

# Vision 2030



**Central Research Institute for Jute and Allied Fibres**  
(Indian Council of Agricultural Research)  
Barrackpore, Kolkata 700 120, India  
[www.crijaf.org.in](http://www.crijaf.org.in)



# Vision 2030



**Central Research Institute for Jute and Allied Fibres**  
(Indian Council of Agricultural Research)  
Barrackpore, Kolkata 700 120  
India



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## Foreword

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The diverse challenges and constraints as growing population, increasing food, feed and fodder needs, natural resource degradation, climate change, new parasites, slow growth in farm income and new global trade regulations demand a paradigm shift in formulating and implementing the agricultural research programmes. The emerging scenario necessitates the institutions of ICAR to have perspective vision which could be translated through proactive, novel and innovative research approach based on cutting edge science. In this endeavour, all of the institutions of ICAR have revised and prepared respective Vision-2030 documents highlighting the issues and strategies relevant for the next twenty years.

Jute constitutes about 50% of the total global production of bast and hard fibres. Global production of jute and allied fibres is near about 30 lakh tonnes and India alone contributes around 18 lakh tonnes, which accounts for about 60% of world's production. Jute occupies an important place in Indian economy.

Central Research Institute for Jute and Allied Fibres (CRIJAF), Barrackpore undertakes responsibility of agricultural research on jute and allied fibres in India. Although CRIJAF-bred jute varieties and production technologies have contributed a lot to achieve the landmark production of over 100 lakh bales/annum, it is realized that a lot more need to be addressed to withstand the competition thrown by cheaper synthetic fibres. Since the expansion of area under these crops is difficult, concerted efforts need to be taken to further enhance the productivity of jute and mesta so as to meet the raw jute demand of around 250 lakh bales in 2030.

It is expected that the analytical approach and forward looking concepts presented in the '*Vision 2030*' document will prove useful for the researchers, policymakers, and stakeholders to address the future challenges for growth and development of the agricultural sector and ensure food and income security with a human touch.



**(S. Ayyappan)**

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29 June, 2011  
New Delhi



## Preface

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Jute is the second most important fibre yielding annual plant, next to cotton, cultivated in tropical regions of the world. It is mainly grown in the South-East Asian countries like India, Bangladesh, Nepal, China, Indonesia, Thailand, Myanmar and some South American countries. The lower gangetic delta contributes more than 80% of total production of jute in the world. Beyond its traditional uses, jute has gained importance in production of diversified value added products which earn more than ₹ 300 crores per annum and the trend is increasing.

Most of the raw jute consisting of jute and mesta in the country has been used traditionally as a source of raw material for the packaging industry. Hence, emphasis so far was given mainly on the production of more fibre irrespective of quality. However, recently finer fibres with higher strength are of great demand for producing value added products. Whole plant of mesta can be used as raw material for pulp and paper industry. High  $\alpha$ -cellulose content of sunnhemp fibre and its degree of polymerization make it suitable for production of high quality paper. Ramie fibre can be successfully utilized for manufacturing fabrics, apparels, bio-composites etc. Sisal fibre due to its strength and durability has potential for making cordage, industrial fabrics, geotextiles, bio-composites, etc. while flax fibre can be used for manufacturing high quality fabrics and paper. In view of their growing demand from industry, production of these allied fibres needs to be augmented.

Jute and allied fibre sector today is facing stiff competition from synthetics, changing climatic conditions, shortage of farm labour, non-availability of quality seeds/planting materials and other inputs, and is in the lookout for overcoming these hurdles. Diversified uses of jute and allied fibres crops are however proving more remunerative, but they require different kinds of production and processing technologies. To meet the new challenges, Central Research Institute for Jute and Allied Fibres (CRIJAF) envisions employing new and emerging disciplines of sciences like nanotechnology and advanced research methodologies over the next two decades. Designing of small machines for various operations of Jute and Allied Fibres farming and production of quality seeds/planting materials will hugely contribute to boost country's production of these fibres. Jute and allied fibres and their by-products can be highly economical, renewable, natural sources of bio-energy and important means for mitigating global warming.

The genetic base of cultivated jute and allied fibre crops is narrow which may result in vulnerability to biotic and abiotic stresses. Broadening of genetic base by using new germplasm as well as different wild species having wider adaptation, higher resistance to major pest and diseases is necessary. Jute is a labour intensive crop and weeding accounts for about 35% of the total cost of cultivation. With the ever decreasing supply of agricultural labourer, alternative approach of weed management in jute with eco-

friendly means is inevitable. Jute is mainly a rainfed crop. Owing to the erratic nature of rainfall over space, time and quantity, the crop is often subjected to phasic drought spells especially in the early growth stage. However, the crop is equally sensitive to water logging in the field. Therefore, effective water management techniques for jute crop are required to be developed.

The ability of CO<sub>2</sub> sequestration by jute crop may be handy to reduce the concentration of CO<sub>2</sub> in the air, an inevitable effect of climate change, by further increasing the biomass of the jute plant. Large volume of fresh water is necessary for retting to obtain good quality jute fibres. Efforts towards reduction in water volume with ensured fibre quality are needed. Efficient retting microbes need to be identified for further improvement in the fibre quality with significant reduction in duration of retting.

I have the confidence that this vision document will serve as a valuable guide and give necessary roadmap to the researchers and policy makers to achieve the targeted fibre production (raw jute) of 250 lakh bales by 2030. All the scientists of CRIJAF have contributed their intellectual inputs to prepare the document in the present form. Constant encouragement and support received from Hon'ble Director General, Deputy Director General (Crop Science) and Assistant Director General (Commercial Crops), Indian Council of Agricultural Research, New Delhi is gratefully acknowledged. It is hoped that the document would be subjected to periodic reviews to accommodate imminent changes in future so that the perspective plan continues to be close to our target.



**(B. S. Mahapatra)**

Director

25 June, 2011  
Barrackpore

Central Research Institute for Jute and Allied Fibres

# Preamble

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Jute and allied fibres (mesta, sunnhemp, ramie, sisal and flax) play an important role in Indian economy. Raw jute (jute and mesta) supports about 4 million farm families and provides employment to the tune of 10.0 million man days in the rural sector. Moreover, about 0.25 million industrial workers and 0.50 million traders get employment in jute sector. Thus, raw jute farming, industry and trade provide livelihood support to about 5 million people though it occupies only 0.47% of the gross cropped area of the country. India is the single largest producer of jute goods in the world, contributing about 60% of the global production. The domestic market continues to be the mainstay of industry consuming about 87% of the total production. At the same time, our export market share is estimated at around 30% of the global market and it is showing an increasing trend. India today earns about ₹ 1200 crores per annum through jute good export as against ₹ 233 crores in early sixties. This clearly shows that despite stiff competition from cheaper synthetic fibres, jute and allied fibres have made significant progress and have a very bright future.

The productivity of jute and mesta has increased by two folds since independence which may be treated as a significant achievement. This was made possible through introduction of high yielding varieties supported by location-specific production and protection technologies. Besides, the tossajute varieties having pre-mature flowering resistance enabled crop to be fitted in the intensive rice based cropping sequence of the eastern and north-eastern part of the country.

At present, jute is cultivated over an area of 8.5 lakh ha in the country with an average productivity of 22 q/ha, while mesta (kenaf and roselle) is cultivated in an area of about 1.5 lakh ha and the average national productivity of the crop is around 11 q/ha. Moreover, couple of varieties of finer fibre quality (fineness less than 2.5 tex) have been developed in tossa jute, which can cater to the need of industry for producing value added diversified products.

In the changing climatic scenario, the crop is more likely to be exposed to increased biotic and abiotic stresses. The uneven distribution of rainfall may pose jute to early season drought while the shrinkage in the natural water resources may affect fibre quality as large volume of clean and slow moving water is required for quality retting. Moreover, the crops may face a wider range of pest and diseases with the elevated temperature, some of which is already making their presence visible. Jute and allied fibre production under the present system of cultivation is labour intensive and costly which need to be reduced significantly to make it competitive with the cheaper synthetic fibres.

The Central Research Institute for Jute and Allied Fibres (CRIJAF), a premier crop research institute of the Indian Council of Agricultural Research (ICAR), is mandated to develop technologies to improve yield and quality of jute and allied fibres. It

remains vigilant and responsive to changing scenario through development of novel technologies and by promoting problem-solving knowledge products. Jute varieties and production technologies developed by CRIJAF have contributed a lot to achieve the landmark production of raw jute over 100 lakh bales/annum. Efforts for exploiting potentials of allied fibre crops sunnhemp, sisal, ramie and flax have been relatively little. Though ramie and sisal are much costlier and qualitatively superior to jute fibre, there is stagnation in the area, production and productivity of these crops in India. Similarly fibre production potentials of sunnhemp and flax have largely remained unexploited in India.

CRIJAF envisions challenges that jute and allied fibre sector is facing, especially the competition from synthetics, changing climatic conditions, shortage of farm labour, non-availability of quality seeds/planting materials and other inputs to the farmers, and is in the lookout for emerging domestic and global opportunities. Jute and allied fibre crops and their by-products can be highly economical, renewable, natural sources of bio-energy and important crops for environmental cleaning. The carbon sequestration potential of jute and allied fibre crops are estimated to be much higher than many tree species. Diversified uses of jute and allied fibres crops are proving more remunerative, but they require different kinds of production and processing technologies.

The first systematic effort by the CRIJAF and its sub-stations to identify the challenges ahead, formulate approaches, strategies and work plan for future was made by preparing 'Vision 2020' document in 1999; the next attempt was after five years by preparing 'Perspective Plan 2025' to address the changes that had taken place, and to articulate new challenges that had emerged. These efforts coincided with the preparation of the XI Five-Year Plan.

It is now realized that jute and allied fibre sector would have to face several challenges and threats, along with the opportunities that are emanating from both supply and demand perspectives. An effective natural fibres invention-and innovation continuum would play a crucial role in addressing a number of supply-side obstructions and in harnessing numerous demand-side opportunities. The pre-conditions for making jute and allied fibre sector more remunerative and sustainable would be to evolve effective mechanisms for technology delivery and to enhance capacity of all stakeholders in the invention-innovation continuum.

'CRIJAF Vision 2030' document narrates key challenges and opportunities in the jute and allied fibre sector in the next two decades for developing an appropriate strategy and gives a roadmap to articulate role of the Central Research Institute for Jute and Allied Fibres in shaping the future of the jute and allied fibre crops research for growth, development and equity.

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# Scenario of Jute and Allied Fibres

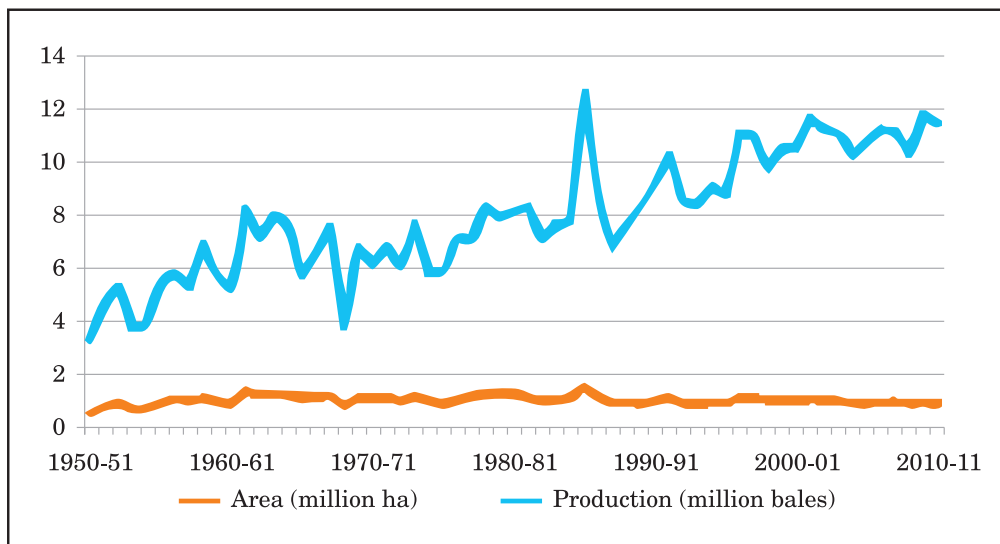
The compound annual growth rate (CAGR) of manmade fibres (MMF) is significantly higher (6%) than that of natural fibres (4%) indicating the growing demand for MMF (polypropylene) at global level. In 1990, the share of natural fibres and MMF was 51% and 41% respectively, while in 2007 it has been reversed. Moreover, production of one tonne of polypropylene emits 3.7 tonnes of CO<sub>2</sub>, whereas one hectare of jute consumes around 15 tonnes of CO<sub>2</sub> in 100 days. Thus, it is quite apparent that the use of natural fibres is a much safer option as compared to synthetic fibres. Jute and allied fibres are eco-friendly and bio-degradable, besides creating the much needed employment in the economically underdeveloped regions of the country. With the growing awareness about pollution free environment, it is the high time to promote natural fibres for the sake of protecting the nature from global warming.

## Area, production and productivity

Global production of jute and allied fibres is around 30 lakh tonnes. Developing countries contributes 29.90 lakh tonnes (99.97%) of the world's production, and 92.5% of the contribution has come from the two South Asian countries, India (17.82 lakh tonnes) and Bangladesh (9.90 lakh tonnes). Developed countries contribute only 0.002%. India ranks first in terms of area and production of raw jute. It alone contributes about 60% of the world's raw jute production. The production of raw jute has been increasing gradually over the decades and has now crossed 100 lakh bales as against only around 35 lakh bales during 1950s. However, the area under raw jute has reached a plateau and is hovering around 9 lakh hectares over the past six decades. Since the expansion of area under these underprivileged crops is extremely difficult, concerted efforts need to be taken to enhance the productivity of jute and mesta, which is hovering around 22 q/ha and 11 q/ha, respectively. The productivity of raw jute in Bihar, Assam and Odisha is 15, 19, and 9 q/ha, respectively as against 24 q/ha in West Bengal. Thus, one of the important issues to be addressed to meet out the fibre demand of 250 lakh bales in 2030 is the less productivity in the states of Bihar, Assam and Odisha.

Although India is self-sufficient in meeting the domestic demand of around 14 lakh tonnes of jute goods, the entire quantity of flax fibre is being imported from Belgium and Holland. Apart from

jute, ramie and sisal are among the fifteen topmost natural fibres of the world. Ramie fibre is the strongest and finest among the vegetable fibres known to the world. Despite its unique quality, ramie received comparatively less prominence among the fibre crops of Indian sub-continent. Though ramie and sisal are

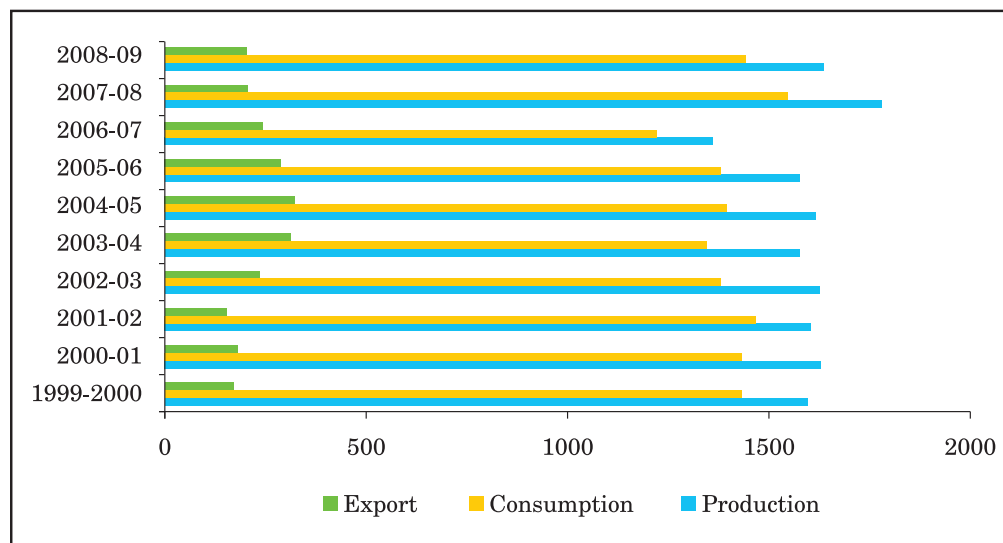


Trend in area and production of raw jute

much costlier and qualitatively superior to jute fibre, there is a status quo in the area, production and productivity of these crops in India. The annual production of ramie fibre is near about 150 tonnes from 150 hectares of area with the productivity of around 10 q/ha. Although the domestic demand of sisal fibre is around 40,000 tonnes/annum, the annual production is dwindling around 300-500 tonnes in India. Therefore, it is inevitable to expand the area under allied fibres to meet the future demand for natural fibres.

### Jute farming and its impact on socio-economic status

Jute, “the golden fibre of India”, though occupies only 0.42% of gross cropped area, provides livelihood to more than 40 lakh farm families. It also provides direct and indirect employment to another 10 lakh people in the industrial sector. India earns ₹ 1200 crores/ annum through the export of jute goods. Hessian has been the single largest component accounts for about one third of the export earnings, followed by JDPs (jute diversified products), yarn and sacking. This is a good sign that



the contribution of JDPs has crossed 25% of the total export earnings from the jute goods. This clearly indicates that value addition and product diversification are the need of the hour. The market price of raw jute has gone to the all-time high of more than ₹ 3000/q, which has created conducive environment for jute farming in India.

Production, consumption and export (000' tonnes) of raw jute

However, it is imperative to note that only about 1.5 lakh tonnes of jute goods accounting for about 8.5% of the total jute good production are being exported and the rest are consumed by the domestic sector. Hence, it is imperative to mention here that separate marketing strategies need to be developed for domestic and export markets in order to rise the ratio of domestic to export markets to 50% : 50% by 2030.

### Growing demand for natural fibres

World market for geo-jute is growing at faster rate. At present, consumption of jute for various geo-textile applications varies between 1.5 and 2 million tonnes accounting for less than 1% of total demand of geo-textile. If 10% of the shopping bags were replaced by jute bags worldwide, then the entire quantity of jute fibre produced in India and Bangladesh would be utilized for the said purpose. Thus, the demand for natural fibres is increasing at a rapid pace especially for diversified uses. The share of jute diversified products (JDPs) at present is around 25% of total export value of the jute goods. This clearly indicates that the product diversification is answer to sustain the jute farming as well as the jute industries in long run. Majority of these JDPs require finest fibres, and hence, necessary efforts need to be taken to develop varieties with finest quality fibre. In India, paper and newsprint production during 2008-09 was 6.5 and 1.1 million MT, respectively and is projected to

touch 22.4 and 6.1 million MT, respectively by 2030-31. The shortage of raw materials required to meet out the estimated production of paper and newsprint by 2030 at the present CAGR of 5.8% and 8.1% cannot be met with depleting forest resources. Jute and kenaf with similar strength of hard wood and comparatively higher cellulose content have emerged as potential alternative fibrous material for the pulp and paper industry. In order to meet the growing demand of pulp and paper industries, breeding efforts should be focused towards the development of varieties with more biomass productivity. Moreover, replacing wood by jute and mesta for paper and pulp will certainly curtail the rate of deforestation and protect the environment to a greater extent.

### **Climate change and its impact**

Jute is predominantly grown as a rainfed crop (>85%) by marginal and small farmers of India. Nowadays jute farming suffers from deficit rainfall. The deviation of rainfall from the normal was -18.6% during 2009-10 and it was -22.7% during the monsoon season (June - September, 2010). Thus, drought is emerging as the most important issue, which deserves adequate attention to sustain the jute farming under the changing climatic scenario. Hence, concerted research efforts are required to mitigate the drought stress through strengthening of breeding programmes for developing drought tolerant varieties, identification of QTLs for drought resistance and manipulation of agronomical practices etc. It is a well-known fact that jute is a short day plant and the critical day length has been worked out to be 12.5 hours. The reproductive phase would be induced if the day length went below 12.5 hours. This is the most unwanted phenomenon as far as bast fibre crops are concerned. Although at present, the day length in the jute growing belts of the country and West Bengal in particular, is well above the critical limit during the cropping season, there may be every chance that the duration of sunshine hours may be getting reduced gradually over the next two decades. Therefore, development photo-insensitive varieties of tossa jute should be given utmost priority in the research agenda of CRIJAF otherwise jute farming will be in oblivion due to vagaries of climatic condition.

Waterlogging due to flood is yet another important phenomenon that cannot be ignored to sustain the jute farming in the years to come. *Tossa* jute is more sensitive to waterlogging during early phase of its vegetative growth. Therefore, necessary efforts need to be taken to collect germplasm that are resistant/ tolerant to waterlogging. This may ensure higher productivity in the flood prone areas of the jute growing belts and Assam in particular.

The scientific community across the world is striving hard to combat the ill effects of climate change due to greenhouse gases like CO<sub>2</sub>. Jute and kenaf have tremendous potential to sequester atmospheric CO<sub>2</sub>. The carbon sequestering capacity of jute and kenaf is several times higher than that of tree crops. Jute can sequester as high as 15 tonnes of CO<sub>2</sub> in 100 days. Therefore, jute and kenaf farming deserve appreciation and support from the scientific community and policy makers across the globe. In this context, carbon trading needs to be promoted and this will ensure additional income to the resource-poor farmers. In the era of environmental concern, in the near future the farm income through carbon trading may exceed the profit obtained from the sale of fibres.

### **Technology landscape**

Farm mechanization is regarded as *sine qua non* to reduce the human drudgery and enhance the agricultural productivity. The ever-increasing wage rate for human labour urges us to mechanize the jute and allied fibre agriculture. Fibre extraction is the costliest operation, which consumes around 36% of the total cost of cultivation followed by weeding (about 34%). Thus, about 70% of the total cost is consumed for fibre extraction and weeding as these two operations are performed solely

by human labour. Although CRIJAF has made significant breakthrough in design and fabrication of machineries, it is realized that a lot more needs to be addressed for further reduction in the cost of cultivation. CRIJAF has the vision to develop a tractor drawn harvester-cum-ribboner, which can harvest and extract green ribbons from jute plants of at least one acre in an hour. This should be a combined harvester meant for both jute and mesta as the cultivation practices like spacing, and plant morphology like height and basal diameter of the stem are almost similar for both the crops. Though the resource-poor jute farmers of India can't afford this costly technology, they can hire this harvester-cum-ribboner for one or two hours as practiced in case of rice combined harvester. This may be the major breakthrough in jute agriculture rather than developing machines which can extract 25 kg/ 50 kg dry fibre/hour.

The potential of genetic engineering needs to be exploited to develop jute varieties/hybrids resistant to herbicides and insect pests. The genetically modified jute should hit the farmers' fields at least by 2030. There has been a spectacular achievement in production, productivity and export of cotton in India over the last five years. It has also been predicted that India will surpass China by 2020 and become the world leader in cotton. A single technology, i.e. Bt cotton has revolutionised the cotton scenario in India and at present the acreage under Bt cotton has crossed 90% of the total area under cotton. A paradigm shift is also inevitable in case of jute and the potential of biotechnology needs to be harnessed effectively.

At present, only 15-20% of the area has good quality retting facility and the traditional method of retting costs around ₹ 300-400/q, which is more than 30% of the total cost of production of ₹ 1093/q. Insufficient water volume coupled with the requirement of large number of labourers for retting under traditional method has been ranked as the second most important constraint by the jute farmers of West Bengal. Therefore, we need to develop a ribbon retting technology, which can ret the jute within 3 days by employing either microbes or novel chemical accelerators with spectacular improvement in the quality of fibre aimed at TD<sub>1</sub> or at least TD<sub>2</sub>.

### **Transfer of technology**

Only 6% of the jute farmers could avail the extension services provided by the village extension personnel known as *Krishi Prajukti Sahayak*. Lack of effective extension services has been identified as the major reason for lack of awareness about the recent technologies among the farming community. A survey carried out by CRIJAF in 2007-08 clearly indicated that more than 90% of the farmers are unaware about the improved production-cum-post harvest technologies such as high yielding varieties of jute (98%), jute ribboner (94%) and chemical weed control (92%). As high as 73% and 83% of the farmers lack awareness about seed drill and judicious application of fertilizers, respectively. The dissemination of improved technologies is still worse in case of allied fibres like ramie, sisal and sunnhemp. Therefore concerted efforts are required to make the farmers aware about the cost-effective technologies. The extension strategies need to be modified in such a way that at least 50% of the farmers should be in a position to adopt the technologies developed at CRIJAF by 2030.

# Organizational Structure of CRIJAF

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Indian Central Jute Committee (ICJC) was established in 1936 upon the recommendations of the Royal Commission on Agriculture (1928) to look after the research and marketing of jute. ICJC established Jute Agricultural Research Laboratory (JARL) in 1939 at Tejgaon, Dhaka and the administrative control of which had gone to the Government of Pakistan in 1947. Although all of the 108 jute mills came under the Indian jurisdiction, only 16% of the area under jute had come to the Indian sub-continent. After the partition of East Pakistan from India, research activities on jute were initiated at Rice Research Institute, Chinsurah, Hooghly, West Bengal. Jute agricultural research thus continued with uncertainty during 1948-1952. In 1953, the institute was re-established at its present site of Barrackpore, 24-Parganas (North), West Bengal under the name of Jute Agricultural Research Institute (JARI). The institute functioned under ICJC from 1953 to 1965 with major emphasis on breeding of high yielding varieties and development of appropriate production technologies. ICJC was abolished in 1966 and as a consequence, JARI came under the administrative control of Indian Council of Agricultural Research (ICAR) in 1966. In 1990, JARI was renamed as Central Research Institute for Jute and Allied Fibres (CRIJAF) to highlight its activities on allied fibres.

CRIJAF has four regional stations, viz. Ramie Research Station, Sorbhog, Assam, Sisal Research Station, Bamra, Odisha, Sunnhemp Research Station, Pratapgarh, Uttar Pradesh, and Central Seed Research Station for Jute and Allied Fibres, Budbud, West Bengal. CRIJAF has 10 collaborative centres (9 SAU-based and NIRJAFT) under All India Network Project on Jute and Allied Fibres (AINPJAF), which was originally established as All India Coordinated Research Project on Jute and Allied Fibres (AICRPJAF) in 1967.

CRIJAF has well-equipped laboratories and experimental fields for basic and applied research in various disciplines of jute and allied fibres agriculture. The Institute has three divisions (Crop Improvement, Crop Production, and Crop Protection) and a section (Agricultural Extension). The biotechnology unit of CRIJAF has been recognized by the DBT, Govt. of India as an “Accredited Test Laboratory” for certification of tissue culture-raised materials under National Certification System for Tissue Culture Raised Plants (NCS-TCP). The central laboratory for soil-plant-water testing and consultancy services is equipped with all modern facilities and instruments. CRIJAF activities are well-supported by PME Cell, AKMU, ITMU, Administration and Accounts. The institute is endowed with good auditorium, lecture hall, conference hall, hostel and well-furnished guest house to organize conferences, seminars, workshops and training programmes. CRIJAF has 61.04 ha of land at its headquarters located at Barrackpore. Ramie Research Station, Sisal Research Station, Sunnhemp Research Station, and Central Seed Research Station for Jute and Allied Fibres have 56.00, 103.60, 9.18 and 65.00 ha of land, respectively for conducting field experiments.

## **Mandate**

- Improvement of jute (tossa and white jute), mesta (kenaf and roselle), sunnhemp, ramie, sisal and flax for yield and quality.
- Improvement of jute and allied fibre crops for biotic and abiotic stresses.
- Development of economically viable and sustainable production technology, and cropping systems with jute and allied fibre crops.

- Development of post-harvest technology for improving the quality of fibre.
- Transfer of technology and human resource development in relation to jute and allied fibre crops.

CRIJAF has been striving hard since its inception to improve the livelihood of five million people of India, who directly or indirectly involved in jute farming. As of 2011, 18 white jute (*Corchorus capsularis*) varieties were released through All India Network Project (AINP) on Jute and Allied Fibres, of which 11 varieties were developed at CRIJAF. JRO 632 was the first tossajute variety released by CRIJAF in 1954, a year after its establishment at Barrackpore. This variety was however, susceptible to pre-mature flowering if sown before mid-April. JRO 878 was the first tossajute variety released by CRIJAF in 1967 with most-wanted pre-mature flowering resistant trait. As of today, as many as 16 tossa jute varieties were released through AINP on Jute and Allied Fibres, of which 13 varieties were developed at CRIJAF, and 10 of them are resistant to pre-mature flowering. Moreover, the crop duration for fibre purpose has also been curtailed from five months to four months. Besides varieties, improved management packages like fertilizer management, weed management, pests and disease management, farm mechanization and post harvest technologies have also contributed equally to enhance the fibre yield of jute. In an effort to rectify the retting related constraints, CRIJAF has developed 'ribbon retting' and 'in situ whole plant retting' technologies, which could ret the jute in 7-9 and 10-12 days, respectively using significantly lesser volume of water as against 18-21 days required for conventional retting. The fibre quality could be improved at least by two grades (from TD<sub>6</sub> to TD<sub>7</sub>) by adopting these novel technologies. The labour requirement has been brought down to 45-50 man-days for ribbon retting as against 110-115 man-days required in the traditional method. CRIJAF is not only leading the way in developing farmers'-friendly, cost-effective and commercial technologies, but also in the protection of intellectual wealth for the benefit of the resource-poor farmers of India. As of March, 2011 five applications have been filed by the CRIJAF for favour of obtaining patents for seed drill, herbicide brush, nail weeder, retting consortium and microbial degumming process besides a Trade Mark for "CRIJAF Seed". *Corchorus olitorius* accessions OIN 125, OIN 154, OIN 651 and OIN 853 were identified as moderately resistant to *Macrophomina phaseolina* after rigorous screening at "hot spot", which will be utilized for developing the disease resistant varieties through conventional plant breeding approach or by marker aided selection. CRIJAF has taken all the possible initiatives to disseminate the technologies at faster rate to the far away places to make the jute cultivation a viable and competitive one. There has been a sustained effort by CRIJAF in conducting frontline demonstrations in the farmers' fields to make them aware about the cost-effective technologies. As many as 737 frontline demonstrations were conducted in an area of 141 ha over the past five years in the intensive jute growing districts of West Bengal. It has also been proved that the production technologies developed at CRIJAF could enhance the fibre yield and the net income of the farmers significantly over the farmer's practice.

Although CRIJAF has contributed a lot since its inception, it realizes that a lot more need to be addressed to withstand the competition thrown by cheap synthetic fibres. CRIJAF keeps on changing the research priorities with the changing demand among the stakeholders at national and at global level. It is a well known fact that fibre constitutes only 4-6% of the total biomass, while the rest is remained under-exploited or under-utilized or the potential of which is still untapped and hence, value-addition and product diversification of jute and allied fibre crops will be given utmost priority in the research agenda of CRIJAF. CRIJAF gives due importance to the feedback from the farmers and accordingly every technology developed by CRIJAF is refined in such a way that it is readily acceptable by the farming community. Thus, CRIJAF has been working with the motto of "farmer first" to make the jute and allied fibre farming a viable and sustainable.

# CRIJAF 2030

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**C**RIJAF is marching ahead with renewed vigour to face complex challenges and to harness domestic and global opportunities for the welfare of farmers and other stakeholders. The efforts will be to become a leading organization in the world, which is responsive, vibrant and sensitive to the needs of its stakeholders.

## **Vision**

Ensuring the livelihood security of resource-poor farmers by enhancing the productivity of quality jute and allied fibres through generation, assessment, refinement and adoption of appropriate technologies

## **Mission**

The primary mission of the institute is to explore traditional and new frontiers of science for technology development and policy guidance resulting in a resilient jute and allied fibre agriculture which must be effectively productive, eco-friendly, sustainable, economically profitable and socially equitable.

## **Focus**

To accomplish the vision and mission of CRIJAF the focus will be given in the below mentioned priority areas:

- To enhance productivity of jute and allied fibre crops resulting in increased net returns.
- To breed varieties yielding finest quality fibre for favour of promoting the Jute Diversified Products.
- To reduce the cost of cultivation through cost-effective and user-friendly production technologies with special emphasis on alleviating constraints in low productivity areas.
- To minimize the use of pesticides in the agro ecosystem by promoting bio-rational pest management tactics.
- To develop cost effective, user-friendly and energy saving machineries.
- To harness the potential of frontier areas of agricultural sciences to mitigate the vagaries of climate such as drought, flood and global warming.
- To foster repositories of genetic resources of jute and allied fibre crops for their sustainable utilization
- To strengthen the inter-institutional linkage and public-private partnership in research, extension and developmental activities.
- To promote the human resource development with special emphasis on training in frontier areas of research in state-of-the-art laboratories in abroad.
- To develop a vibrant Information and Communication Technology (ICT) system to disseminate the knowledge, skill and technologies among the stakeholders.

# Harnessing Science

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The CRIJAF would strive to harness power of science in increasing productivity, enhancing input use efficiency, reducing cost of production and post-harvest operations, minimizing risks and improving quality of fibre through conventional techniques as well as emerging disciplines of science and tools.

In the present context, technological challenges are becoming more complex than before as demand for raw fibres and supply sources are dwindling. Incidentally science is also changing rapidly with emergence of new tools, methods, techniques and approaches that promise technological breakthroughs to accomplish the mission. Following areas and newly emerging disciplines of science and techniques will be used in research for improving productivity and quality of jute and allied fibres.

## **Genetic resource enhancement**

Much of the gains in productivity of raw jute in the past have been attributed to genetic alterations of the crops. This will continue to be the primary driver for augmenting the productivity. Germplasm or gene pool is the basic source for all the crop improvement programmes. CRIJAF has a moderate gene pool of around 5000 accessions of jute and allied fibre crops, which is neither sufficient in number, nor satisfactory in terms of their genetic variability, for demand-driven research programmes of the future. The same is true for allied fibre crops also. Therefore, germplasm collection from far unexplored regions of the country, and particularly the exotic types especially from the centers of origin must be given top priority. Priority-wise direct exploration for exotic types must be launched in countries like Republic of South Africa for jute; Mexico and Brazil for sisal; Mediterranean region, central Asia and near east and other European countries for flax; Eastern Asian countries for ramie, and Zaire and Mozambique for roselle. To address future needs and challenges research will facilitate sustainable use of these germplasm through characterization, genetic enhancement and pre-breeding, functional genomics, proteomics, molecular breeding through tools like marker aided selection and genetic engineering (development of trait-specific transgenic).

## **Emergence of diversified sectors**

Traditionally jute industry is sacking and hessian based (about 80%). But in the context of global awareness for environment, interest in jute and allied fibres as ecofriendly packaging materials are gaining centre stage as against synthetics. Commensurate with increasing demand of natural packaging materials steady demand in jute diversified products (JDPs) in different sectors like textile industry, paper and pulp industry, building and automotive industries and geotextile are noticed both in domestic as well as in international markets. High value products may also be expected. Except jute geo-textiles, all the items mentioned above basically require higher quality fibre (tex value below 2.7) which is inadequately available in India. Two major parameters of fibre quality, i.e. strength and fineness are genetically controlled. For the development of value added products and specific varieties, conventional breeding by greater utilization of existing germplasm is one route, while the other would be molecular breeding using short listed germplasm and identification of QTLs (using RILs and NILs) that would enable to tailor quality trait/ specific varieties more efficiently in the future. Jute leaf is being traditionally used as vegetable. Current research showed that jute leaf contains high amount of antioxidants which may help to combat different types of diseases. Among all the vegetables assessed worldwide by Asian Vegetable Research and Development Centre (AVRDC), jute ranked 2nd in antioxidant content. Bangladesh is presently growing jute as vegetable and exporting to the tune of ₹ 200 crores to Japan and Gulf countries. Therefore, research should intensify to develop varieties available throughout the year for the same purpose.

## **Biotechnology**

For jute and other annual allied fibre crops, biotechnological interventions are the keys to realizing the long-term objectives of producing short-duration photo-insensitive varieties suitable for diverse cropping systems, tailoring specific agronomic and compositional traits and sustaining the productivity vis-à-vis the value chain. Whole genome sequencing and associated high-quality annotation in the cultivated jute, kenaf and roselle species would allow not only to develop partial resources and tools for genomics, epigenomics and transcriptomics, but also to initiate translational genomics in terms of characterization of chromosomal intervals containing genes that condition agronomic, compositional and abiotic/biotic stress resistance traits. Informatics tools and resources should be developed in terms of genomics data collection, computation, exchange and management. Resequencing and annotation of the genomes of their closely related wild relatives will assist in system-wide understanding of genome structure, organization and functions in relation to plant growth, form, function, adaptation, diversity and evolution. By successful integration of genomics and genetics, genomics will be translated into genome-enhanced breeding strategies including transgenics/ cisgenics and reverse genetic approaches like TILLING, for improving composition, performance, adaptability and productivity of jute and (annual) allied fibre crops under diverse agro-ecological conditions. System-based research on global regulatory networks that define bastfibre growth and development, and plant responses to various forms of abiotic and biotic stresses will be initiated in order to enhance the ability to design jute and (annual) allied fibre crops according to specific performance or product. For perennial bast and leaf fibre crops like ramie and sisal, respectively, which are clonally propagated, transgenic and/or cisgenic approaches will be used to improve specific agronomic and quality traits.

## **Nanotechnology**

Nanotechnology will revolutionize materials use in the 21st century. Ligno-cellulosic biopolymers are some of the most abundant biological raw materials. They have a nanofibrillar structure, the potential to be made multifunctional, and can be controlled in self-assembly. The nano-meter dimensions of the cellulose, lignin and other components provide the origin for the unique properties to the bast fibres. Ligno-cellulosic and like-derived biomass provide the key materials platform for the sustainable production of renewable, recyclable, and environmentally preferable goods and products to meet the needs of people in our modern society. They are used in conjunction with ligno-cellulosic products to impart greater functionality. Nanotechnology may be used to (i) achieve lighter weight, higher strength materials; (ii) produce nano-crystalline fibrils from jute and allied fibres; (iii) control water interactions with cellulose; (iv) produce hyper-performance nano-composites using nano-crystalline cellulose fibrils; (v) capture the photonic and piezoelectric properties of lignocelluloses; (vi) reduce energy usage and capital costs in processing bast fibre to products; (vii) hybrid nanostructures for efficient light harvesting in photosynthesis process; and (viii) develop improved systems for monitoring environmental conditions and delivering nutrients or pesticides as appropriate. Nanotechnology can improve our understanding of the biology of jute and allied fibre crops and thus potentially enhance yields or nutritional values. In addition, it may offer routes to added value crops or environmental remediation.

## **Management of natural resources**

There is widespread concern that the stock of natural resource is dwindling and its quality is deteriorating. Undoubtedly the jute agriculture is highly dependent on the natural resources. Jute is a rainfed crop. In early phase of jute growth, water scarcity as well as after harvesting availability of water for retting are the major concerns in changing climatic scenario. Therefore, conservation of soil moisture, efficient use of water and conservation of rainwater are the prime focus in the coming two decades. Therefore, crop management aspects primarily at early phase and retting phase should be focused in region specific manner. Efficient farming system, composite farming,

integrated crop management, integrated nutrient management and integrated water management would be fine-tuned further for wider adaptability and would be integrated with various public sector support programme for holistic development. Next generation jute agriculture would require improvement in production efficiency. This would require obtaining relevant parameters and simulation of most complex systems with application of increasingly powerful computer, sophisticated software and advanced sensors. Improved long-ranged weather prediction technology would be required to take advantage of precision operations for crops and resource applications.

### **Bio-energy and waste utilization**

Jute and allied fibre crops can be highly economical, renewable, natural sources of bio-energy and important crops for environmental cleaning. In India, jute stick alone can provide 29 GJ of energy per year which may be used to produce bio-fuel. Leaf fall from jute crop during a season is about 1500 kg per ha (dry weight basis) which contributes about 29 kg N, 15 kg P, 24 kg K along with 21 kg Ca and 15 kg Mg to the soil. Fallen leaves thus could be used as a source of organic manures. Efficient utilization of huge amount (more than 90%) of bio-waste generated during post-harvest processing and product development is a great challenge before us. Waste utilization in production of bio-energy (bio-gas, bio-fuel); processing of waste materials into enriched animal feeds and composts, extraction of useful chemicals, bio-molecules, etc. are some of the emerging areas of research.

### **Farm mechanization and post-harvest operation**

Mechanization in jute and allied fibre crops cultivation is essential in view of rising labour cost, shortage of farm labour and to make cultivation of these crops profitable. Considering farmers' socio-economic condition and marginal holding size, appropriate machines needs to be developed for various farm operations like sowing, weeding, harvesting and fibre extraction. Problem of inadequate volume of water for retting whole plants of jute, mesta, sunnhemp and flax will be overcome by developing suitable machines/technologies like ribboner. Low cost and less energy requiring fibre extracting machines are needed for semi-perennial crops like ramie and sisal. Development of harvester-cum-ribboner for bast fibre crops, and jute seed thresher also need priority. New machines need to be developed for processing the by-products of jute and allied fibres as they could be good sources of raw materials for board, chemical, paper, or manure making industries.

### **Quality planting materials/seed**

Seed is the basic input for crop production. Almost entire quantity (5000 tons) of jute seed required in India is currently produced in Andhra Pradesh and Maharashtra, far off from the jute growing states causing delayed availability and extreme price hike at the time of demand. Earlier it was thought that jute seed cannot be produced in jute producing states because of warm and humid climatic conditions. CRIJAF's experience during last two years showed immense possibility of seed production in West Bengal where almost 80% jute area is situated. There is need of research for developing production technologies for jute seed crop in non-traditional areas and drier tracts of West Bengal. Paucity of ramie rhizome, the traditionally used propagating material, has necessitated search for alternate sources like waste stalk cutting, tissue culture, true ramie seed, etc. Standardization and commercial exploitation of micro-propagation technology in sisal can solve the ever increasing demand for planting materials.

### **Climate change and bio-risk management**

In the context of climate change, the effect of extreme weather conditions is certainly going to influence the growth, production, processing and quality of jute and allied fibres. The most crucial consequence may be the earliness in flowering which may have adverse impact on the jute fibre yield to great extent. At the same time with increase in greenhouse gas (GHG) there is a possibility

of carbon capitalization and reduction in greenhouse effect of climate change. Research should be oriented to development of breeding and crop management strategies to sustain the jute productivity under elevated climatic parameters. Focus will also be given on estimation of CO<sub>2</sub> and GHG balance sheet in jute cultivation and processing. Bio-risk is increasing in jute sector with climate change owing to emergence of new weed flora, trans-boundary insect-pests and diseases. It is adding to the cost, reducing fibre yield and adversely affecting farm income. To overcome this problem of bio-risk, efforts would be made to develop effective integrated crop management system. Bio-risk intelligent system such as early warning system, drought indicators, migratory movement of bio-risk agents, etc. would be developed for taking informed decision at local, regional and national level.

### **Human resource development**

Improving quality of human resources is a pre-requisite for effective implementation and upgradation of research programmes, development of useful technologies to face emerging challenges and harness opportunities, maintenance of global standard and enhancement of competitiveness. Huge development in science and technology has taken place in the last decades and many potential fields have emerged to tackle the future challenges. For capacity building in emerging areas like genome sequencing, molecular breeding, input use efficiency, quality analysis, isotope analysis and carbon partitioning, microbiology, GIS and crop modeling, young scientists of CRIJAF need to be sent to advanced, state-of-the-art laboratories/institutes. Scientists and researchers of CRIJAF and its regional centres will also serve as part time faculty of SAUs with an eye to train and attract young talents in the field of JAF research. Efforts will be made to develop state-of-the-art facilities for research in newly emerging disciplines of science, completely equipped engineering workshop for designing demand-driven farm machineries and an e-library on jute and allied fibres. Skillful integration of modern expert system and decision support system among technical workforce for dissemination of cutting edge technologies through e-extension will be on the institute's agenda.

### **Jute and allied fibres informatics**

Bioinformatics now entails the creation and advancement of databases, algorithms, computational and statistical techniques and theory to solve formal and practical problems arising from the management and analysis of biological data. Application of bioinformatics tool to the jute and allied fibre origin, biogenesis and development by computational approach employing the genomic information generated from jute genome sequencing will give new insight. The database generated by data mining and system biology approach of proteins and genomic information of jute and allied fibres may be validated through combining structural protein database for functional and structural relation aspects.

### **Transfer of technology**

It is important to continuously strive to develop new and better technologies for accelerated dissemination of improved technologies. Latest communication tools like e-kiosk and cyber extension may be used for faster dissemination of information. Promotion of public-private partnership will facilitate more effective transfer of technologies. Empowerment of rural youth/ farm women through entrepreneurship development in diversified use of jute and allied fibres will have positive impact on their production. Their effective delivery mechanism would greatly help in building wide gap between potential and realizable productivity. More far-reaching, participatory information and communication technology would be evolved by optimizing print and electronic delivery systems and by showcasing research accomplishments with stakeholders.

# Strategy and Framework

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**F**or accomplishing the vision and the goals of the Central Research Institute for Jute and Allied Fibres and for enhancing efficiency and effectiveness of the research resources, the following 6-point strategy would be adopted. The strategic framework indicating the goals, approaches and performance measures are presented in Annexure 1.

## **Development and strengthening of infrastructure/ facilities for conducting upstream research**

- Establishment of well-equipped and centralised laboratories pertaining to genomics, biotechnology, biochemistry, fibre quality, physiology, soil science, plant protection and agricultural chemicals
- Development of new and renovation of old equipment/buildings/workshop, farm office, fibre extraction unit and storage facilities.
- Establishment of greenhouse/polyhouse and creation of phytotron facilities for initiating simulation studies on impact of climate change on jute and allied fibre production,
- Modernization of library facilities through digitization, e-resources and utilization of relevant electronic journals through network (national and international level) in secured manner
- Improvement of conveyance facilities for proper monitoring of off-farm research and extension activities

## **Strengthening of human and financial resources**

- Increasing cadre strength for focused in-depth research and allocating human resources in different crops in tune with relative importance
- Mobilizing fund from various sources through motivating scientific staffs for submission of winning proposals in burning scientific fields acquiescence to jute and allied fibre crops
- Training and visit of scientists in state-of-the-art laboratories for exposure to the advanced research methodologies

## **Accelerating research through collaborative/partnership/network mode and development of technologies**

- Organization of network research projects to meet location specific requirements and refinement/validation of technologies
- Implementation of externally funded and inter-intuitional/collaborative research projects
- Effective dissemination of technologies by adopting innovative methods of extension
- Modernization of KVKs with adoption of more villages and accommodation of more stakeholders
- Establishment of seed village for boosting quality seed production and farm income
- Development of Agricultural Technology Information Centre (ATIC) with creation of e-extension channel to benefit large number of clientele

**Commercialisation of technologies and research output in IPR regime**

- Protection of plant varieties to preserve the varietal purity and motivating researchers through incentives and recognition
- Patenting of inventions/ noble output of research
- Marketing/ commercialization of research products (seeds, machines, etc) through private firms

**Efficient management of research and extension programme**

- Creation of crop- and/or region- specific research stations/centres to concentrate on focused research activity
- Creation and strengthening of KVKs and extension centres for effective dissemination of technologies
- Promotion of e-governance (paperless administration) in office

## Epilogue

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The Central Research Institute for Jute and Allied Fibres (CRIJAF) is mandated with development of cost-effective and environment-friendly technologies for production, protection and processing of jute, mesta, sisal, sunnhemp, ramie and flax fibres to meet growing demand of the industry. As demand of these fibres and their by-products for diversified and non-traditional uses is rising, and changing climatic conditions is creating more and more abiotic and biotic stresses on these crops, task of the scientists engaged in jute and allied fibre research become more challenging. For addressing the new challenges, the research efforts of CRIJAF shall be directed towards strengthening of basic and strategic research on genetic resources (characterization, documentation, pre-breeding and enhanced utilization); development of improved varieties (with higher productivity, improved fibre quality and diversified uses, resistance to biotic and abiotic stress); enhancing system efficiency through development of cost effective, location specific sustainable production technology (especially in the field of weed management) to enhance production and productivity along with providing sustainability to the production system and also to meet the emerging needs for maintaining and enhancing the competitiveness in the post-WTO era; development of improved (user friendly as well as ecofriendly) retting technology; integrated pest management; integrated nutrient management; promoting diversified uses; strengthened efforts to facilitate transfer of technology and establishment of linkages with industry and related R&D agencies. Changing climatic conditions and emerging biotic and abiotic stresses would also be considered for developing suitable production and protection technologies for these crops.

For organization of relevant research and extension activities, the institute will also employ new and emerging disciplines of sciences like genomics, biotechnology, nanotechnology and bio-informatics; and use more and more collaborative and network modes of research. The institute would require development and strengthening of infrastructure facilities, strengthening of human and financial resources, and improvement of research and extension management using modern tools. It is hoped that the goals set by CRIJAF can be achieved through implementation of strategic framework/roadmap given in this vision document.

# Annexure 1: Strategic framework

Goal	Approach	Performance measure
<p>Productivity and quality improvement of jute and allied fibres crops</p>	<p>Characterization of germplasm of jute, mesta, sunnhemp, ramie, sisal and flax both at morphological and molecular level, genetic divergence analysis, evaluation for economically important characters, cataloguing/ documentation and registration of identified germplasm</p> <p>Enhanced utilization of germplasm resources through introgression of desirable traits from genotypes of cultivated and wild species; development of pre-breeding materials to broaden the genetic base of jute, mesta, sunnhemp, ramie, sisal and flax</p> <p>Development of improved varieties of jute, mesta, sunnhemp, ramie, sisal and flax through utilization of pre-breeding materials; integrating marker assisted selection in the conventional breeding programme involving hybridization and mutagenesis; development of plant ideotype for increasing fibre yield in jute</p> <p>Exploitation of hybrid vigour through development/identification of male sterility of jute for productivity improvement</p> <p>Development of transgenics in jute for resistance to biotic and abiotic stresses and better quality parameters for diversified uses</p> <p>Genetic manipulation of lignin biosynthesis for achieving improved fibre fineness in jute, and of pectin biosynthesis for reducing gum content in ramie. Use of nano-technology for improvement of lignocellulosic biopolymers</p> <p>Determination of anatomical parameters responsible for fibre development in jute and mesta</p> <p>Inclusion of mesta, ramie, sisal, sunnhemp and flax as notified crops for DUS tests</p>	<ul style="list-style-type: none"> <li>• Increase in yield and quality of bast fibres</li> <li>• Increase in fibre fineness</li> <li>• Reduction in crop loss due to biotic and abiotic stress</li> </ul>

Goal	Approach	Performance measure
<p>Improved production technologies in cropping system mode with special reference to moisture use &amp; nutrient stress in different agro-climatic conditions prevailing in jute and allied fibre crops growing areas.</p>	<p>Development of socially acceptable and cost-effective cropping system modules</p> <p>Development of cost-effective and eco-friendly package of practices with special emphasis on weed management suiting to different agro-climatic conditions</p> <p>Management of soil fertility with special emphasis on use of locally available organics and biofertilizers, recycling of crop residues under different agro-climatic conditions</p> <p>Optimizing irrigation schedules for jute and allied fibre crops under different agro-climatic conditions</p> <p>Development of contingency plans to mitigate drought and waterlogging stresses in jute and allied fibre crops</p>	<ul style="list-style-type: none"> <li>• Reduction in cost of cultivation</li> <li>• Increase in farm income</li> <li>• Improvement in sustainability of production</li> </ul>
<p>Evolving appropriate plant protection measures for different agro-climatic conditions prevailing in jute and allied fibre crop growing areas.</p>	<p>Pest behavioral studies in terms of pest status, tritrophic interaction and pest life cycle in the context of climate change</p> <p>Development of weather based forecasting models for important pest and disease outbreaks and their impact on crop yield and fibre quality for different agro-climatic zones</p> <p>Systematic characterization and improvement of beneficial microbes including endophytes through biotechnological interventions for eco-friendly pest and disease management</p> <p>Development of expert system for integrated pest and disease management</p>	<ul style="list-style-type: none"> <li>• Reduction of risk in pest and disease</li> <li>• Reduced use of chemical pesticides</li> </ul>
<p>Post-harvest operations for improved quality of fibres with special attention to meet industrial demands.</p>	<p>Up-scaling of jute retting microbial consortia; development and delivery of consortia formulations to the end users</p> <p>Up-scaling of degumming technology for ramie and decortication technology for sisal</p> <p>Development of medium and long term storage module for whole jute &amp; mesta plants to ensure continuous supply of raw materials to paper pulp industry</p>	<ul style="list-style-type: none"> <li>• Reduction in extraction and retting costs</li> <li>• Improvement in fibre quality</li> <li>• Increased storage life of raw materials for paper and pulp</li> </ul>

Goal	Approach	Performance measure
<p>Mechanization of farm activities for higher productivity and economic return suited to different economic class of farmers.</p>	<p>Development of cost-effective and user friendly machines for sowing/planting, weeding and application of fertilizer and pesticides in jute and allied fibre crops</p> <p>Development of harvester-cum-ribboner machines for jute and mesta</p> <p>Design of cost-effective, user friendly and portable machines for extraction of fibres of jute and allied fibre crops</p>	<ul style="list-style-type: none"> <li>• Reduction in labour requirement for various operations</li> <li>• Reduction in water requirement for retting</li> <li>• Improvement of fibre quality</li> </ul>
<p>Transfer of technology and human resource development in jute/ allied fibre crops</p>	<p>Dissemination of technologies through electronic media/e-extension</p> <p>Training of trainers and farmers in improved fibre production technologies; farmer to farmer approach through farm schools</p> <p>Utilization of innovative and progressive farmers as para-professionals for extension</p> <p>Promotion of public-private partnership in extension</p> <p>Establishment of accelerated research-extension-farmer-market linkages; facilitation of marketing for diversified products of jute &amp; allied fibres</p>	<ul style="list-style-type: none"> <li>• More effective transfer of technologies</li> <li>• Generation of employment opportunities for rural youth</li> </ul>
<p>Quality seeds and planting materials</p>	<p>Development of location-specific technologies for production of seeds and planting materials for jute, mesta, sisal, ramie, sunnhemp and flax</p> <p>Public-private partnership in production of quality seeds and planting materials</p> <p>Farmers participatory seed production programme</p>	<ul style="list-style-type: none"> <li>• Increase in production of quality seeds and planting materials</li> <li>• Increase in area under cultivation</li> </ul>
<p>Diversified use of jute &amp; allied fibres and their by-products</p>	<p>Promoting use of jute as leafy vegetables</p> <p>Extraction of edible healthy oil with high linoleic acid from seeds of jute &amp; allied fibres</p> <p>Exploring potentials of the jute &amp; allied fibre biomass as fodder, bio-fuel and paper pulps</p> <p>Cultivation of jute &amp; allied fibre crops for ameliorating problem soils/wastelands</p>	<ul style="list-style-type: none"> <li>• Entrepreneurship development in diversified use of fibres and their by-products</li> <li>• Increased income to farmers</li> </ul>

Goal	Approach	Performance measure
Coping of jute & allied fibre crops production with changing climate	Simulation studies on weather-growth relationship of jute and allied fibre crops Development of photo/thermo-insensitive varieties Exploring the potentials of jute (with high carbon sequestration capacity) in mitigating global warming	<ul style="list-style-type: none"> <li>• Stability in production</li> </ul>
Expansion of area under allied fibre crops	Promotion of cultivation of allied fibre crops in non-traditional areas Cultivation of jute and allied fibres in wastelands Establishment of accelerated research-extension-farmers-market linkages for widening area under allied fibre crops	<ul style="list-style-type: none"> <li>• Increase in production</li> </ul>



हर कदम, हर डगर

किसानों का हमसफर

भारतीय कृषि अनुसंधान परिषद

*Agri*search with a human touch