SATSA Mukhapatra - Annual Technical Issue **29** : 2025 ISSN 0971-975X

Mesta (*Kudlung*) : Production Technology of Underutilized Crop in Purulia District

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(Received : November 13, 2024; Revised : December 28, 2024; Accepted : January 15, 2025)

ABSTRACT

"Mesta" is a potentially profitable crop which is not in surplus in today's world but proves to be a useful raw material for industrialization and domestic uses. There are, however, two distinct cultivated forms in roselle. The tall non branching types cultivated for fibre purpose are designated as *H. sabdariffa* var. *altissima* Hort. while the bushy and wild types grown mainly for their fleshy edible calyces on their flower buds. In southern India, pickles prepared out of these are most popular. Mesta seed contains 16-22% of oil and 32% of protein, due to which it is used in cooking. Besides, it has unsaturated fatty acid in low proportion which is used in the elaboration of margarine. After the extraction of oil, the residue contains approximately 32% of protein and is used as livestock feed. The seedlings, leaves and fruits are used to make sauces, jellies and wines. Mesta is also gaining global attentions as a source of good quality paper pulp due to increasing shortage of hard wood.

Keywords : Mesta, *Kudlung*, *Hibiscus cannabinus, Hibiscus sabdariffa*, fibre, edible calyces.

Introduction

Mesta is one of the important crops which provides fibre, forage and paper pulp and has broadened our agricultural diversity to reduce pressure on forest resources. It is one of the important bast fibre crops which stand next to jute in production. It is a herbaceous annual plant (lignocellulosic bast fibre crop like jute) believed to be originated from Afro- Asian countries, ranks next to jute in importance (sharing 15% of raw Jute-cum-Mesta fibre production) and comprises of two major distinct cultivated species – *Hibiscus cannabinus* (Kenaf, 2n = 36) and *H. sabdariffa* (Roselle, 2n = 72) belonging to cotton family Malvaceae, order: Malvales). Mesta is more adaptive than jute under diverse conditions of climate and soil and it is also very resistant to drought. It is tougher and stronger than jute fibre but is somewhat coarser and less supple. It, however, equals in quality to the medium grades of jute (Berger, 1969). Mesta has proved as a major substitute for jute and is successfully being grown in tropical and subtropical regions of both the hemispheres. The principal producing countries are India, China, Thailand, Egypt, Sudan, Brazil and Australia. In

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India (2004- 05), area under Mesta is around 1.5 lakh ha with an average fibre production of 10.16 q/ha (Mitra *et. al.*, 2006). The majority of the area (36%) is concentrated in Andhra Pradesh (A.P.) accommodating roselle which shares 51% of estimated fibre production. In A.P., Mesta is concentrated in Srikakulam and Vizianagaram districts accounting for 98.7% area of total area in the State (Sreelatha and Kanaka Raju, 2004). The productivity of Mesta is, however, highest (17.12 q/ha) in West Bengal followed by Andhra Pradesh (14.17 q/ha) and Tripura (13.95 q/ha). Mesta area is likely to be enhanced gradually even in non-traditional areas due to increasing frequency of drought. Of late, even traditional jute growing belts are gradually shifting towards Mesta cultivation. As communicated by concerned Agricultural Development Officers of Kumarganj and Hili blocks of south Dinajpur, West Bengal on 22nd May 2007, it has been learnt that around 40% of the jute area has already been replaced by Mesta primarily due to shortage of adequate rainfall, low input requirement and lesser weed problems. All the existing types of *H. sabdariffa* (roselle) are characterized by slow growth rate and require a longer vegetative period of 180 to 237 days when sown in the optimum period (mid-March to mid-May) and do not flower before the second week of November, irrespective of sowing dates (Chakravarty, 1974). *H. cannabinus* (kenaf) varieties, on the other hand, are quick growing in nature and exhibit considerable variation in their maturity behaviour. In spite of the slow growth rate of roselle, resulting in lesser productivity per unit area per unit time, poor harvest index due to lesser fibre recovery % and inferior fibre quality, it is preferred to be cultivated under rainfed conditions of India (covering more than 80% area) since it is harder and more resistant to drought and can also stand incessant rainfall provided there is no stagnation of water. There are, however, two distinct cultivated forms in roselle. The tall non-branching types cultivated for fibre purpose are designated as *H. sabdariffa* var. *altissima* Hort. while the bushy and wild types grown mainly for their fleshy edible calyces on their flower buds (Chakravarty, 1974). It is the nearest ally of jute and plays an effective role in supplementing the short supply of jute industry. In recent years, this crop is gaining the attention of research workers for its use as a raw material in the paper industry substituting bamboo and eucalyptus the supply of which is becoming scarce day by day. Mesta fibre is used as an alternative to jute fibre or for blending with jute in the manufacture of jute goods *viz.*, cordage, sackings, hessians, canvas and rough sack cloths. It is also used for making ropes, twines, fishing nets etc. The stalks are used in making paper pulp, structural boards, blends with wood pulp and for thatching huts. In recent years, it has been proved that the crop could be allowed to grow till seed setting stage and the sticks after seed collection can be utilized for pulp production to manufacture all types of paper including newsprints. Its seed contains 18 to 20 per cent oil, which can be directly used in soaps and other industries. The crop possesses fleshy red calyces, which are used for preparing natural dyes, jam, jellies, pickles etc. and the leaves for preparing pickles and also as leafy vegetable. It also acts as a natural

fibre substitute for fibre glass. It serves as raw material for automobile dash boards, carpet padding and is also used in molded plastics. In southern India, pickles prepared out of these are most popular (Singh, 1997). Mesta seed contains 16-22% of oil and 32% of protein, due to which it is used in cooking. Besides, it has unsaturated fatty acid in low proportion which is used in the elaboration of margarine. After the extraction of the oil, the residue contains approximately 32% of protein and is used as livestock feed. The seedlings, leaves and fruits are used to make sauces, jellies and wines (Wilson and Menzel, 1964 and 1967). Of late, Mesta is receiving increasing global attentions as a source of good quality paper pulp due to increasing shortage of hard wood. At present Mesta is grown in more than 26 lakh hectares of land area with a production of more than 12 lakh bales. In India, *sabdariffa* Mesta is generally grown in larger parts covering areas from Karnataka to Tripura including West Bengal. In West Bengal it is grown in sandy to sandy-loam marginal lands. Mesta can grow in a wide range of climate and soil conditions. Its cultivation has been restricted due to certain constraints which affect the fibre yields in this crop. But harvesting time is very important in bast fibre crops like Jute and Mesta. From the economic point of view, Mesta fibre production offers distinct advantage over other crops specially for developing countries like India on the following grounds :

i) Mesta provides domestic resources and the raw materials for industrialization.

ii) It requires less labour than jute and can be produced more cheaply.

iii) It provides a greater cash return than other crops.

iv) It is a potentially profitable crop.

v) The fibre is useful for every country.

Mesta cultivation in Indian Sates

India had lost about 80% of total jute production area at the time of partition of the country during 1947. The jute crop needs a specific set of climatic conditions, therefore, the cultivation of jute could not be extended beyond the states of West Bengal, Assam, Bihar, Orissa, and parts of U.P. and Tripura. As a result the production of jute fell below the requirement of mills. Mesta can, however, be grown even in those areas where jute is not grown under wider climatic and soil conditions with much less care. This helped the country to expand more area under Mesta. At present Mesta is grown in an area of more than 26 lakhs hectares with a production of more than 12 lakhs bales.

Mesta is cultivated in an area of about 1.5 lakhs hectare and the average national productivity of the crop is around 11q/ha. According to CRIJAF, though its productivity has increased two folds since independence, it faces tough competition from cheaper synthetic fibres. It is one of the important bast fibre crops which stand next to jute in production. At the time of partition, India had to loose about 80% of total jute production area. In India, Mesta is grown in larger parts covering areas from Karnataka to Tripura including Maharastra, Andhra Pradesh, West Bengal, Bihar, Orissa and Meghalaya. In Tripura and Meghalaya the Mesta is grown in highlands either as a solo crop or in

mixture with rice. In West Bengal and Bihar it is grown in sandy to sandy loam marginal lands. In Orissa it is grown in the hilly districts of Koraput and Kalahandi. Andhra Pradesh has maximum area under Mesta in the country.

Soil & Climate

According to Singh, a warm humid climate is considered most suitable for growing Mesta. It grows well in the drier rain fed areas. The *sabdariffa* being drought resistant type, grows well in tropical areas also. In areas where the rainfall is 50 to 90 mm, the *Hibiscus Cannabinus* suits better by virtue of shorter duration and comparatively faster growth than the other. It cannot withstand water logging and is grown in kharif season in India. It requires rich loamy soils although it may grow in a variety of soils including new and old alluvium & lateritic loam. The acid soils are not suitable without proper amendment. The *sabdariffa* develops chlorosis with high pH of the soil.

Land preparation

The land is ploughed and cross ploughed thrice to four times depending upon the type of soil. The ploughing is followed by laddering. This helps in pulverising the soil properly. The ploughed field is made free of weeds and stubbles and levelled properly. The pulverised soil helps in the proper operation of seed drills etc. It is advised to apply organic manure before the land is prepared. Recommended dose of inorganic fertilizer is also applied as a basal dose after the preparation of land.

Sowing

Seed is the basic and most vital input for optimizing productivity and quality of any crop and, therefore, only certified seed from a reputed agency should be procured for sowing. Line sowing proves superior to traditional broadcasting in both the species as the former facilitates better and timely crop management with reduced cost resulting in comparatively uniform plant stand, better crop growth and higher fibre productivity. Roselle is grown under two situations - as a rainfed kharif crop during May-June to September-October and as a rabi crop during February-March to August in places receiving both the monsoons (South-west and north-east). In other areas, sowing needs to be completed as early as possible, preferably by mid-April to harness higher productivity with reduced pest and disease incidence. Saha and Sengupta (1965) observed that time of sowing and photoperiod exerted significant effect on the growth and development of *cannabinus* Mesta. It has been observed that crop sown between March to July is flowered by mid or end of September as in case of Jute while the vegetative and flowering periods are short with late sowings and yield lesser. Experimental data suggest that a seed rate of 12.5 kg/ha in case of roselle and 15 kg/ha for kenaf is optimum to achieve the desired plant population of around 4 lakh per ha (Sreelatha and Kanaka Raju, 2004). In drier areas with reduced organic matter content, intra-row spacing of 30 cm is generally adopted while this can advantageously be reduced to 25 cm to accommodate more plants per unit area to enhance fibre productivity consistent with quality, particularly in areas with higher rainfall and soil organic matter content. Besides, plants with reduced diameter provide significantly higher fibre

content and dry matter than those with stems of greater diameter (Maiti, 1997).

Nutrient Management

Balanced application of fertilizer at proper time is very important for a crop. A balanced fertilizer dose also helps in the improvement of physical properties of soils as well. A proper balance between organic and inorganic doses is important for proper plant growth.

Organic fertilizer in the form of compost at the rate of 10 to 12 tons/ha is recommended. Nowadays it is difficult to get so much of compost. It is, therefore, advised to at least, apply 4 to 5 tons of compost to the crop for better growth. It is advisable to apply organic manure before the land is prepared for sowing.

Application of inorganic fertilizer to the crop of Mesta is also important. Nitrogen is essential for cell enlargement and for division of cells at faster rate.

Phosphorus helps in proper root development. Potassium is most important in inducing drought tolerance in this crop. It also induces resistance to pests and diseases. Besides, it helps in the development of fibre cells properly. A fertilizer dose of N:P_2O_5: K_2O at the rate of 40:20:20 per hectare is recommended for higher fibre yields.

The inorganic fertilizer is applied in two split doses of N, P and K. The nitrogen is applied for top dressing into two split doses, half at the time of first weeding and another half after six weeks of sowing. The P and K are applied as basal dressing before sowing.

The nutrient uptake by a crop grown in one hectare of land has been studied. It has been found that the crop of cannabinus can lift easily about 172 kg of nitrogen, 13 kg of phosphorus, 72 kg of potassium and 150 kg of calcium. This clearly indicates that a crop of cannabinus Mesta responds quite well towards the application of nitrogen and calcium. Similarly, *sabdariffa* lifts 100 kg of nitrogen, 31 kg of phosphorus, 148 kg of potassium and 153 kg of calcium. *sabdariffa* needs more potassium and phosphorus as compared to *cannabinus*. Requirement of other nutrients is more or less same.

Intercropping

Like jute, Mesta is a narrowly spaced fibre crop limiting the scope of intercropping within the rows due to competition effects. In a three-year study (1983-85) at Central Research Institute, Barrackpore with roselle cv. HS-4288, it has, however, been observed that intercropping single rows of groundnut (cv.TMV-7, low canopy, 120days), soyabean (cv. Bragg, low canopy, 90days) or Black gram (cv.T-9, low canopy, 85days) between paired or triple roselle rows spaced 15 cm apart is commercially more viable than a roselle crop alone, particularly if the intercrops are sown 15 days after the roselle and groundnut proves to be the most suitable intercrop (Roy *et.al.*, 1990). At Mesta Research Station, Amadalavalasa, intercropping of Black gram with roselle (1:1) has been proved promising (Mitra *et. al.*, 2006).

Weed Management

Being primarily a monsoon crop, weeds pose a serious problem in Mesta as in Jute accounting for around 40% of its cultivation cost towards weeding-cum thinning alone. In a 2-year study (1982-83), Bhattacharjee *et. al.* (1988) observed

that post-emergence application of monosodium methane arsonate (MSMA) @5.60 kg/ha was effective in controlling the weeds of roselle (cv. HS 4288) grown in both heavy and light soils. On heavier soils, MSMA also significantly influenced the growth and yield attributes of roselle and registered the highest herbicidal efficiency index (HEI, 0.673) and net profit (58.20%). In a comparatively light soil supporting remarkably higher weed growth, it proved phytotoxic to the crop resulting in the lowest HEI

(-0.047) and net return (24.92%) whereas fluchloralin at 1 kg/ha as pre-plant application though found beneficial but could not control nuts edges. The recommended practice of manual weeding twice, was found significantly superior in suppressing weed growth in the light soil but proved economically unfavourable in both the soil types because of escalating cost of the hired labour. In comparatively drier regions of Amadalavalasa (A.P.), application of preplant herbicides like Fluchloralin and Pendimethalin exerted phytotoxic effects(AICRP Annual Report of CP (SA) 13.3a for1987-89) as evidenced by gappy and delayed emergence of roselle (cv. AS-73-CP-304). It has, however, been found that these herbicides were capable of doing away with the first manual weeding at 21days after sowing. Identical findings were achieved at Coimbatore centre, Tamil Nadu. Weed management technologies evolved for jute is likely to be equally effective in general for Mesta crop also. However, under drier conditions with poor soil organic matter content, due cautions need to be undertaken while opting for herbicides, particularly pre-plant and pre-emergence tones (fluchloralin, pendimethalin, triflurain, metolachlor, etc.) due to their phytotoxic effects. In the United States (Lane, Oklahoma), metolachlor, however, proved more promising than trifluralin in a fine sandy loam soil primarily due to its reduced toxicity even at a higher dose of 2.24 kg/ ha (Webber, 1992). With increasing environmental consciousness, systematic attempts need to be diverted for managing the weeds preferably through eco-friendly measures as far as practicable considering the harmful role of the herbicides in soil plant-water system. Further, weeds are important components of biota and are potential source of nutrients. These should not be treated as absolute pests; rather these should preferably be conserved as source of organic compost following manual weeding and their growth needs to be regulated judiciously, preferably through quick growing legume cover crops with low water requirement.

Crop protection

Major diseases :

(A) *H. cannabinus*

(a) Anthracnose - This disease is caused by fungus *Colletotrichum hibisci* (syn.-Volutella). The stem of the plant is affected in patches. This disease makes whole plant to wilt. A proper spray of copper oxychloride (50% copper fungicide at the rate of 3kg per/ha) checks this disease to a great extent. The disease may attack at any time of plant growth. The leaves also may be affected leading to defoliation. The flowers, seed capsules and older parts of stem are affected badly.

(b) Tip rot - In this case the tips of the growing plants, stipules, young leaves, leaf

buds etc. are affected by the fungus called Phoma spp. (syn. - *Trichosphaeria* spp.). The tip turns brown and the further growth of the plant is checked. Any of the copper fungicides can be used for controlling this disease.

(c) Root rot/collar rot - Prevalence of high relative humidity during July and August cause spreading of this disease. Presence of high moisture in the soil for long time also causes these diseases. The disease is caused by *Rhizoctonia bataticola* alone or in combination with *Fusarium oxysporum*. After the attack the plants start wilting and finally die. Seed treatment with organo mercurial compounds or Captan helps in controlling it.

(d) Eye rot - This disease is caused by *Myrothecium roridum* fungus which creates eye shaped patches on the stem and leaves. The disease can be controlled by the spray of any copper fungicide. The disease is marked by necrotic spots on stem initially smaller. Later on they elongate and become brown. Ultimately the infected stem is broken.

(B) H. *sabdariffa* (Roselle)

(a) Foot and stem rot - This disease is caused by the infection of *Phytophthora parasitica* var. *sabdariffae*. This fungus is both soil and water borne and the infection starts when there is water stagnation in the field. It is a serious disease in India. The lower portion of the plant (stem) turns black and the plant dies. It has been observed that the varieties with pigmented stem are less affected by this disease.

(b) Leaf spot - This disease is predominantly found in this country. The leaf lobes are attacked and start rotting. First of all, the tips of leaves start blackening and thereafter whole leaf becomes black. The leaves start falling and ultimately the plant growth is adversely affected. This disease is caused by a fungus *Phoma sabdariffae*.

Major pests :

(A) H. *cannabinus*

(a) Spiral borer - It is a serious pest of Mesta. The insect bores through the main stem of the plant. It forms rings on the main stem and the stem breaks from that portion. This pest causes heavy damage to the crop. The fibre obtained from the infected plants become useless. This pest is known as *Agrilus acutus*. A spray of endrin has been found to be effective to some extent.

(b) Root knot nematodes - The root knot nematodes also affect Mesta plants. The infection is caused by *Meloidogyne incognita*. After the infection of nematodes, the plants also develop chlorosis. The infection is more pronounced in sandy loam soils. Proper crop rotations have been found to be useful.

(B) H. *sabdariffa*

(a) Mealy bug - In this case the tip of the plant is crowded with leaves and the further growth of the plant is completely checked. The symptoms are caused by an insect called *Maconellicoccus hirsutus*. This may be controlled by a spray of Parathion (0.04%) or Fenitrothion (0.04%).

(b) Flea beetle - This beetle feeds on the leaf lamina of this Mesta . Although it has not proved so serious even than it needs proper control. This beetle is known as *Nisotra orbiculate*. It can be controlled by dusting SHC (10%) powder on the leaves.

Cultivation of Mesta for fleshy calyces

Wild forms of sabdariffa have been found to possess fleshy calyces on their flower buds. These calyces have been used for many culinary purposes since long. In southern parts of India, the pickles prepared out of these calyces are most popular.

The types with fleshy calyces can be grown in a variety of soils with the pH ranging in between 4.4 to 7.8. The area should have a rainfall of 100 to 150 mm, with a temperature range of 30°C to 35°C. Excess of rainfall may lead to water logging and result in the infection of diseases.

The land of growing plants with fleshy calyces is prepared as usual and the crop is generally sown in rows in the last week of May in India. If needed the sowing may even be attempted in the first week of June. The rows are kept 40cm apart with a distance of 15-20 cm between plants in a row. Approximately 9 to 10kg of seeds per hectare are required for sowing. Germination of seeds takes place within 2 to 3 days if soil moisture of 25-30% is available.

The seedlings, if required are thinned in two instalments when they are 10 to 20 cm tall. A dose of nitrogen, phosphorus and potash @ 20:20:10 per hectare in the form of ammonium sulphate, single super phosphate and muriate of potash is added. The P and K are applied preferably at the time of land preparation before sowing and after the thinning is over. This helps the plants to grow well and produce more fleshy calyces. Two weeding and wheel hoeing are sufficient to raise a good crop.

The plants grow and start forming flower buds within 130-150 days after sowing. The calyces are collected just before the opening of flowers. The calyces collected at this stage are good in taste. More fleshy calyces can be had if the plucking is done just at the time of opening of flowers. The calyces are plucked by hand in baskets like tea leaves. These calyces are then sent for the preparation of different items like jam, jelly and pickles.

About 30 quintals of fleshy calyces can be harvested from one hectare of good Mesta crop.

Varieties suitable for fleshy calyces

Long Calyx type

The variety is dwarf, branched, non-bristle, red and resistant to lodging. It possesses alternate leaves, which are palmately lobed, with glabrous lamina. The flowers are axillary, solitary, 4 to 6 cm. in diameter and bloom for longer period. Epicalyx is inconspicuously channelled. Calyx is fleshy, thick, broad and non-bristle. Petals are generally of sulphur-yellow in colour. Nearly 1500 plants can be accommodated in 100 sq. m. plot.

Wild forms of *sabdariffa* (dwarf, branched and bushy) have been found to bear fleshy calyces on their flower buds and for culinary purposes (jam, jelly, sauce, pickle, etc.). These can successfully be grown during end of May to October for fleshy calyces in a variety of soils (pH 4.4-7.8) using a wider row spacing of 40 cm and 15-20 cm between plants with a marginal fertilizer dose of N20 P20 K10 per hectare to yield up to 30 q/ha of calyces. Calyces harvested before opening of the flowers were, however, found to be of superior quality (Singh, 1997).

Conclusion

The Mesta has proved very economical in cultivation because of certain distinct advantages over other crops in the developing countries. This is because of the following -

(i) It is a potentially profitable crop which is not in world surplus.

(ii) It provides raw material for industrialization and also for domestic use.

(iii) The crop can be grown on upland soils providing good cash return than other crops.

(iv) The crop requires less labour than jute and can be produced cheaply.

(v) The fibre is useful for every country.

Although the fibres of jute and Mesta are used more or less in the same manner, the prices of both vary. The Mesta fibre is always cheaper than jute because of the following reasons.

(i) Mesta fibre in India is of poor quality and is not exported, but blended with jute for local burlap manufacture.

(ii) Prior to 1962, the only large producer of Mesta for export was Thailand. The rapidly expanding production was still poorly graded.

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The Mesta varieties released for cultivation in India is presented below :

Sl. No.	Name of the Variety	Year of release	Potential yield (q/ha)	Significant attributes	Area recommended
1	2	3	4	5	6
Kenaf (*Hibiscus cannabinus*)					
1	HC-583	1963	25	Most popular variety, tolerantto root rot disease.	Mesta growing area of W.B.
2	AMC-108	1982	20-25	Resistant to foot and stem rot diseases, tolerant to jassids and spiral borer	Southern India, Bihar, Odisha.
3	MT 150 (Nirmal)	2005	30	Superior paper pulp qualityfor newsprint.	Entire Mesta growing belt
4	JBM-2004-D (Sumit)	2009	27	Resistant to foot and stem rot and tolerant to Spiral borer, mealy bug and good fibre quality and strength	North Bengal, Assam, Bihar, Odisha.
5	JRM-3 (Sneha)	2010	25-38	Suitable for mid-April to mid-May, better fibre quality, resistant to major pests and diseases	Mesta growing belt of the country.
6	JRM-5 (Shrestha)	2010	27.5	Suitable for mid-April to mid-May, better fibre quality, resistant to major pests and diseases	Mesta growing belt of the country.
7	JBM 81 (Shakti)	2013	25.50	Suitable time of sowing mid April to mid May, Pod slightly cylindrical and non-shattering; seed colour: black	Mesta growing belt of the country.
8	JBM 71 (Shanti)	2013	27.49	Suitable time of sowing mid April to mid May, Petal colour yellow and stigma colour: red, Pod cylindrical and non-shattering; seed colour: black	Mesta growing belt of the country.
9	JRKM 91 Satyen)	2016	24.26	Suitable for mid-April to last week of May sowing, tolerant to major diseases (foot and stem rot) and major pests (spiral borer and mealy bug), better fibre tenacity.	Mesta growing belt of the country.
10	JBMP 2 (Central Kenaf)	2016	28.42	Suitable sowing time is mid-April to last week of May, tolerant to foot and stem rot and major pests (spiral borer and mealy bug.	Suitable for mid and highland rainfed situation.
11	JBMP-3 (Priya)	2018	26.2	Mid April to last week of May	Major Mesta growing states
12	JBMP-4 9U (Utkarsh)	2019	28.0	Mid April to last week of May.	Major Mesta growing states
13	Central Kenaf JRHC-3	2020	28.6	Mid April to last week of May.	Major Mesta growing states.