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Fibre crop production technology in Katihar Region: A comprehensive overview

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Abstract
Fibre crops play a pivotal role in global agriculture, providing raw materials for textiles, packaging, and industrial products while supporting rural economies and environmental sustainability. The Katihar region of Bihar, India, is a prominent area for fibre crop cultivation, especially jute. This review paper provides a comprehensive analysis of the region's climatic suitability, soil conditions, crop production technologies, challenges, and future prospects. Emphasis is laid on integrated nutrient and pest management, water conservation practices, post-harvest processing, and opportunities for value addition. The findings highlight the immense potential for Katihar to emerge as a leading hub for eco-friendly fibre production in India.

Keywords: Fibre crops, jute, Katihar, integrated management, retting, sustainable agriculture

Introduction
Fibre crops are cultivated for their fibrous tissues, which are used extensively in textile manufacturing, rope-making, paper production, handicrafts, and emerging biocomposite industries (ICAR-CRIJAF, 2022; Kundu *et al.*, 2019) [14-18, 24-27]. Globally, important fibre crops include cotton (*Gossypium* spp.), jute (*Corchorus* spp.), hemp (*Cannabis sativa*), and coir (from *Cocos nucifera* husks) (Singh & Yadav, 2020) [38-40]. Among these, jute holds a special place in eastern India, being referred to as the "Golden Fibre" due to its lustre and eco-friendliness (Ministry of Textiles, Govt. of India, 2023; ICAR-CRIJAF, 2022) [, 14]. Katihar district in Bihar is renowned for its contribution to jute production owing to its fertile alluvial soils, high humidity, and abundant rainfall (Kumar & Thakur, 2021; Ministry of Agriculture & Farmers Welfare, 2023) [19, 22, 28-30]. This region plays a crucial role in supporting rural livelihoods, contributing to national fibre production, and promoting sustainable agricultural practices (ICAR-CRIJAF, 2022) [14-18].

Major Fibre Crops in India
1. **Cotton:** The most important fibre crop, used in textiles (Ministry of Textiles, 2023; ICAR-CRIJAF, 2022) [14-18].
2. **Jute:** Known as the "Golden Fibre", widely grown in West Bengal, Bihar (including Katihar), and Assam (ICAR-CRIJAF, 2022; Ministry of Agriculture & Farmers Welfare, 2023) [14-18, 28-30].
3. **Hemp:** Used in ropes, fabrics, and bio-composites (Kundu *et al.*, 2019) [24-27].
4. **Coir:** From coconut husk, used in mats and ropes (Singh & Yadav, 2020) [38-40].

Importance of Fibre Crops
1. Agricultural and Economic Significance
Fibre crops contribute significantly to soil health through crop rotation systems, particularly when combined with cereals and legumes. Their deep root systems aid in soil conservation, reducing erosion and improving soil structure (Singh & Yadav, 2020; Kumar & Thakur, 2021) [38-40, 19, 22]. Economically, fibre crop cultivation supports millions of farmers and laborers, providing rural employment and generating income through related agro-industries (Ministry of Agriculture & Farmers Welfare, 2023) [28-30].

2. Industrial and Environmental Significance: Industrially, fibres from jute, hemp, and coir are essential for manufacturing textiles, ropes, biodegradable packaging, and various handicraft products (Kundu *et al.*, 2019; ICAR-CRIJAF, 2022) [24-27, 14-18]. In the automotive and construction sectors, natural fibres are increasingly replacing synthetic materials in composites and insulation products due to their lower carbon footprint (Kundu *et al.*, 2019; Singh & Yadav, 2020) [38-40, 24-27]. Environmentally, fibre crops are biodegradable and help reduce plastic dependency. Moreover, they act as carbon sinks, sequestering atmospheric CO_2 and mitigating climate change effects (ICAR-CRIJAF, 2022; Ministry of Textiles, 2023) [14-18].

Overview of the Katihar Region: Katihar, a district in Bihar, India, is known for its agriculture-based economy and plays a significant role in fibre crop cultivation, especially jute production (ICAR-CRIJAF, 2022; Ministry of Agriculture & Farmers Welfare, 2023) [14-18, 28-30]. Its climate and soil conditions make it highly suitable for growing fibre crops (Kumar & Thakur, 2021; Singh & Yadav, 2020) [19, 22, 38-40].

Major Fibre Crops in Katihar Region

1. **Jute (*Corchorus* spp.)**: Main fibre crop grown extensively (ICAR-CRIJAF, 2022; Ministry of Textiles, 2023) [14-18].
2. **Mesta (*Hibiscus* spp.)**: Alternative fibre source, resistant to adverse conditions (Singh & Yadav, 2020) [38-40].
3. **Sunn Hemp (*Crotalaria juncea*)**: Used for making ropes, fishing nets, and as green manure (Kundu *et al.*, 2019) [24-27].

Agro-climatic Suitability of Katihar Region

Climate: Katihar experiences a tropical monsoon climate characterized by high humidity and abundant rainfall, which is essential for jute cultivation (ICAR-CRIJAF, 2022; Ministry of Agriculture & Farmers Welfare, 2023) [14-18, 28-30]:

- **Temperature**: 25°C to 38°C in summer; 7°C to 22°C in winter.
- **Rainfall**: 1,200-2,000 mm annually, predominantly during June to September.
- **Humidity**: 70-90%, crucial for optimal retting and fibre quality.
- **Growing season**: March to June for sowing, with crop duration of 100-120 days.

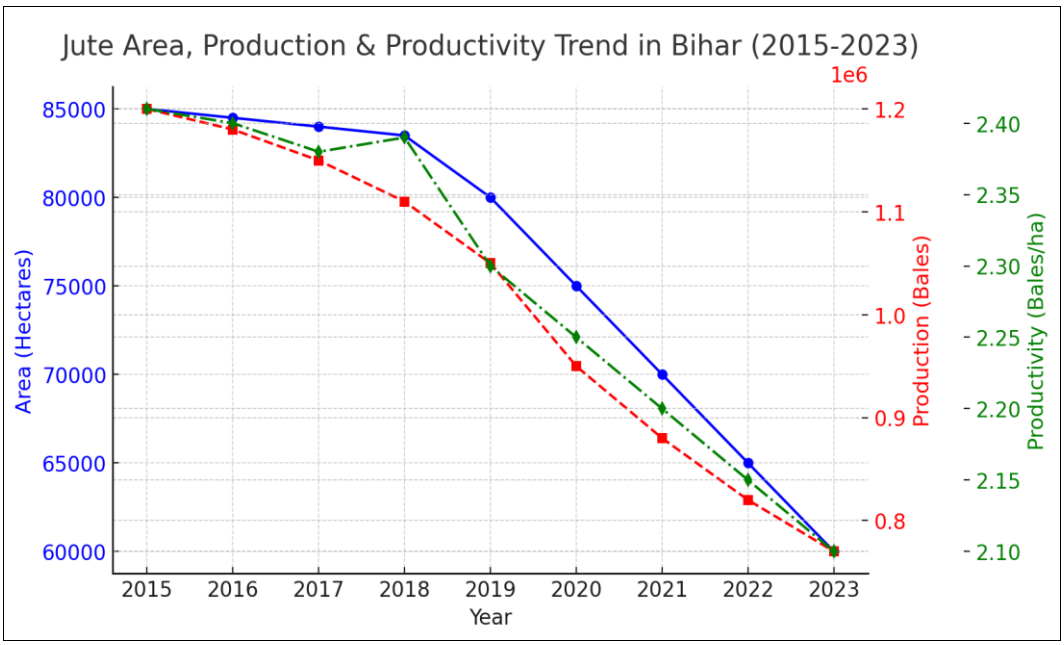
Soil

The region's soils are mainly alluvial, deposited by the Ganges and its tributaries (Kumar & Thakur, 2021; ICAR-CRIJAF, 2022) [19, 22, 14-18]:

- **Texture**: Loamy to clayey, providing excellent water retention.
- **pH**: Slightly acidic to neutral (5.5-7.0), suitable for jute and mesta.
- **Nutrient content**: High in organic matter and potassium, moderate in phosphorus; loamy-clay soil retains water well, ensuring adequate moisture for fibre crops.

Why Katihar is Ideal for Fibre Crop Cultivation?

1. **Favorable Rainfall & Humidity**: Perfect for jute and mesta (ICAR-CRIJAF, 2022; Ministry of Agriculture & Farmers Welfare, 2023) [14-18, 28-30].
2. **Fertile Alluvial Soil**: Provides necessary nutrients for fibre crops (Kumar & Thakur, 2021; Singh & Yadav, 2020) [19, 22, 38-40].
3. **Well-Drained Lands**: Supports strong root systems, preventing water logging (ICAR-CRIJAF, 2022) [14-18].
4. **Loamy to Clayey Texture**: Helps retain moisture for fibre crops (ICAR-CRIJAF, 2022) [14-18].
5. **Neutral to Slightly Acidic pH (5.5-7.0)**: Ideal for jute and mesta cultivation (Kumar & Thakur, 2021) [19, 22].
6. **Humidity (70-90%)**: Essential for jute retting and fibre quality (Ministry of Textiles, 2023; ICAR-CRIJAF, 2022) [14-18].
7. **Long Growing Season**: Fibre crops like jute, mesta, and sunn hemp thrive in Katihar's warm climate (Singh & Yadav, 2020; Ministry of Agriculture & Farmers Welfare, 2023) [38-40, 28-30].
8. **Traditional Farming Knowledge**: Local farmers have expertise in fibre crop cultivation, especially jute (ICAR-CRIJAF, 2022; Kundu *et al.*, 2019) [24-27, 14-18].
9. **Presence of Jute Mills & Markets**: Easy access to processing units and buyers (Ministry of Textiles, 2023).
10. **Government & Research Support**: Various schemes, trainings, and incentives for jute (ICAR-CRIJAF, 2022; Ministry of Agriculture & Farmers Welfare, 2023) [14-18, 28-30].



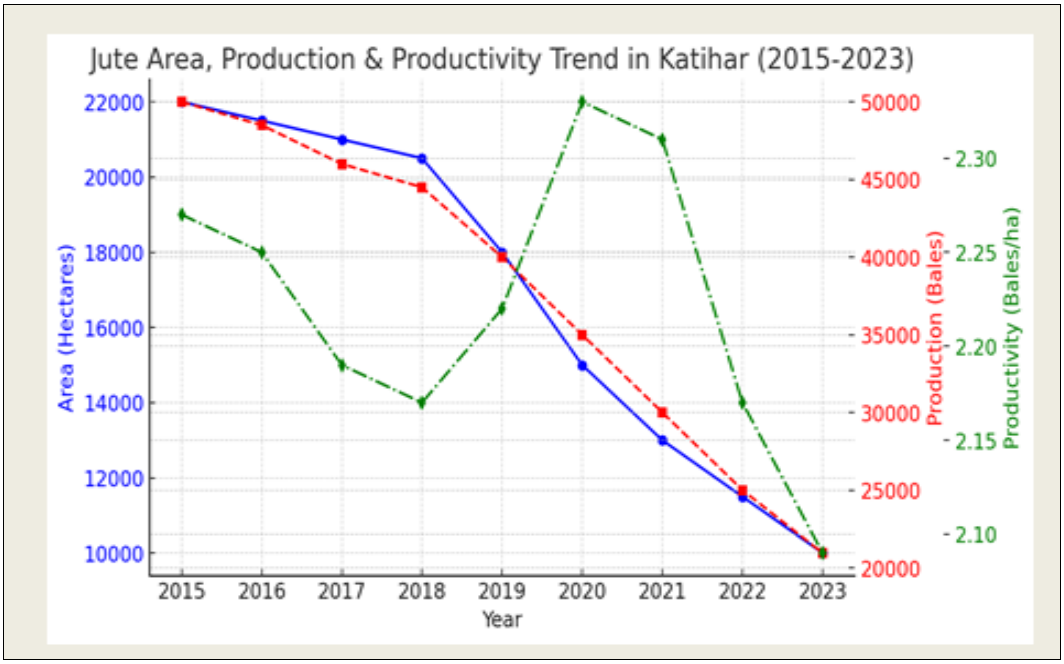


Fig 1: Area, Production, & Productivity of Jute in Katihar and Bihar

Fibre Crop Production Technologies

Land Preparation: Land preparation involves multiple ploughings (3-4 times) to break clods and improve aeration. Incorporating well decomposed farmyard manure (FYM) or compost at 5-10 tons per hectare enhances soil fertility. Proper levelling and drainage are essential to prevent waterlogging, which is detrimental to jute (ICAR-CRIJAF, 2022) [14-18].

Seed Selection and Sowing

1. Popular varieties

Navin (JRO-524): This variety is widely adopted by farmers in Katihar. Studies indicate that marginal, small, and semi-medium farmers prefer Navin, with approximately 50.68% of the jute cultivation area dedicated to this variety (ICAR-CRIJAF, 2022; Ministry of Textiles, 2023) [14-18].

Suren (JRO-204): Another popular variety in the region, Suren is cultivated on about 49.31% of the jute-growing area in Katihar. Medium and large farmers particularly favor this variety (ICAR-CRIJAF, 2022) [14-18].

Subala (S-19): Subala is an *olitorius* jute variety known for its high yield potential of 30-35 quintals per hectare and tolerance to major pests and diseases (Singh & Yadav, 2020; Kumar & Thakur, 2021) [19, 22].

Seed treatment

Carbendazim (2 g/kg seed) or *Trichoderma viride* (5 g/kg) to reduce fungal infections (Singh & Yadav, 2020; ICAR-CRIJAF, 2022) [14-18].

Sowing methods: Broadcasting and line sowing with a spacing of 25-30 cm, seed depth of 2-3 cm, and seed rate of 5-7 kg/ha (ICAR-CRIJAF, 2022; Kumar & Thakur, 2021) [19, 22].

Sowing period: March to June, depending on rainfall onset (Ministry of Agriculture & Farmers Welfare, 2023; ICAR-CRIJAF, 2022) [28-30].

Nutrient and Fertilizer Management

Integrated nutrient management (INM) combines organic sources (FYM, green manure) and inorganic fertilizers (urea, DAP). Recommended practice includes:

- 50% nitrogen from urea and 50% from organic sources (ICAR-CRIJAF, 2022; Singh & Yadav, 2020) [14-18, 38-40].
- Use of biofertilizers such as *Azotobacter* and phosphate solubilizing bacteria (PSB) (Kumar & Thakur, 2021; ICAR-CRIJAF, 2022) [19, 22, 14-18].
- Avoid excessive nitrogen to prevent lodging and pest outbreaks (ICAR-CRIJAF, 2022) [14-18].

Table 1: Fertilizer requirement of Jute (ICAR-CRIJAF, 2022) [14-18]

Fertilizer Type	Quantity (kg/ha)	Application Time
Nitrogen (N)	40-60	50% at sowing, 50% after 4 weeks
Phosphorus (P_2O_5)	20-30	At the time of sowing
Potassium (K_2O)	20-30	At the time of sowing
Sulfur (S)	20-25	At sowing (Gypsum or Ammonium Sulfate)
Zinc ($ZnSO_4$)	05	Soil application if deficiency observed

Organic Fertilizer & Green Manuring

1. **Farmyard Manure (FYM)**: 5-10 tons per hectare to improve soil structure and enhance microbial activity (ICAR-CRIJAF, 2022; Singh & Yadav, 2020) [14-18, 38-40].
2. **Green Manure Crops (Dhaincha, Sunhemp)**: Improve soil fertility when incorporated back into the field, adding organic matter and enhancing nitrogen availability (Kumar & Thakur, 2021).

Integrated Nutrient Management (INM)

A combination of organic and chemical fertilizers ensures sustainable productivity. Apply 50% nitrogen from urea and

50% from organic sources (compost, vermicompost). Biofertilizers such as *Azotobacter* and phosphate solubilizing bacteria (PSB) help improve nutrient availability and reduce dependency on chemical fertilizers (ICAR-CRIJAF, 2022; Singh & Yadav, 2020) [14-18, 38-40].

Best Practices for Maximum Yield

1. Use balanced fertilizers based on soil test reports to correct site-specific deficiencies (ICAR-CRIJAF, 2022) [14-18].
2. Avoid excessive nitrogen, which can cause lodging and increase susceptibility to pests and diseases (Singh & Yadav, 2020) [38-40].
3. Maintain proper soil moisture to ensure efficient nutrient absorption (Kumar & Thakur, 2021) [19, 22].
4. Adopt crop rotations such as Jute-Paddy and Jute-Mustard to maintain soil fertility and break pest/disease cycles (Kumar & Thakur, 2021; ICAR-CRIJAF, 2022) [19, 22, 14-18].

Irrigation and Water Management

While jute is largely rainfed, supplemental irrigation is crucial during dry spells, especially during germination and early vegetative stages. Raised beds and field channels help prevent waterlogging, which reduces root respiration and fibre quality. Use of soil moisture sensors and alternate wetting and drying (AWD) methods improve water efficiency (Kundu *et al.*, 2019) [24-27].

Critical Stages for Irrigation

Table 2: Critical Stages of Irrigation in Jute (Kumar & Thakur, 2021; ICAR-CRIJAF, 2022) [19, 22, 14-18].

Growth Stage	Irrigation Requirement
Before Sowing	Pre-sowing irrigation to ensure moisture for germination
Germination (0-7 days)	Light irrigation if dry conditions persist
Vegetative Growth (15-45 days)	2-3 irrigations if rainfall is insufficient
Flowering (45-60 days)	1 irrigation if drought conditions occur
Pre-Retting	Maintain soil moisture to ensure better fiber quality

Best Irrigation Methods for Jute

Table 3: Irrigation Methods of Jute (ICAR-CRIJAF, 2022)

Method	Advantages
Furrow Irrigation	Efficient water use, prevents water-logging
Flood Irrigation	Suitable for flat fields with proper drainage
Drip Irrigation	Ideal for water-scarce areas but costly

Impact of Water logging

1. Reduces root respiration, leading to stunted growth and lower nutrient uptake.
2. Increases pest and disease risks, especially root rot and stem rot (ICAR-CRIJAF, 2022; Singh & Yadav, 2020) [14-18, 38-40].
3. Reduces fiber strength and overall yield by affecting plant vigor and retting quality (Kundu *et al.*, 2019) [24-27].

Effective Drainage Practices

1. **Raised Bed System**: Prevents waterlogging and improves aeration.
2. **Field Channels**: Ensure rapid drainage of excess water, especially during heavy rainfall.
3. **Inter-row Drainage**: Helps remove excess water quickly, reducing disease risk and improving root health (ICAR-CRIJAF, 2022) [14-18].

Water Conservation and Management Strategies

1. **Use of High Yielding Varieties**: Cultivating drought-tolerant jute varieties that require less water (ICAR-CRIJAF, 2022) [14-18].
2. **Integrated Water Management**: Combining traditional methods with modern systems (e.g., furrow irrigation, alternate wetting and drying) for better efficiency (Kundu *et al.*, 2019) [24-27].
3. **Monitoring Soil Moisture**: Using soil moisture sensors to avoid under- or over-irrigation (Kumar & Thakur, 2021) [19, 22].
4. **Crop Rotation**: Rotating jute with legumes or other crops improves soil structure and water retention capacity (Singh & Yadav, 2020) [38-40].
5. **Rainwater Harvesting**: Storing rainwater in ponds or tanks for supplemental irrigation (ICAR-CRIJAF, 2022) [14-18].
6. **Mulching**: Reduces surface evaporation and improves moisture conservation.
7. **Alternate Wetting and Drying (AWD)**: Helps minimize excessive water use while maintaining soil health (Kundu *et al.*, 2019) [24-27].
8. **Avoid Water Logging**: Implement proper drainage to reduce diseases and physiological stress.
9. **Irrigate at Critical Stages**: Such as germination and vegetative growth to ensure uniform crop establishment (Singh & Yadav, 2020) [38-40].
10. **Use Clean Water for Retting**: Essential for improving fiber color and strength and reducing contamination (ICAR-CRIJAF, 2022) [14-18].

Pest and Disease Management

Major Pests

Key pests include stem weevils, jute hairy caterpillars, and semiloopers. Management strategies involve:

- Seed treatment with bioagents (*Trichoderma*, *Pseudomonas fluorescens*).
- Neem oil sprays (3-5%) and mechanical removal of pest-infested plants.
- Conservation of natural enemies like ladybird beetles and spiders (Singh & Yadav, 2020) [38-40].

Table 4: Major Pest of Jute & their management (Singh & Yadav, 2020) [38-40].

Pest	Symptoms	Management
Jute Semilooper (*Anomis sabulifera*)	Caterpillars feed on leaves, causing defoliation.	Spray Neem oil (5%) or Bacillus thuringiensis (Bt). If severe, use Lambda Cyhalothrin (2.5% EC) @ 1 ml/L water.
Yellow Mite (*Polyphagotarsonemus latus*)	Yellowing and curling of leaves, reduced plant vigor.	Spray Neem oil (3%) or Acaricides like Dicofol (0.05%).
Aphids (*Aphis gossypii)*	Sucks sap from young leaves, leading to curling and stunted growth.	Introduce ladybird beetles as natural predators. Use Imidacloprid (0.3 ml/L water) if infestation is severe.
Stem Weevil (*Apion corchori*)	Larvae bore into stems, causing wilting and fiber quality loss.	Apply Beauveria bassiana (biocontrol fungus). Use Chlorpyrifos (2.5 ml/L water) in case of severe attack.

Major Diseases:

Common diseases include stem rot, root rot, and anthracnose. Control measures include:

- Crop rotation with rice or mustard.
- Use of resistant varieties (e.g., JRO-524, JRO-8432).
- Fungicide application only when disease levels exceed threshold (ICAR-CRIJAF, 2022) [14-18].

Table 5: Major Diseases of Jute & their management (Singh & Yadav, 2020) [38-40].

Disease	Symptoms	Management
Stem Rot (*Macrophomina phaseolina*)	Black lesions on stems, wilting, and lodging.	Use disease free seeds and follow crop rotation. Apply *Trichoderma viride* (5 g/kg seed) before sowing.Drench soil with Carbendazim (1 g/L water) if needed.
Root Rot (*Rhizoctonia solani*)	Yellowing, root decay, and plant death.	Apply neem cake (250 kg/ha) to soil. Drench roots with Copper Oxychloride (3 g/L water).
Anthracnose (*Colletotrichum corchori*)	Brown leaf spots, premature defoliation.	Spray Mancozeb (2 g/L water) or Copper Fungicides.
Mosaic Virus (Jute Leaf Curl Virus)	Yellow mottling, curling of leaves, stunted growth.	Use virus free seeds. Remove infected plants to prevent spread. Control aphids (virus vectors) with Neem oil (5%).

Integrated Pest & Disease Management (IPDM) Strategies

1. **Crop Rotation:** Avoid continuous jute cropping in the same field. Use Jute-Paddy-Mustard rotation (Ghorai *et al.*, 2021) [4-5].
2. **Resistant Varieties:** Grow resistant varieties like JRO 524 (Navin), JRO 632, and JRC 321 (Sarkar *et al.*, 2017) [33-37].
3. **Seed Treatment:** Treat seeds with *Trichoderma viride* (5 g/kg) or Carbendazim (2 g/kg) before sowing (Sinha & Dutta, 2014) [41, 42].
4. Intercropping with Green Gram/Mustard reduces pest attacks (ICAR-CRIJAF, 2020) [9-13].
5. Introduce Predators (Ladybird Beetles, Spiders) for natural pest control (Chakraborty *et al.*, 2015) [1-2].
6. Use Neem Oil (3-5%) Spray for aphid and mite control (Sarkar & Dutta, 2018) [31].
7. **Weed Removal:** Remove infected plants and weeds that host pests (Ghosh & Bhattacharya, 2012) [6-7].
8. **Selective Pesticide Use:** Apply chemicals only if pest levels exceed Economic Threshold Levels (ETL) (FAO, 2020) [3].
9. Use botanical extracts like Neem (Azadirachtin 1%) for insect control (Kumar *et al.*, 2016) [20, 21].
10. Apply *Trichoderma*-based biofungicides for disease control (ICAR-CRIJAF, 2020) [9-13].
11. Promote trap crops (marigold, mustard) to divert pests away from jute (Ghorai *et al.*, 2021) [4-5].
12. Adopt Integrated Pest & Disease Management (IPDM) to reduce chemical dependency (FAO, 2020) [3].
13. Follow proper irrigation & drainage to minimize disease outbreaks (Sarkar *et al.*, 2017) [33-37].
14. Use biological control agents like *Trichoderma*, *Beauveria bassiana*, and Neem oil (ICAR-CRIJAF, 2020) [9-13].
15. Monitor fields regularly to identify pest/disease symptoms early (Ghosh & Bhattacharya, 2012) [6-7].

Weed Management

Integrated weed management (IWM) practices include

1. High seed rates to suppress early weed growth.
2. Timely hand weeding (15-60 DAS).
3. Mulching and intercropping with pulses (e.g., green gram).
4. Pre-emergence herbicides like pendimethalin (0.75-1.0 kg a.i./ha) (Kumar & Thakur, 2021) [19, 22, 19, 22].

Table 6: Major Weeds in Jute Field (Kumar & Thakur, 2021)

Type	Common Weeds	Impact
Grasses	*Cynodon dactylon* (Bermuda Grass), Echinochloa crus-galli (Barnyard Grass)	Competes for nutrients and space
Broadleaf Weeds	*Alternanthera sessilis*, *Trianthema portulacastrum*	Reduces fiber yield
Sedges	*Cyperus rotundus* (Nut Grass), *Cyperus iria*	Difficult to control and aggressive

Table 7: Recommended IWM Schedule in Jute (Kumar & Thakur, 2021) [19, 22].

Stage	Method
Before Sowing	Deep plowing to expose weed seeds.
1-2 DAS	Apply Pendimethalin 1 kg/ha (pre-emergence herbicide).
15-20 DAS	First hand weeding + Quizalofop-ethyl (for grasses).
35-40 DAS	Second hand weeding + Imazethapyr (for broadleaf & sedges)
50-60 DAS	Spot weeding if necessary.

Integrated Weed Management (IWM) Strategies

1. High Seed Rate (6-7 kg/ha): Helps jute outcompete weeds (Ghosh & Bhattacharya, 2012) [6-7].
2. Timely Sowing: Sowing jute at the right time (mid-March to April) ensures better crop establishment (Sarkar *et al.*, 2017) [33-37].
3. Crop Rotation: Rotating jute with paddy or mustard reduces weed pressure (ICAR-CRIJAF, 2020) [9-13].
4. Mulching: Application of straw, dry leaves or plastic mulch helps suppress weed growth (Chakraborty *et al.*, 2015) [1-2].

Weeding with Hand Tools

i) First Weeding (15-20 DAS)- Essential for early stage weed removal (Sarkar *et al.*, 2017) [33-37].

ii) Second Weeding (35-40 DAS)- Controls emerging weeds and prevents seed formation (ICAR-CRIJAF, 2020) [9-13].

iii) Third Weeding (50-60 DAS)- Final weeding if needed (Ghorai *et al.*, 2021) [4-5].

5. Inter row Cultivation with Hoe & Bullock drawn Implements improves aeration and reduces weed competition (Ghosh & Bhattacharya, 2012) [6-7].
6. Use of Bioagents: Certain natural enemies help suppress weed growth (Chakraborty *et al.*, 2015) [1-2].
7. Fungal Bioherbicides: Colletotrichum truncatum (effective against *Cyperus rotundus*) (Hoque *et al.*, 2013) [8].
8. Allelopathic Crops: Intercropping jute with green gram or cowpea helps suppress weeds (Sinha *et al.*, 2014) [41, 42].
9. Combine different weed control methods for long term effectiveness (FAO, 2020) [3].
10. Use pre-emergence herbicides like Pendimethalin for early weed suppression (Kumar *et al.*, 2016) [20, 21].
11. Avoid excessive weeding after 45 DAS to prevent crop root disturbance (ICAR-CRIJAF, 2020) [9-13].
12. Intercropping with pulses (Green Gram, Cowpea) reduces weed growth (Sinha *et al.*, 2014) [41, 42].
13. Monitor fields regularly and take action before weeds become dominant (FAO, 2020) [3].

Harvesting and Post-harvest Technology

Harvesting

Harvesting at 50% flowering stage (120-150 days) ensures optimal fibre strength and quality (Sarkar *et al.*, 2017) [33-37]. Plants are cut 5-10 cm above the ground using sickles (Ghosh & Bhattacharya, 2012) [6-7]. In waterlogged fields, uprooting is practiced (ICAR-CRIJAF, 2020) [9-13].

Retting Process (Fiber Extraction Process)

Retting is the microbial decomposition of jute stalks in water to separate fibers from the woody core. Retting involves microbial decomposition of pectins binding the fibre to the stem (Sarkar *et al.*, 2015) [32].

Steps in Retting

- Submerging jute bundles in 60-100 cm deep water with weights (bamboo/stone) (ICAR-CRIJAF, 2022) [14-18].
- Monitoring after 10-15 days for fibre separation (Kundu *et al.*, 2016) [23].
- Washing, stripping, and shade drying of fibres to preserve color and strength (ICAR-CRIJAF, 2022) [14-18].

Table 8: Retting Method in Jute (Sarkar *et al.*, 2015) [32]

Retting Method	Description	Suitability
Traditional Water Retting	Stems are submerged in slow-flowing, clear water for 10-15 days.	Commonly practiced but time consuming.
Accelerated Retting	Use of microbial retting agents (CRIJAF SONA, Pectinolytic Bacteria) to speed up retting.	Reduces retting time to 7-10 days.
Tank Retting	Jute bundles are soaked in artificial tanks with a controlled microbial environment.	Suitable for water scarce areas.

Fibre Extraction and Grading

Stripped fibres are washed and sun-dried for 2-3 days. Grading is based on fineness, color, and strength. High-quality fibres fetch premium prices, especially golden-brown, lustrous fibres preferred by export markets (Kundu *et al.*, 2019) [24-27].

Stripping (Fiber Separation)

1. After retting, fibers are stripped manually from the softened stalks (Sarkar *et al.*, 2017) [33-37].
2. The stripped fibers are washed thoroughly in clean running water (ICAR-CRIJAF, 2022) [14-18].

Washing and Sun Drying

1. After washing, fibers are dried in the sun for 2-3 days (Ghosh & Bhattacharya, 2012) [6-7].
2. Proper drying is essential to maintain color and prevent fungal growth (Kundu *et al.*, 2016) [23].

Sorting and Grading

1. Dried fibers are sorted based on color, strength, and fineness (ICAR-CRIJAF, 2022).
2. Golden brown, strong, and fine fibers are of higher quality (Kundu *et al.*, 2016) [23].

Yield and Varietal Performance

Jute varieties are classified into two species

1. **Corchorus capsularis (White Jute):** Suitable for waterlogged areas (ICAR-CRIJAF, 2022) [14-18].
2. **Corchorus olitorius (Tossa Jute):** Higher fiber quality and yield (Sarkar *et al.*, 2017) [33-37].

Adoption of high-yielding varieties (HYVs), efficient nutrient management and improved retting methods can further increase yield by 20-25% (Singh & Yadav, 2020) [38-40].

Yield scenario of Jute

1. **National average yield:** 2.5-3.0 t/ha (ICAR-CRIJAF, 2022) [14-18]
2. **Bihar average yield:** 2.8-3.2 t/ha (Ghorai *et al.*, 2021) [4-5].
3. **Katihar yield:** 3.0-3.5 t/ha (attributed to favourable soil and climate conditions) (Ghorai *et al.*, 2021) [4-5].

Table 9: High Yielding Jute Varieties (HYVs) (Ghorai *et al.*, 2021) [4-5].

Variety	Type	Yield (tons/ha)	Fiber Quality	Maturity (Days)	Special Traits
JRO 524 (Navin)	Tossa	3.2-3.5	Fine	130-135	Disease resistant
JRO 8432 (Shakti)	Tossa	3.5-3.8	Strong, fine	120-130	High biomass
JRC 321	White	2.8-3.2	Moderate	130-140	Suitable for waterlogged areas
JRO 66 (Sudhir)	Tossa	3.0-3.4	Golden	125-135	Drought resistant
JRC 80	White	2.5-3.0	Moderate	130-140	Suitable for late sowing

Harvesting and Processing Strategies

1. Choose high yielding varieties (HYVs) for better returns (Singh & Yadav, 2020) [38-40].
2. Use quality seeds (certified seeds improve yield by 15-20%) (ICAR-CRIJAF, 2020) [9-13].
3. Ensure proper nutrient and irrigation management (Ghorai *et al.*, 2021) [4-5].
4. Harvest at the right time (50% flowering stage) for best fiber quality (Sarkar *et al.*, 2017) [33-37].
5. Adopt timely retting techniques for high quality fiber (Kundu *et al.*, 2016) [23].
6. Use microbial retting (CRIJAF SONA) to reduce retting time and improve fiber color (ICAR-CRIJAF, 2020) [9-13].
7. Ensure retting in clean, slow-moving water for uniform fiber separation (Sarkar *et al.*, 2017) [33-37].
8. Dry fibers properly under shade to prevent discoloration (Kundu *et al.*, 2016) [23].
9. Adopt sorting and grading practices for better market prices (Kundu *et al.*, 2016) [23].

Challenges in Katihar Region

Despite its potential, Katihar faces several challenges

1. Erratic rainfall and drought events.
2. Water scarcity for retting due to pollution and declining water bodies.
3. Nutrient depletion from continuous cropping.
4. Labour-intensive harvesting and retting methods.
5. Low mechanization and lack of retting tanks.
6. Market volatility and absence of stable Minimum Support Price (MSP).
7. Middlemen dominance reducing farmer profits.
8. Competition from synthetic packaging materials.

Probable Solutions

Key interventions include

1. Adoption of HYVs such as JRO-524 and JRO-8432.
2. Promotion of microbial retting agents like CRIJAF SONA to improve fibre quality and reduce retting time.
3. Development of irrigation infrastructure and rainwater harvesting.
4. Mechanization to reduce labour dependency.
5. Strengthening farmer cooperatives and direct market linkages.
6. Implementation of MSP and government procurement schemes.
7. Extension programs for training on improved cultivation, harvesting and marketing practices.

Opportunities and Future Prospects

Katihar has significant growth potential in jute and fibre crop production:

1. **Policy support:** Jute Packaging Materials Act (1987) mandates use of jute for packaging, ensuring demand.
2. **Value addition:** Handicrafts, home décor, eco-friendly bags, and bio-composites.
3. **Export opportunities:** Branding Katihar as a centre for premium jute products.
4. **Industrial development:** Scope for establishing fibre processing mills and industrial clusters.
5. **Employment generation:** Large potential for rural youth in weaving, handicrafts, and small-scale enterprises.

Conclusion

Fibre crops, particularly jute, represent a sustainable and economically vital sector for the Katihar region. The combination of favourable agro-climatic conditions, traditional farming expertise, and government support positions Katihar to become a major hub for eco-friendly fibre production. Overcoming challenges through technological innovation, mechanization, improved retting, and stronger market systems will be key to maximizing this potential. With integrated efforts, Katihar can ensure economic prosperity for farmers while promoting environmental sustainability.

References

1. Chakraborty K, Mandal N, Majumdar B. Biological control of insect pests in jute: Present status and future prospects. Indian Journal of Agricultural Sciences. 2015;85(5):623-628.
2. Chakraborty K, Mandal N, Majumdar B. Biological control options in weed management for jute. Indian Journal of Weed Science. 2015;47(2):160-165.
3. FAO. Integrated weed management: Principles and practices. Rome: Food and Agriculture Organization of the United Nations; 2020.
4. Ghorai AK, Sinha MK, Mandal S. Recent advances in integrated weed management of jute. Journal of Natural Fibre Research. 2021;19(2):85-93.
5. Ghorai AK, Sinha MK, Mandal S. Varietal performance and yield enhancement in jute cultivation in eastern India. Journal of Natural Fibre Research. 2021;19(2):55-62.
6. Ghosh GK, Bhattacharya S. Harvesting and fibre extraction techniques in jute. Indian Journal of Agricultural Sciences. 2012;82(3):281-286.
7. Ghosh GK, Bhattacharya S. Weed and pest management in jute ecosystem. Indian Journal of Weed Science. 2012;44(3):189-193.
8. Hoque MS, Hasan MS, Alam MM. Efficacy of Colletotrichum truncatum as a potential mycoherbicide against Cyperus rotundus. Archives of Phytopathology and Plant Protection. 2013;46(10):1215-1222.
9. ICAR-CRIJAF. Integrated pest and disease management in jute. Barrackpore: ICAR-Central Research Institute for Jute and Allied Fibres; 2020.
10. ICAR-CRIJAF. Jute cultivation and production technology. Barrackpore: ICAR-Central Research Institute for Jute and Allied Fibres; 2020.
11. ICAR-CRIJAF. Jute fibre grading standards and marketing practices. Barrackpore: ICAR-Central Research Institute for Jute and Allied Fibres; 2020.
12. ICAR-CRIJAF. Jute production technology package. Barrackpore: ICAR-Central Research Institute for Jute and

Allied Fibres; 2020.
13. ICAR-CRIJAF. Weed management in jute: Guidelines for farmers. Barrackpore: ICAR-Central Research Institute for Jute and Allied Fibres; 2020.
14. ICAR-CRIJAF. CRIJAF SONA and microbial retting innovations for jute. Barrackpore: ICAR-Central Research Institute for Jute and Allied Fibres; 2022.
15. ICAR-CRIJAF. Handbook of Jute and Allied Fibres. Barrackpore: Central Research Institute for Jute and Allied Fibres; 2022.
16. ICAR-CRIJAF. Improved post-harvest technology in jute. Barrackpore: ICAR-Central Research Institute for Jute and Allied Fibres; 2022.
17. ICAR-CRIJAF. Improved retting methods for quality jute fibre. Barrackpore: ICAR-Central Research Institute for Jute and Allied Fibres; 2022.
18. ICAR-CRIJAF. Jute and Allied Fibre Crops: Production Technologies and Practices. Barrackpore: Central Research Institute for Jute and Allied Fibres; 2022.
19. Kumar A, Thakur MB. Weed and water management strategies in jute-based cropping systems. Indian Journal of Weed Science. 2021;53(3):285-290.
20. Kumar A, Singh R, Yadav M. Herbicide use and management in fibre crops. Plant Protection Bulletin. 2016;68(1):38-42.
21. Kumar A, Singh R, Yadav M. Use of botanicals for pest management in fiber crops. Plant Protection Bulletin. 2016;68(1):45-49.
22. Kumar MB, Thakur AK. Integrated crop management practices for sustainable jute production in Bihar. Journal of Plant Science Innovations. 2021;6(2):45-52.
23. Kundu A, Dey SK, Mukherjee D. Advances in jute retting and fibre quality improvement. Journal of Natural Fibers. 2016;13(5):602-611.
24. Kundu A, Sinha MK, Dutta S. Quality assessment and grading of jute fibres for domestic and export markets. Indian Journal of Fibre & Textile Research. 2019;44(1):7-13.
25. Kundu DK, Mondal SS, Pal SK. Water management strategies for jute cultivation under changing climatic scenario. Indian Journal of Agronomy. 2019;64(3):332-338.
26. Kundu D, Banerjee R, Sarkar S. Impact of improved retting and cultivation techniques on jute fibre quality. Indian Journal of Fibre & Textile Research. 2019;44(3):287-295.
27. Kundu P, Sarkar S, Banerjee S. Natural fibers: Scope and opportunities for Indian agriculture. Indian Journal of Agricultural Sciences. 2019;89(2):210-218.
28. Ministry of Agriculture & Farmers Welfare. Annual Report 2022-23. New Delhi: Government of India; 2023.
29. Ministry of Textiles, Government of India. Annual Report on Jute Sector and Allied Industries. New Delhi; 2023.
30. Ministry of Textiles. Jute Statistics and Policy Report. New Delhi: Government of India; 2023.
31. Sarkar SK, Dutta S. Eco-friendly pest management in jute. Journal of Biological Control. 2018;32(2):71-77.
32. Sarkar SK, Dutta S, Ghorai AK. Microbial retting of jute: Recent developments and prospects. Indian Journal of Fibre & Textile Research. 2015;40(1):1-8.
33. Sarkar SK, Dutta S, Ghorai AK. Breeding for pest and disease resistance in jute. Indian Journal of Genetics and Plant Breeding. 2017;77(1):15-23.
34. Sarkar SK, Dutta S, Ghorai AK. Cultural and chemical methods for weed control in jute. Indian Journal of Agricultural Sciences. 2017;87(4):457-462.
35. Sarkar SK, Dutta S, Ghorai AK. Improved harvesting and post-harvest technology of jute. Indian Farming. 2017;67(12):24-27.
36. Sarkar SK, Dutta S, Ghorai AK. Improvement in jute varieties for better fibre quality and yield. Indian Journal of Agricultural Sciences. 2017;87(4):457-462.
37. Sarkar SK, Dutta S, Ghorai AK. Post-harvest handling and grading of jute. Indian Farming. 2017;67(12):28-31.
38. Singh DP, Yadav JS. Advances in jute cultivation and pest management strategies. Indian Journal of Agricultural Sciences. 2020;90(7):1123-1131.
39. Singh R, Yadav AK. Integrated nutrient and pest management in jute: A practical approach. Journal of Plant Protection Sciences. 2020;12(1):55-64.
40. Singh R, Yadav MK. Impact of improved varieties and agronomic practices on jute productivity. Indian Farming. 2020;70(1):33-36.
41. Sinha MK, Dutta S. Seed treatment in jute: A vital component of integrated disease management. Journal of Mycology and Plant Pathology. 2014;44(1):74-77.
42. Sinha MK, Ghorai AK, Dutta S. Allelopathic potential of intercrops in weed management of jute. Journal of Crop and Weed. 2014;10(2):128-131.