

Agronomy – Kharif Crops

Jute

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JUTE

Botanical name: *Corchorus* sp.

Family: Tiliaceae

Chromosome number: 2n=14

Jute is cultivated for its bast (stem)



fibre obtained from 2 cultivated species of *Corchorus capsularis* and *C. olitorius*. The fibre has great utility in both domestic and industrial uses. It is used for making various types of ropes, rugs, carpets, mats, coarse woolen fabric (druggets), cloth (hessians) and sacks to store foodgrains. It is also used in making coarse canvas for wrappings, wall covers; its blend gives good blanket and clothing. Of the various trade goods, sacking constitutes the major utility followed by hessians. *C. olitorius* and *C. capsularis* contribute to 78 and 10% of the total fibre sources of the country.

The sticks are used as fuel and lighting material, and for making gun powder and charcoal. In paper industry, these are used as raw material for coarse paper and resin cloth. Resin bonded and pressed jute sticks make durable hard boards.

Origin

The genus *Corchorus* has 2 cultivated species. *C. olitorius* L. is widely cultivated, and has originated from Africa (primary center of origin) with India or Indo-Myanmar region as its secondary center of origin. This species has been reported from Africa, Asia and Northern Australia. The other cultivated species *C. capsularis* is found in Indo-Myanmar and South China region, but not in Africa and Australia. It has originated from Indo-Myanmar region including South China. In India, nine species of *Corchorus* (7 wild and 2 cultivated) have been reported so far. *C. capsularis* is commonly distributed in north-eastern parts of India, and gradually becomes scarce towards west, whereas *C. olitorius* is more common in western and north-western India.

Geographic distribution

Jute is mainly cultivated in India and Bangladesh, Besides, these two countries it is also grown to some extent in China, Myanmar, and Nepal (Table 1)

Table 1. Area, production and productivity of Jute in major producing countries (2004)

Country	Area (m ha)	Production (m t)	Productivity (t/ha)
Bangladesh	0.437	0.800	1.831
China	0.036	0.068	1.889
India	0.820	1.900	2.317
Myanmar	0.030	0.026	0.867
Nepal	0.011	0.016	1.433

Source: FAO Production Year Book, 2004

In India, the most important jute producing state is West Bengal, contributing more than 75% of India's total production of 1.69 million tonnes (Table 2). Other states are Assam, Andhra Pradesh and Bihar

Table 2. Area, production and productivity of jute in important states of India (2004-05)

	Area (000 ha)	Production (000 bales)*	Productivity (kg/ha)
Andhra Pradesh	58.0	410.4	1274
Assam	134.5	1056.2	1414
Jharkhand	0.1	1.1	1980
Orissa	5.0	41.0	1476
West Bengal	569.0	7853.0	2484
India	773.9	9399.3 (1.69 mt)	2186

*Bale: 180 kg

Source: Fertilizer association of India, 2006

Classification

Genus *Corchorus* has 2 species viz. *olitorius* (It is raised on well drained high lands only), and *capsularis* (It is more popular and widely grown). The plant has tap root system with numerous lateral branches. It is hardy in nature and can grow well both on high and low lands and is able to tolerate waterlogging conditions to some extent). Jute growing areas in India may be divided into the following 8 agro-climatic zones.

1. *Lower Bengal* (The Ganga Riverine Tract): This is primarily *C. olitorius* raising tract with JRO 632 as a standard variety. This tract includes 24 Pargana, Hoogly, Nadia and Murshidabad districts.
2. *Malda, Dinajpur*: Both species of jute (*C. olitorius* and *C. capsularis*) are raised in this tract comprising Malda and West Dinajpur districts.
3. *North Bengal and Brahmaputra Valley New Alluvium*: This tract is spread into Cooch-Bihar and Jalpaiguri districts of West Bengal, and Golpara, Kamrup, Nowgoan districts of Assam. This is mainly *C. capsularis* raising tract with JRC 321 in low lying areas, and JRC 212 in rest of the areas. On uplands, *C. olitorius* variety JRO 632 is also raised.
4. *Tripura, Cachora Area of Old Alluvium*: This tract is very small, but productivity is very high. *C. capsularis* is mainly grown in this tract.
5. *Kosi area – Purnea and Saharsa*: Purnea and Saharsa are important jute raising districts of Bihar. This is a *C. capsularis* raising tract but *C. olitorius* is also raised on a very small area.
6. *Muzaffarpur, Darbhanga area*: This is a *C. capsularis* growing tract.
7. *West Bihar and eastern Uttar Pradesh*: This tract includes Champaran district of Bihar, and Bahraich, Sitapur and Lakhimpur Kheri districts of Uttar Pradesh. This is *C. capsularis* raising tract.

8. *Cuttack-Balasore area*: This tract includes Cuttack, Balasore, Sambalpur and Puri districts of Orissa. This is mainly *C. capsularis* raising tract, but *C. olitorius* is also cultivated under upland conditions.



Corchorus olitorius(Source: http://commons.wikimedia.org/wiki/Image:Corchorus_olitorius.jpg)



Corchorus Capsularis. .(Source: <http://art-handbook.com/surfaces.html>)

Botanical Description

Jute is a herbaceous annual plant. Although both the species of jute (*C. capsularis* and *olitorius*) are alike in general appearance, there are considerable differences between them as given hereunder.

Character	<i>C. capsularis</i>	<i>C. olitorius</i>
Stem	Conical, base diameter tapering sharply towards apex. Pigmentation varies from green to dark red with various intermediate shades. Periderm develops prominently at base. Technical height is more. Stem is branched or unbranched.	Cylindrical, base diameter tapering gradually towards apex. Pigmentation is green or light red or deep red. Shades of colour are fewer. Periderm is absent. Technical height is less than <i>capsularis</i> . Stem is branched usually.
Leaves	Leaves are dull. Tastes bitter owing to presence of glucoside corchorin, hence called <i>tita pat</i> . Leaves are lanceolate, oblong with coarsely toothed margin. Lower most pair of serrations enlarged and end in filiform appendages.	Leaves with shining upper surface and rough under surface. Taste less or slightly sweet, hence called <i>mitha pat</i> . Leaves are elliptic to ovate with smoothly serrated margin. Lower most pair of serrations enlarged and end in filiform appendages that are long and prominent.

Flowers	Small with 5 yellow-pale yellow sepals. Ovary is round, anthers have 20-30 stamens.	Larger (2-5 times that of <i>capsularis</i>) with 5-6 coloured or green sepals, ovary is elongated; anthers have 30-60 stamens.
Pods	Rounded, 1-5 cm diameter with flat tops, wrinkled with green, yellowish to copper coloured and 5 locular. The fruits are internally divided by 5 septa and dehisce into 5 segments	Cylindrical-long (6-10 cm long 0.3-0.8 cm diameter) green capsule with 5-6 locules.
Seeds	Copper coloured, 2-3 mm long with 7-10 seeds in 2 rows in each locule with transverse partition between seeds. Contains 35-50 seeds/pod with a test weight of about 2 g.	Bluish green to steel grey coloured with 25-40 small seeds/row with transverse partition between each seed. It contains 125-200 seeds/pod with a test weight of about 3.33 g.
Fibre	Ordinarily whitish, hence called white jute for trade purposes. The fibre layers are more (10-24) with more fibre bundle/cross section (2573)	Frequently finer, stronger and more lustrous than <i>capsularis</i> with yellowish or greyish fibre (<i>tossa</i> jute). The fibre layers are less (8-19) with less fibre bundles/cross section (2181).
Roots	Less deeper, having more lateral roots and is tolerant to water logging. Root:shoot ratio is less (1:7)	Deeper with less number of lateral roots and less tolerant to water logging. Root:shoot ratio is more (1:12).

Climate

Jute is a crop of humid tropical climates. It thrives well in areas with well distributed rainfall of 2,500 mm spread over vegetative growth period of the crop with no cloudiness. Locations with a mean rainfall of <1,000 mm, incessant rainfall and waterlogging are not suitable for its cultivation. For better growth, a mean maximum and minimum temperature of 34°C and 15°C and a mean relative humidity of 65% is required. Temperatures below 15°C and above 43°C during growth are not suitable for jute crop. *C. olitorius* can not withstand waterlogging, however, *C. capsularis* can withstand water logging, but its fibre quality is impaired with prolonged water stagnation. At a temperature below 10°C no germination occurs in both the species. *C. capsularis* can withstand higher temperature at germination (up to 32°C), while *C. olitorius* is sensitive to such high temperatures.

Soil and its preparation

Jute can be raised on all kinds of soils from clay to sandy loam, but loamy alluvial are best suited. Laterite and gravel soils are not suitable for this crop. The new grey alluvial soils of good depth, receiving silt from the annual floods are the best for jute cultivation. A soil pH of 5.0-7.4 is within the tolerable limit of soil reaction. Soils with acidic pH (<4.5), effective soil depth <50 cm, electrical conductivity >2 dS/m and exchangeable sodium percentage >15 are not suitable for the crop. The crop is raised successfully on old alluvial soils of Bihar, mild acidic soils of Assam, Orissa, and light alkaline soils of *tarai* districts of Uttarakhand. It has

been observed that clay loam for *C. capsularis* and sandy loam for *C. olitorius* are most suitable soil types.

Jute seeds being small require very fine tilth. The land can be prepared by ploughing and cross-harrowing 3-5 times followed by planking. In acidic soils (pH <6.0), incorporation of 1-1.5 t/ha of lime, 30-40 days before sowing is necessary for better crop performance. Soil moisture between 21-45% is considered ideal for proper germination.

Sowing

Time of sowing

C. capsularis sowing starts from late February, whereas that of *C. olitorius* in early April and continues up to mid June. In Bihar and Uttar Pradesh, sowing is done up to mid July as per the onset of monsoon. In lowlands, February sowing is ideal, as it helps in avoiding waterlogging in early crop growth phases. In mid-lands and uplands, March-April sowing is preferred. For *capsularis*, March-April and for *olitorius* April-May is the optimum sowing time.

Method of sowing

Broadcast sowing is the most common method. Owing to the small size of seeds, small quantity of seed is required. To ensure even distribution of seed, they are mixed with 3-4 times well powdered soil and broadcast cross-wise. Immediately after sowing, the soil is harrowed and planked for covering the seeds. In broadcast crop, weeding is difficult and cumbersome owing to uneven distribution of plants. Hence line sowing behind a plough or using seed drill are preferred for ease of interculture.

Seed rate and spacing

Seed rate varies with method of sowing and species to be grown. For broadcast sowing, 6 and 10 kg seed/ha of *olitorius* and *capsularis* are required. Line sowing needs 4 and 6 kg seed/ha only.

The seeds are sown in row 20 cm (*olitorius*) and 30 cm (*capsularis*) apart. The plants within the row should be thinned manually at 2 stages. First thinning is done 20 days after sowing (DAS), when the plants are of 5-10 cm. At this stage, plants are thinned to a distance of 5 cm. In second and final thinning 35 DAS, when plants are 12-15 cm height, and are thinned to a distance of 10 cm. Thus the optimum population varies from 3.33 (*capsularis*) to 5.0 lakh/ha (*olitorius*).

Varieties

The important varieties of jute for different states are given below.

Important varieties of jute recommended for different states for cultivation

State	Recommended varieties	
	Corchorus olitorius	Corchorus capsularis
Assam	JRO 524 (Navin), JRO 632 (Baisakhi tossa), JRO 7835 (Vasudev), JRO 66, JRO 8432, JRO 128 (Surya), JRO 878, JRO 36E, S 19, Subala	JRC 212 (Sabuj sona), JRC 321 (Sonali), JRC 7447 (Shyamali), UPC 94 (Reshma), Hybrid C (Padma), JRC 1108, Bidhan Pat 3 (D-110), Bidhan Pat 1, Bidhan Pat 2, Fanduk, D-154, UPC 7716, C-80, CIN 178, CO 234

State	Recommended varieties	
Bihar	JRO 524, JRO 7835, JRO 66, JRO 8432, JRO 128 (Surya), JRO 632, JRO 878, JRO 36E, S 19, Subala	JRC 212, JRC 321, JRC 7447, KTC 1 (Rajendra Sada Pat), UPC 94, JRC 698, Bidhan Pat 3 (D-110), Bidhan Pat 1, Bidhan Pat 2, Fanduk, D-154, C 80, CIN 178, CO 234
Orissa	JRO 524, JRO 632, JRO 878 (Chaitali tossa), JRO 7835, TJ 40 (Mahadev), KOM 62 (Rebati), JRO 878, KOM 9	JRC 212, JRC 7447, UPC 94, JRC 4444 (Baldev), KC 1 (Jaydev), JRC 1108, Bidhan Pat 1, Fanduk, JRC 321
Uttar Pradesh	JRO 524, JRO 3690 (Sabitri), JRO 66, JRO 8432, JRO 128 (Surya), JRO 632, JRO 878, JRO 7835, JRO 36E, S 19, Subala, Co 234	JRC 212, JRC 321, JRC 7447, UPC 94, JRC 1108, Bidhan Pat 3 (D-110), Bidhan Pat 1, Bidhan Pat 2, Fanduk, D-154, C 80, CIN 178, Co 234
West Bengal	JRO 632, JRO 3690, JRO 524, JRO 7835, JRO 878, JRO 66, JRO 8432, JRO 128 (Surya), S 19, Subala	JRC 212, JRC 321, JRC 7447, UPC 94, JRC 1108, Padma (Hybrid C), JRC 698, Bidhan Pat 3 (D-110), Bidhan Pat 1, Bidhan Pat 2, Fanduk, D-154, C-80, CIN 178, Co 234

Manures and Fertilizers

In general, the nutrient requirement of *capsularis* is more than that of *olitorius*. In soils with low organic carbon content, FYM application @ 5-10 t/ha, a month prior to crop sowing is recommended. The leaf fall from the standing crop and also root stubbles left in the soil after harvest results in recycling of handsome amount of nutrients besides organic matter in intensive cropping systems. The recommended doses of fertilizers are 20 to 60 – 20 to 30 – 20 to 50 (*olitorius*) and 40 to 80 – 40 to 50 – 60 to 80 (*capsularis*) kg/ha of N-P₂O₅-K₂O respectively.

In heavy soils with low to moderate rainfall, all nutrients are applied as basal. In light soils and high rainfall situations, N is applied in 2 equal splits, ½ basal and ½ top dressing, i.e. preferably after weeding and thinning operations. Seed inoculation with *Azotobacter chroococum* and *Azospirillum brasilense* has been found promising to supplement part of N fertilizer. Foliar application of 20 kg N through urea solution with teepol as sticker at pre-flowering stage is promising. In acidic soils, P gets fixed; hence, their placement is better. K is usually applied as basal, but in leaching prone soils, split application is ideal.

In acid soils and regions with high rainfall, calcium and magnesium deficiency is common. Liming of soil @ 2-5 t/ha, once in 4 years or Dolomite application (40 kg MgO) is found promising as it supplies both calcium and magnesium.

Water management

Jute is sensitive to both drought and waterlogging. The crop sown during the months of February-April requires irrigation till the onset of monsoon. At germination and knee-high stages, adequate soil moisture must be ensured by irrigation. In general, after pre-sowing irrigation, monthly irrigation till onset of monsoon may be necessary. During rainy season,

the crop experiences waterlogging that adversely affect fibre quality. Provision of quick drainage in uplands will be beneficial to the crop. However, in lowlands, it may not be feasible.

Weed management

The crop suffers from heavy weed infestation in the initial 6-8 weeks after sowing. Two-three hand weedings or mechanical hoeings are required to arrest weed menace. The first 2 manual weedings are combined with thinning operations at 20 and 35 DAS. The third weeding should be done 55-60 DAS. Due to continuous rains, sometimes manual weeding may not be possible. In such a situation, herbicide integrated with manual weeding is promising. Fluchloralin (pre-plant incorporation, 3-7 days before sowing) or pendimethalin (pre-emergence, 1-2 days after sowing) @ 0.75-1.0 kg/ha combined with one hand weeding at 35DAS may effectively control the weeds. Recommended post-emergence herbicides for weed control include MSMA (mono sodium methane arsenate) @ 4-5 kg/ha and dalapon @ 6 kg/ha. They should be applied 20 days after sowing.

Cropping Systems

Jute can be intercropped with greengram and groundnut. Greengram is sown in lines 40 cm apart. After 1 month 2 rows jute variety JRO 878 or JRO 7835 are sown in between greengram rows. Groundnut is sown in 60 cm rows in mid January (in eastern India only) and 2 rows of jute 'JRO 878' or 'JRO 7835' are sown in between groundnut rows in the end of March. In seed crop of jute, intercropping of urdbean is promising.

The following crop rotations are adopted in jute-growing areas.

Irrigated areas

Jute + greengram-paddy-potato

Jute-paddy-potato

Jute-paddy-gram

Jute-paddy-wheat

Jute-paddy-mustard

Jute-paddy-barley

Cowpea-jute-potato

Jute-paddy-berseem

Rainfed areas

Jute-paddy-pulses

Jute-gram

Jute-paddy-mustard

Jute-mustard

Jute-paddy

Jute-wheat

Harvesting

Harvesting of the crop at pre-bud or bud stage gives best quality fibre; however, the yields are low. Hence, as a compromise between quality and quantity, early pod formation stage has been found best for harvesting. Harvesting is done by cutting the plants at or close to the ground level with sharp sickles. In flooded lands, the plants are uprooted. The harvested plants are left in the field for 2-3 days for the leaves to shed. Next, the plants are tied into bundles 20-25 cm of diameter and the branching tops are lipped off to rot in the field.

Retting of jute

Retting is an aerobic and anaerobic microbiological process by which the fibres in the bark get loosened and separated from the woody stalk. There are 2 processes of retting of jute. The bundles are kept in 30 cm deep water, and later placed side by side in retting water, usually in 2-3 layers and tied together. They are covered with water-hyacinth or any other weed that does not release tannin and iron. The float is then weighed down with seasoned logs or with concrete blocks or are kept emerged (at least 10 cm below the surface of water)

with bamboo-crating. Clods of earth used as a covering material or as weighing agent produce dark (Shyamla) fibre of low value. Retting is best done in shallow canal with slow running clean water. The optimum temperature is around 34°C. If fibre comes out easily from the wood on pressure from the thumb and fingers, retting is considered complete



Extraction of fibre

The fibre, extracted separately from each reed (stem) with fingers is sleek, clean and free from entanglement. By the beat-break-jerk method, 10-12 reeds are taken at a time, their stiffer root-ends are beaten with a mallet to loosen the fibre. The bundle is then broken in the middle and the fibre is loosened. By gripping this loosened fibre in the middle, the broken bundle is jerked in water so that the sticks slip off. The fibre is then washed in clean water, rung and eventually spread to dry, preferably in shade or mild sun. The second method often leaves the broken sticks and make fibre somewhat entangled resulting in sticky fibre. The extraction of fibre from the green stem with a machine followed by a short period retting has also proved to be successful.



Source: <http://en.wikipedia.org/wiki/Jute>

Yield

The national average is 1.3 tonnes of fibre/ha. However, with improved package of practices, it is possible to get 2.0-2.5 tonnes of fibre yield/ha from improved varieties. If the seed is produced, it may yield about 0.4-0.5 tonnes in case of white jute and 0.25-0.30 tonnes/ha in case of *tossa* jute.

100 yards of hessian = 54 lbs of raw jute

4148 yards of hessian = 1 tonne raw jute (5.55 bales raw jute)

1 tonne of sacking = 1.11 tonne of raw jute (6.17 bales of raw jute)

1 tonne of hessian, sacking etc.=1.05 tonnes raw jute (5.85 bales of raw jute)