north Bengal districts) and interact with the enlisted and general jute farmers of the region for dissemination of improved jute production technologies. In spite of limited physical and manpower resources, the institute demonstrate improved jute production technologies through 230 FLDs in the jute growing blocks of West Bengal. Demonstrated technologies increased the fibre yield by 4.45 q/ha over farmers' practice and the impact of FLD was recoded with increase of yield (at least 3 q/ha) in other villages within 3-7 km radius from the adopted village (Chapke, 2012). Every 5 years, all the Field Extension Centres of the institute are shifted to a newer non-adopted jute areas with an aim to disseminate improved jute production technologies among the other farmers. It is not out of place to mention that for north Bengal districts, the All India Network Project on Jute and Allied Fibres (AINP-JAF) located at UBKV, Coochbehar caters the need of jute farmers of that region. It was opined that the FLD on promising technologies of jute need to be multiplied in different locations and agro-climatic zones of jute for its wider adoption (Chapke, 2012).

### *State Department of Agriculture*

Jute being one of the important commercial crops of West Bengal and preferred by the small and marginal farmers, Govt. of West Bengal through the Department of Agriculture has given attention for development of this sector. The Assistant Director of Agriculture (ADA) stationed in each jute growing blocks of the state are accessible for the technological and information need of the jute farmers. With the implementation of National Food Security Mission-Commercial Crops (NFSM-CC), the jute developmental programmes of the state has got new impetus. For 2015-16, an amount of Rs. 401 lakh had been earmarked for NFSM-CC (jute) developmental activities for West Bengal. The major share of the fund was utilized for FLDs on improved production technologies in about 4800 ha in farmers' participatory mode, hence directly beneficial for the jute farmers of the state. Other important activities under NFSM-CC (jute) were production of certified seed, seed village programme, state level training etc. (Anonymous, 2015). Achievements under NFSM-CC (jute) programme in West Bengal are moderate due to valid reasons including commencement of jute season non-aligned with the financial year leading to delayed receipt of fund for implementation of the programme. In recent years, ADAs of jute growing blocks of North 24 Parganas, Nadia, Hooghly, Murshidabad and other districts have shown special interest to disseminate some of the improved jute production technologies especially improved microbial retting (by CRIJAF Sona) with active involvement of ICAR-CRIJAF.

### *Non-Government Organization (NGO)*

From 2011 onwards, NGO like Society for Equitable Voluntary Action (SEVA), Atghara is coordinating organic jute fibre production in full fledged with proper certification from IMO in association with private jute mills namely Ganges Jute Mills Pvt. Ltd. and Gloster Jute Mills in North 24 Parganas district of the state. In this endeavour in total 638 farmers were involved during 2011 to 2015 covering 12 villages (Dwipmedia, Ramchandrapur, Masia, Naya Bastia, Khaspur, Durgapur, Atghara,

PaschimSimla, Jangalpur, Panji, Pingleswar and Kankrasuti) of Baduria block and one village (Beliakhali) of Deganga block of the district. In the current year (2016-17) 579 farmers are producing organic jute from an area of 135.24 ha. Although at the beginning of the programme, the organic jute yield was only 15-18 q/ha, but with the awareness of the farmers and more concentrated efforts by the concerned organizations, the organic jute productivity increased to 26-28 q/ha in 2015-16. All the produce of the farmers are purchased by the Ganges and Gloster Jute Mills at a premium price which is at least Rs. 150/- more than the existing market price. The enlisted farmers are getting jute seed free of cost, the organic certification charge is also borne by the respective jute mills. The practice of 2.5% margin/ deduction in weight of jute fibre in the open market is exempted in this farmer-jute mills dealings. So, on an average the organic jute farmers are getting at least Rs. 600/q more price than market price for their jute fibre (Rahaman, 2016).

DakshinChakbhabani Rural Awareness Society (DCRAS), an NGO having registered office at Balurghat and operating at Tapan block of DakshinDinajpur district assisting dissemination of improved jute production technologies among the tribal farmers of Tapan block in association with ICAR-CRIJAF since 2013-14. The NGO's effort increased the jute fibre productivity to 32 q/ha which is an increase of 33% for the tribal dominated areas of the block. The microbial retting technology (CRIJAF Sona) improved the fibre quality by 1-2 grades and thereby farmers are earning at least Rs. 350/q more for their quality jute fibres. The livelihood security of the tribal farmers have been enhanced through adoption of improved jute based agricultural production technologies by the tribal farmers of Tapan block (Sarkar, 2016).

### **Suggestions for Improvement in Existing Initiatives and Further Initiatives Required for Higher Productivity and Better Fibre Quality in Jute**

Indeed Jute-ICARE is a highly praiseworthy programme for development of jute agriculture. In spite of all good intentions in the Jute-ICARE programme, the realized output from the 1st phase of the programme (7-10% yield increase) may not be considered very enthusiastic. The major causes for lower achievement may be due to the fact that only a meagre percentage of total jute farmers have been involved, out of the 20,000 farmers of 1st phase, only 15-20% farmers were trained, only 4 jute production technologies were considered. In such jute production system other limiting factors like imbalanced fertilizer use, micronutrient deficiency, soil acidity, improper insect & disease pest management may nullify the benefits of the provided 4 technologies at least partially. Although JCI, one of the associated organization in this programme has wide footprint in the major jute growing areas but their actual manpower availability for the programme is insufficient. Moreover, involvement of PACS (Primary Agricultural Cooperative Societies) was not up to the desired level due to either for their inherent weakness to manage such mammoth programmes or due to sparing less time beyond their regular activities. State Department of Agriculture has wide extension network in all the blocks with expert and trained personnel who may assist such ambitious programme for development of jute production system. So, their involvement may be ensured through any possible mechanism for better deliverables from Jute-ICARE programme. All these shortcomings and weaknesses need to be addressed while implementing 2nd and later phase/s of Jute-ICARE programme to achieve the aimed target of the programme.

In jute agriculture, the seed sector is mainly operated by private agencies (70%) and Govt. agencies hold only 30% of jute seed sector (Anonymous, 2016b). Virtually, there is no control of the state on the quality of jute seed. Non-certified, poor quality and spurious seed may hamper (at least partially) all other technological interventions and farmers' efforts for achieving higher yield with better quality. Private jute seed agencies have chiefly profit motive and they may not be interested to include newer high yielding jute varieties in the seed chain which undoubtedly greatly influence jute fibre production in the country. Therefore, state owned National Seed Corporation (NSC) and State Seed Corporation (SSC) may have more involvement and authority in jute seed chain operation. Instead of 2 kg size seed packet, which is bigger than the need of small jute farmers, one kg seed packet is recommended to discourage sale of loose and spurious jute seed in the open market (Anonymous, 2016b). Other than existing role of JCI in Minimum Support Price (MSP) operation, due to its physical existence in the nuke and corner of most of the jute producing areas of West Bengal may have greater role if involved in quality jute seed distribution/ sale hub, technology dissemination nodes through posters, folders or even through public address system during the jute growing season.

State Department of Agriculture through its block level officers assisted most of the jute developmental initiatives implemented by the central agencies in the respective blocks. But those initiatives are limited in number due to several valid reasons. It is well known that jute has important role for the agrarian society of West Bengal. In most of the state implemented agricultural developmental programme, jute got comparatively less importance. So, it may be suggested that State Department of Agriculture may design and implement more jute agriculture related programmes in all the intensively jute growing blocks of the state. However, while preparing the jute developmental programmes, region/ zone wise constraints/ limitations need to be considered



and no generalization of programme for the whole state would really help to achieve higher jute productivity with better quality. Moreover, jute need to be included in BGREI activities of eastern India and especially West Bengal, otherwise the very purpose of BGREI will be defeated to a great extent.

Agricultural research institutes on jute and State Agricultural Universities have greater role for technology generation and refinement. In contrast to pure academic research fulfilling personal aspiration of the researcher, significant quantum of jute agricultural research need to be focussed for technology generation which will be directly and immediately usable by the jute farming community. Such agricultural research on jute may encompasses development of variety with specific desirable traits using all possible conventional & biotechnological tools, production and protection technology for sustaining better crop growth (and yield) in short-term and long-term changing and abberative climatic condition, mechanization for efficiency, economy and drudgery reduction in jute agriculture especially for fragmented land holdings and fibre quality enhancement through efficient retting technology having minimum environmental hazard.

Other jute developmental agencies which may not have research mandate per se, but has definite role to improve jute fibre production and productivity in the country. Present day jute agriculture and marketing system suffers from information adequacy on market intelligence. Therefore, a robust market intelligence system beyond the basic information on jute price and quantity of fibre availability may be developed, maintained, updated and provided in real time to the farmers and other genuine information seekers through dedicated portal, SMS and related mechanism.

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