Government of India

Ministry of Textiles

Textiles Committee


Course Name: Hand Held Kapas Machine Operator
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Chapter 1

BASICS OF TEXTILES

1.1. Textile Fibres:

Textile fiber is a material mainly made from natural or synthetic sources. This material will be converts into the making of textile yarns and fabrics; woven, knitted, nonwoven, and carpets. It may be in a form of a pliable hair like strand or as the smallest visible unit of textile production.

1.2. Fibres Classification:

Fibres are classified based on its origin / source.

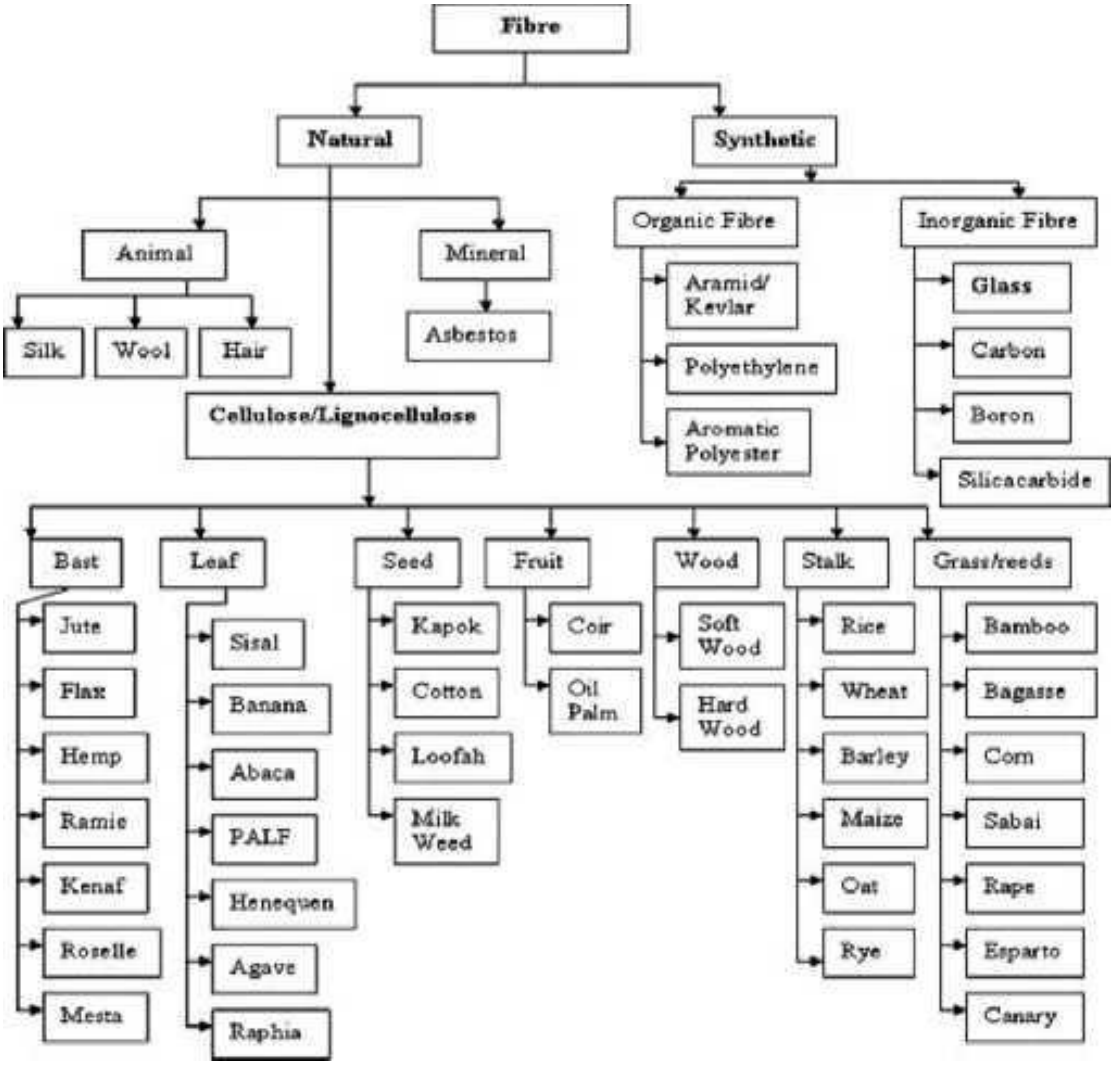


Figure 1 Textile fibre classification chart

1.2.1. Vegetable fibres or cellulosic fibres: The fibres that are derived from plants are called vegetable fibres. The basic material of all plant life is cellulose. These cellulose fibres have certain common properties like low resilience, high density, and good conductor of heat. They are highly absorbent and are resistant to high temperature. Cotton flax, jute, ramie are some of the examples of vegetable fibres.

1.2.2. Animal fibres: The fibres which are obtained from animals are called animal fibres. Wool and silk are common examples of animal fibres. Animal fibres have high resiliency but weak when wet because they are bad conductors of heat.

1.2.3. Mineral fibres: These are the inorganic materials shaped in to fibres and are mainly used in the fire proof fabrics. Asbestos is the example of mineral fibre. Mineral fibres are fire proof, resistant to acids and are used for industrial purposes.

1.2.4. Man-made fibres: Man-made fibres have high strength, strong when wet low moisture absorption characteristics. Examples of man-made fibres are viscose rayon, acetate rayon, nylon, polyester etc. Depending on raw material chosen for making of the fibres they are classified as cellulosic fibres, protein fibres and synthetic fibres.

1.3. General Properties of Textile Fibres:

1.3.1. Staple Fibres: Natural or man-made or short length fibres which measures in inches or fraction of inch example 3/4 inch to 18 inches except silk all other natural fibres are staple fibres. Staple fibres are of limited length.

1.3.2. Filament: Long continuous fibres strands of indefinite length measured in yards or meters fibres of continuous length long enough to be used in fabric as such Natural silk filament is 360-1200 meters. Synthetic filaments can be made many kilometers long.

1.3.3. Texture: It is the tactile sensation experienced when hand is passed over a surface. Staple fibres and fabrics made from staple are lightly rough while filaments and fabrics made from filaments fibres are smooth.

1.3.4. Resilience: It means that when fibre is compressed and later when the pressure is released. It will tend to return to its original shape. Resistance to compression varies from fibre to fibre. Wool has outstanding resiliency while it is poor in cotton.

1.3.5. Luster: It is seen when light reflected from a surface. It is more subdued than shine. Silk and synthetics have luster than cellulosic fibres. Infact synthetics have high luster which is

purposefully removed during spinning.

1.3.6. Static Electricity: It is generated by the friction of a fabric when it is rubbed against itself or other objects. If the electrical charge that is not conducted away, It tends to build up on the surface and when fabric comes in contact with a good conductor a shock or transfer occurs.

1.3.7. Crimp: Wool fibre is more or less wavy and has twists. This waviness is termed as crimp. Finer the wool more will be the crimps in it. Marino wool will have 30 crimps per inch while coarse wool has only one or two.

1.3.8. Elasticity: It is the ability of stretched material to return immediately to its original size

1.4. Essential Properties of Textile Fibres:

1.4.1. Staple Length: Staple length is one of the most important qualities of natural fibres. If the fibre length is more varying in given sample, the quantum of short fibres increases and lower the yarn strength and increases the yarn irregularity.

1.4.2. Tensile Strength: Individual fibres must have sufficient strength to withstand normal mechanical strain in the processing. The resistance of a fibre to use and wear considerably depends on its tensile strength.

1.4.3. Fineness: In a fibre, the ratio or relationship of length to width or cross sectional area is expressed as its fineness.

1.4.4. Uniformity: This means the evenness of individual fibres in length and diameter. The more uniform fibres will produce stronger yarn.

1.4.5. Spinnability: It means the ability of the fibres to be spun into yarn. In addition to the above fibre properties the capacity to take up twist also place an important role in the spinnability of a textile fibre.

1.5. Yarn:

Yarn is a long continuous length of interlocked fibres, suitable for use in the production of textiles, sewing, crocheting, knitting, weaving, embroidery, etc.

1.5.1. Types of Yarn: Spun Yarn – Staple fibres are twisted together to make a continuous yarn. Filament Yarn – Mono or Multiple strands of Continuous fibres are twisted together

1.5.2. Yarn Manufacturing Techniques:

Yarn manufacturing is a sequence of processes that convert raw fibres in to yarn, suitable for use in various end-products.

1.5.2.1. Spun Yarn:

Ring Spinning – Carded / Combed Yarns
Open end spinning – Coarser Yarn spinning system
Hosiery spinning – for knitting application
Compact spinning – producing less hairy yarns

1.5.2.2. Filament yarn:

Dry spinning – The fibre forming substance is dissolved in a solvent and once the solvent is evaporated after extrusion.
Wet spinning – The solution of fibre forming materials are extruded from coagulating bath and gets harden as a yarn
Melt spinning – Polymer chips are melted and extruded as yarn

1.6. Fabric:

Fabric is defined as the interlacement / inter or intra looping of natural / synthetic yarns by using the techniques of weaving or knitting to make a sheet of cloth.

1.6.1. Types of Fabric:

Woven fabric: The fabric is made by interlacement of warp and weft yarns Knitted fabric: The fabric is made by inter or intra looping of yarns

Non-woven fabrics: The fabric is made by the entangled or bonded system of webs constituting staple or filament fibres together.

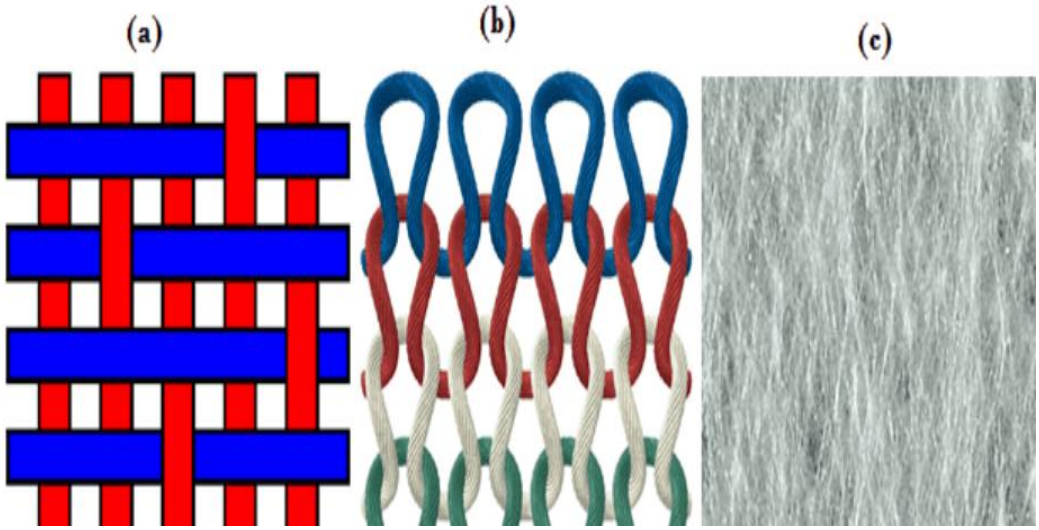


Figure: Fabric Structures- (a) Woven (b) Knitted (c) Non-woven

Chapter 2

BASICS OF COTTON FIBER

2.1 Basic Knowledge of Cotton Fibre:

Cotton is one of the most important fiber and cash crop of India and plays a dominant role in the industrial and agricultural economy of the country. It provides the basic raw material (cotton fibre) to cotton textile industry. Cotton in India provides direct livelihood to 6 million farmers and about 40 -50 millionpeople are employed in cotton trade and its processing.

2.2 Nomenclature of Cotton:

Cotton belongs to family Malvaceae,

Tribe: Gossypieae,

Genus: Gossypium.

There are four cultivated species of cotton viz. Gossypium arboreum, Gossypium herbaceum, Gossypium hirsutum and Gossypium barbadense.

The first two species are native to old world. They are also known as Asiatic cottons because they are grown in Asia. The last two species are referred to as New World Cottons. G. hirsutum is also known as American cotton or upland cotton and G. barbadense as Egyptian cotton or Sea Island cotton or Peruvian Cotton or Tanguish Cotton.

G. hirsutum is the predominant species which alone contributes about 90% to the global production. In USA and Uzbekistan, more than 90% area is covered by G. hirsutum. Perhaps, India is the only country in the world where all the four cultivated species are grown on commercial scale.

Gossypium hirsutum: upland cotton, native to Central America, Mexico and the Caribbean

Gossypium barbadense: extra-long staple cotton, native to tropical South America

Gossypium arboretum: tree cotton, native to India and Pakistan

Gossypium herbaceum: Levant cotton, native to southern Africa and the Arabian Peninsula

2.3. Cotton Growing Regions:

In India, most of the cotton production comes from twelve major cotton growing states, which are grouped into three diverse agro-ecological zones viz:

- Northern zone: Punjab, Haryana and Rajasthan.
- Central zone: Gujarat, Maharashtra, Madhya Pradesh & Odisha.
- Southern zone: Telangana, Andhra Pradesh, Karnataka and Tamil Nadu.
- Cotton cultivation has also gained momentum in small areas of non-traditional States such as Uttar Pradesh, West Bengal, Tripura, etc.

These three cotton growing zones differ from each other in several aspects such as soil type and topography, irrigation facilities, species cultivated, productivity level etc. (Table-1)

Table-1: Comparison of three cotton growing zones.

S. No.	Particulars	North zone	Central Zone	South Zone
1	Soil type	Alluvial	Black soils	Black and red soils
2	Soil topography	Plain	Undulating	Undulating
3	Irrigation	98%	15%	32%
4	Species cultivated	G. Hirsutum G. Arboreum	All except G. Barbadense	All the four species
5	Area Covered	15%	60%	25%
6	Production	20%	55%	25%
7	Yield	High	Low to Medium	Medium

Varieties of cotton:

Table-2A:

Name of species	Staple group	Parameters		Equivalent trade variety
		Staple length	Mic. value	
G. Arboreum	Short staple	20mm & below	6.8-8.0	Assam Comilla, Bengal Desi
G. Hirsutum	Medium staple	20.5mm to 24.5mm	3.4-6.0	V-797, Jayadhar, PCO-2(AP/Kar), MCU-7(TN)
G. herbaceum	Medium Long & Long staple	25.0mm to 27.0mm 27.5mm to 32.0mm	3.4-5.1 3.5-4.8	LRA-5166 J-34-Hybrid, H-4, MECH, RCH-2, Shankar-6, Bunny/Brahma
G. Barbadense	Extra Long staple	32.5mm & Above	3.0-4.3	MCU-5, Surabhi, DCH-32 and Suvin

The cotton produced in India is of diverse varieties covering the entire range ofparameters of cotton used in weaving across the globe viz,

- ✧ Short staple (Staple length: 20 mm & Below, Trade variety: Bengal Deshi),
- ✧ Medium Staple (Staple length: 20.5 mm-24.5 mm, Trade varieties: V797, Jayadhar),
- ✧ Medium Long Staple (Staple length: 25.0 mm-27.0 mm, Trade varieties:J-34, LRA)
- ✧ Long Staple (Staple length: 27.5 mm -32.0 mm, Trade varieties: H-4, MECH, Shankar-6, Bunny, Brahma)
- ✧ Extra Long Staple (Staple length: 32.5 mm & above, Trade varieties:MCU-5, DCH-32, SUVIN).

Table-2B:

Popular Varieties of Cotton in India and their Quality Parameters

Zone	State	Variety of cotton	Quality Parameter	
			Staple Length (in MM)	Micronaire (µg/inch)
NORTH	**Punjab**	Bengal Deshi	<20.0	6.8-7.2
	Punjab	J-34	27.5-28.5	4.0-4.8
	Haryana			
	Rajasthan			
Central	**Gujarat**	V-797	21.5-23.5	4.2-6.0
		S-6	27.5-29.0	3.6-4.8
	Maharashtra	H-4	27.5-28.5	3.5-4.7
		Bunny Brahma	29.5-30.5	3.5-4.3
	Madhya Pradesh	H-4	27.5-28.5	3.5-4.7
		Bunny Brahma	29.5-30.5	3.5-4.3
		DCH-32	34.0-36.0	3.0-3.5
	Orissa	MECH	27.5-28.5	3.5-4.7
		Bunny Brahma	29.5-30.5	3.5-4.3
South	**Telangana**	MECH	27.5-28.5	3.5-4.7
		Bunny Brahma	29.5-30.5	3.5-4.3
	Andhra Pradesh	MECH	27.5-28.5	3.5-4.7
		Bunny Brahma	29.5-30.5	3.5-4.3
	Karnataka	Jayadhar	21.5-22.5	4.8-5.8
		Bunny Brahma	29.5-30.5	3.5-4.3
		DCH-32	34.0-36.0	3.0-3.5
	Tamil Nadu	Bunny Brahma	29.5-30.5	3.5-4.3
		MCU-5	32.0-33.0	3.2-4.3
		SUVIN	38.0-40.0	3.2-3.6

2.4. Climate & Soil Requirement:

Cotton, a semi-xerophyte, is grown in tropical & sub-tropical conditions. A minimum temperature of 15°C is required for better germination at field conditions. The optimum temperature for vegetative growth is 21-27°C & it can tolerate temperature to the extent of 43°C but temperature below 21°C is detrimental to the crop.

Warm days of cool nights with large diurnal variations during the period of fruiting are conducive to good boll & fibre development. Cotton is grown on a variety of soils ranging from well drained deep alluvial soils in the north to black clayey soils of varying depth in central region and in black and mixed black and red soils in south zone. Cotton is semi-tolerant to salinity and sensitive to water logging and thus prefers well drained soils.

2.5. Crop season:

The sowing season of cotton varies considerably from tract to tract and is generally early (April-May) in northern India and is delayed as we proceed to down south (monsoon based in southern zone).

Cotton is a Kharif crop in the major parts of the country viz. Punjab, Haryana, Rajasthan, Madhya Pradesh, Gujarat, Maharashtra and parts of Telangana, Andhra Pradesh & Karnataka. In these areas, the irrigated crop is sown from March-May and the rain fed crop in June-July with the commencement of the monsoon.

In Tamil Nadu, the major portion of the irrigated and rain fed crop is planted in September-October, whereas the sowing of the rain fed crop in the southern districts is extended up to November.

In parts of Karnataka and Andhra Pradesh, the desi cotton is usually sown in August-September. In addition, summer sowings in Tamil Nadu are done during February-March. The sowings of cotton in the rice fallows of Andhra Pradesh and Tamil Nadu extent from the second half of December to the middleof January.

2.6. Harvesting of cotton:

The cotton plucking activity is done traditional by tying cloth to waist and manually pluck the cotton put in to cloth. By this the labour has undergone musculoskeletal problems.

In cotton growing areas harvesting of the crop or cotton picking is an important source of employment for rural women providing supplementary income to rural farm and non-farm households. A large majority of these women are illiterate earning from cotton picking activity which generally lasts for three to four months of the year and is often their only source of income. On an average they work 8 hours a day and pick 40-50 kg of cotton. Most of them belong to landless poor households.

Cotton harvesting manually involves moderate drudgery due to posture, load of picked cotton and abrasion of fingers by the sharp points of dried bracts. Labour shortage for harvesting is experienced in states with intensive cotton cultivation due to synchronization of boll bursting and early maturity by a month that has narrowed the harvesting window besides increasing the demand for labour to harvest and the load on women cotton pickers.

One of the solution is to promote mechanization in cotton harvesting by using hand-held kapas plucker machines. These kapas plucker machines are very reasonable in cost. It may reduce drudgery of cotton picking besides improving picking efficiency and reducing health hazards. Besides this, it requires less labour to pick cotton per unit area thus reducing the cost of cultivation.

2.7. Processing of Cotton:

Cotton picked from the plant is in the form of seed cotton (kapas), and before the fibers can be used for any purpose, they have to be separated from the seed, the process of separation is called ‘Ginning’.

Generally 1/3rd portion of seed cotton is lint and remaining 2/3rd is seed & trash. Ginning is the first mechanical process to which cotton is subjected.

As the fibers are fairly firmly attached to the surface of the seed, it requires certain amount of force to detach them. Unless this force is tampered in some way, the fibers are likely to be torn irregularly and their texture impaired. Thus ginning is not only an essential process in the utilisation of cotton, but also an important one, as any damage to the fibers at this stage cannot be rectified later.

The objectives of ginning are:

- To removes the fiber from the seed.
- To remove the neps and wastage in some extents.
- To collect the seed and seedless cotton fiber separately.
- To separate the cotton fiber from the root position of the seeds.

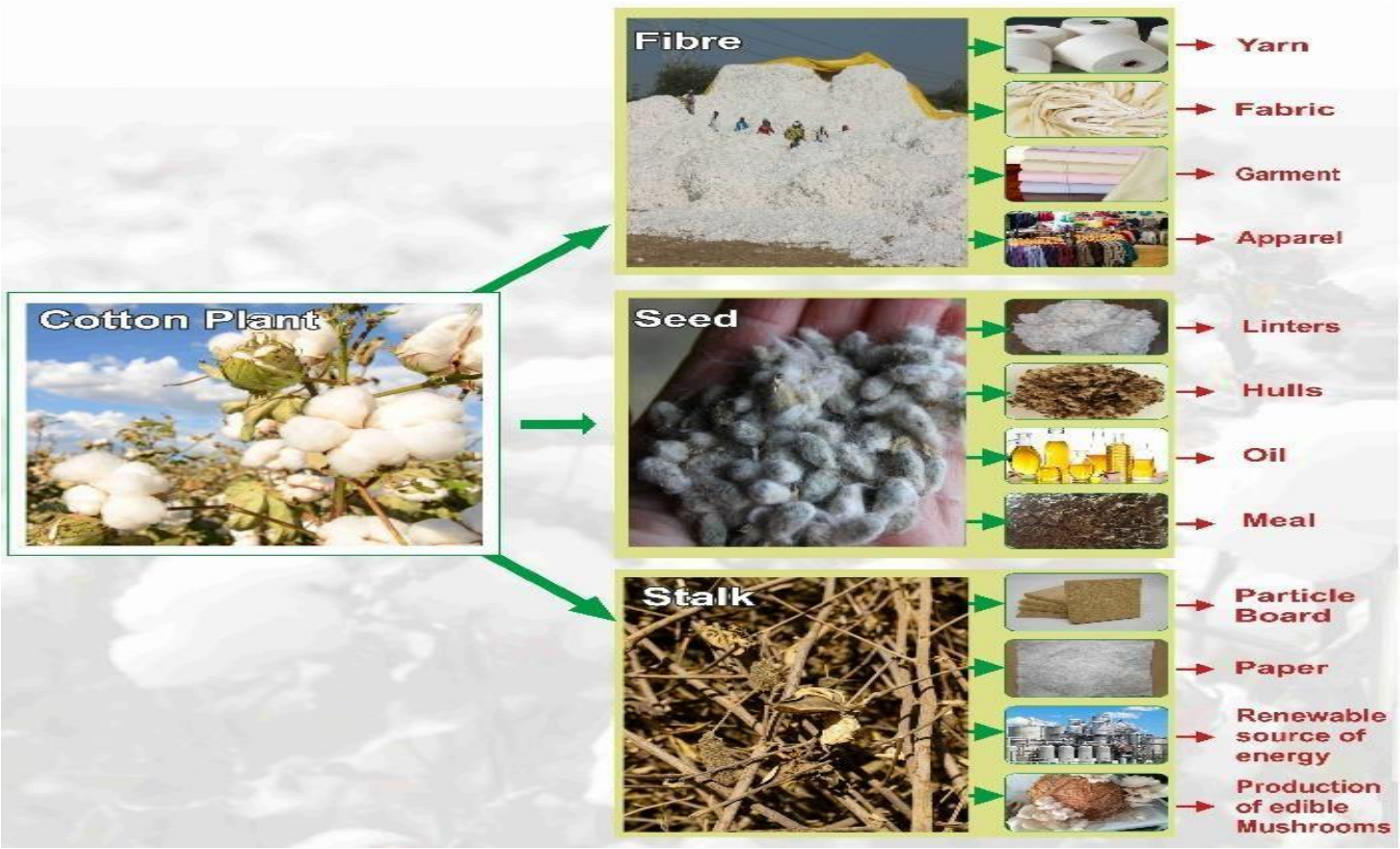
After ginning, the lints are compressed into rectangular bales, which are covered with cotton grey cloth and bound with iron/ plastic hoops. In India one bale generally weigh about 170 kgs. These bales are then sent to godown till its'consumption by textiles mills.

2.8 Usage of cotton and its bye-products:

Cotton is considered a very important crop, as it is the major source of clothing to the world. Cotton yarn is made by processing the cotton fibers and is used for producing a wide range of textiles, apparel and other products. Cotton yarns are spun with the help of spinners, which are getting more and more developed capacity wise with the improvement in technology. The other major processors through which cotton is spun are filament yarns and nonwovens.

Besides this use of cotton, it is also used in various industrial applications. Hence, it is ranked among the most cultivated and traded commodities on the planet. Cotton and its various by-products are traded in the market and are looked upon as an important means of investment. The details about these by products is given below

i) Cotton seed: It is most valuable by-product obtained after ginning of seed cotton. Further, four major by-products are obtained from cotton seed i.e. Linters, Hulls, Meal and Oil. Scientific processing of cotton seed can maximize oil extraction up to 18% as against usual oil recovery of 10-12%.



ii) Cotton seed cake: The cake obtained after crushing of cotton seed is fed to cattle which contains high protein upto 25% and fetches better price.

iii) Cotton seed oil: The cotton seed being rich in edible oil and proteins deserves special attention. Therefore, the cotton seed storage should be proper under cover sheds for better oil extraction and avoid fungi infection. Therefore, a small effort in this regard will maximize good returns.

iv) Preparation of Pulp/Paper from Cotton Linters: These are the short fuzzy fibres that coat the cottonseed. The linter is mechanically cleaned using trash separator. Paper made from cotton linters have high demand in market and hence a good source of income.

v) Cotton seed Hulls, a Bio-enriched Cattle Feed: Cottonseed hull is a conventional feed for cattle and is a by-product of seed crushing industry. Cottonseed hulls are available in abundance and are rich in cellulose content but poor in digestibility which could be improved by a simple aerobic treatment. This process will enhance the physical and financial value of the hulls.

vi) Nano Cellulose from short staple cotton: Nano Cellulose Crystalline Cellulose (NCC) can also be produced from short staple cotton, short fibres and Cotton Linters. Nano-cellulose is biodegradable and can be used in virus infiltration, drugs, fillers in cement and film, paper coating and furnishing additives.

vii) Absorbent cotton: It is made from short staple cotton and is used for multiple surgical purposes. Short fibres are also obtained from mill wastes and commonly known as ‘comber-noil' which is used in technical textiles, medicated cotton, ear buds, security paper, currency notes etc.

viii) Other innovative products: Cottonseed milk powder mix, High protein feed ingredients for cattles food, etc.

ix) Cotton Stalks: It is utilized for the following commercial purpose:

- ✧ Briquettes/Pallets are used as a substitute for coal and LPG gas which reduces cost up to 80%.

- ✧ Power generation: Cotton stalk is a best source of renewable energy generation. 50 tons of cotton stalks can produce 1 MW power.
- ✧ Particle Board: Particle boards are used in furniture making, partitioning, paneling, drop-ceilings etc. One ton of cotton stalks can be used to produce 600 kg of particle boards.
- ✧ Compost: Indian scientist has developed an accelerated process for compost preparation. Compost is enriched with nutrients in plantgrowth and promoting microorganisms. 1 tone of cotton stalks can produce around 800 kg of compost.
- ✧ Edible oyster mushrooms: Edible oyster mushrooms can be grown on cotton stalks, with yields up to 500 gram of mushrooms per kg of cotton stalks. Mushroom production units are found very viable in villages and rural areas.

Thus, value addition to cotton and its by-products enhances not only livelihoodbut also reduces vulnerability of marginal farmers to the market risk and uncertainties.

Chapter 3

KAPAS PLUCKER MACHINE

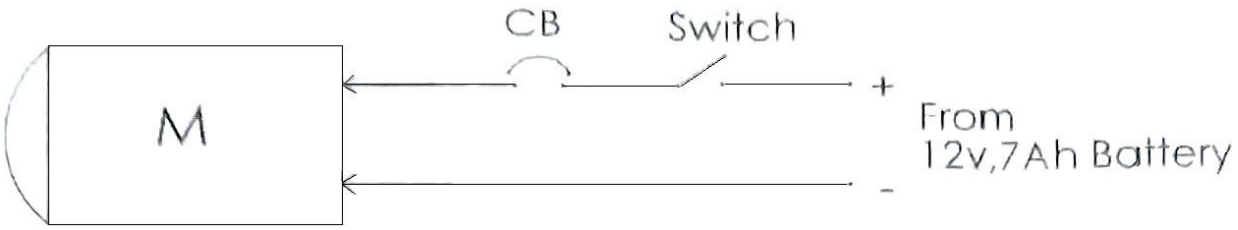
3.1. Introduction

Many developing countries are undergoing a process of structural transformation in which large numbers of workers move from agriculture to other sectors and from self employment into wage work. Using data from various research works, Hand Held Kapas Plucker Machine helps to get self –employment in farming, as opposed to working from wage or being self-employed in non-farming.

As per Manual of Hand Held Kapas Plucker Machine is provided with the battery powered, portable, Hand Held Kapas Plucking Machine is provided with cotton collection bag. The machine has outstanding performance increases the kapas picked per day by 80-100%. Its stable and reliable performance ensures long and continuous working capacity. This machine has a long service life without malfunctioning. This Hand Held Kapas Plucker Machine increases productivity by 100% as compared with manual picking. Retractable teeth design keeps kapas from getting into the transmission system and thus prevents malfunctioning. It will help for self-employment, industrial purpose, farm society as well.

3.2. Hand-held Kapas Plucker Machine:

3.2.1. Wiring Diagram:

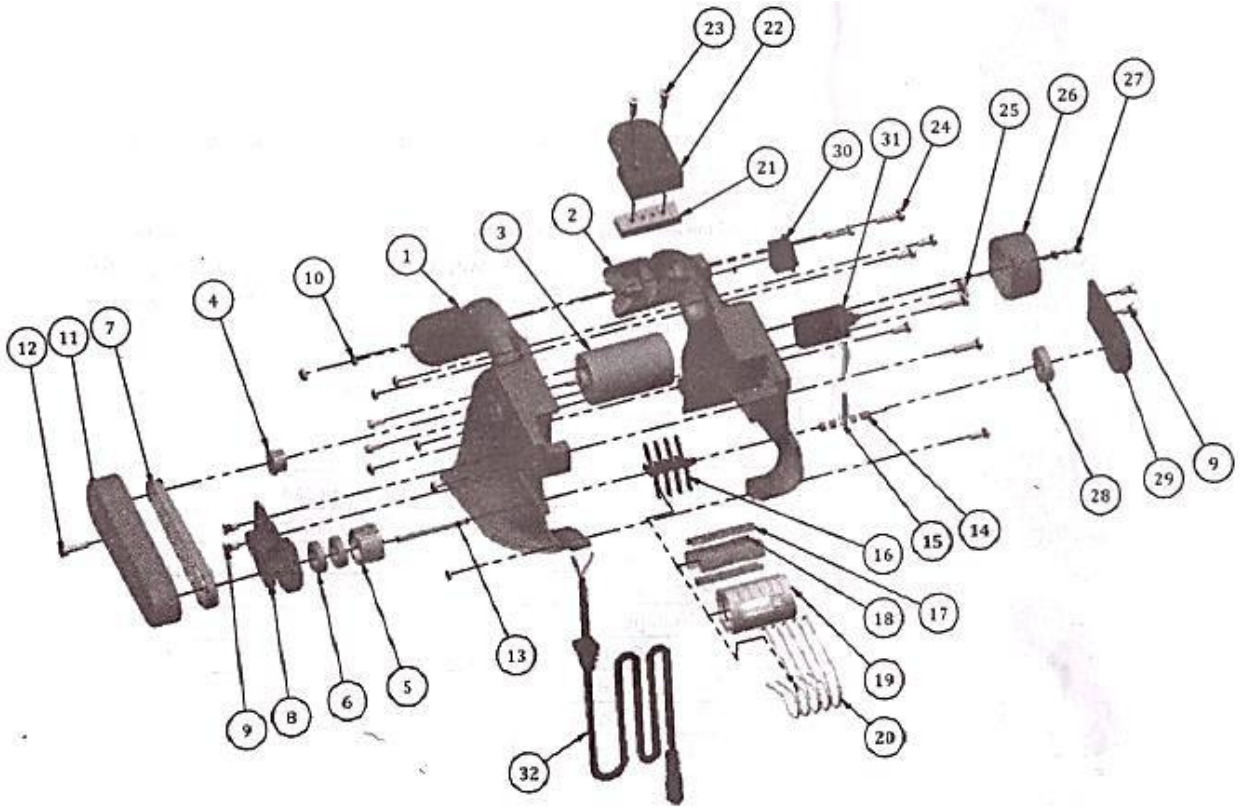


3.2.2. Technical Specifications:

Technical specifications of Hand-held Kapas Plucker Machine are given below:

Particulars	**Specification**
Model	Portable Kapas Plucker
Size/Weight	Size: 280x90x110 mm Weight: 600 gm approx
Motor Power	11 Watt, Voltage:12 Volt, Operating Current: 1.4 Ampere
Rotating Speed	5400 RPM
Battery Type	12 Volt, 7AH rechargeable Lead Acid battery
Charger	Input: 220 Volt, 50-60Hz, Output: 12 Volt, 1.0 Ampere Approximately 8 hours
Trip Switch	2.5 Ampere, 240 Volt-50/60 Hz, 24 Volt DC
Accessories	Machine holding suitcase, Waist Battery pouch, kapas collection bag, charger, essential spares, tools, extra motor, safe kit, etc to preserve the equipment.
Picking Efficiency	Approx. 80 kg to100 kg per 8 hours

3.2.4. Internal Diagram of Kapas Plucker Machine:



S.No.	Item No.	Description	Qty.
1	KP 001	COVER PULLEY SIDE	1
2	KP 002	COVER OTHER SIDE	1
3	KP 003	MOTOR	1
4	KP 004	PULLEY DRIVER	1
5	KP 005	DRIVEN PULLEY	1
6	KP 006	BEARING - 6701	1
7	KP 007	TIMING BELT	1
8	KP 008	BEARIING SUPPORT	1
9	KP 009	IS 6761 - M4 x 10-N	4
10	KP 010	IS 1364-4 - M4-N	8
11	KP 011	BELT COVER	1

S.No.	Item No.	Description	Qty.
12	KP 012	IS 2269 - M4 x 16-N	1
13	KP 013	TIPS ROD	1
14	KP 014	FIRST BUSH	1
15	KP 015	INTERMEDIATE BUSH	4
16	KP 016	CUTTING TIPS	16
17	KP 017	CUTTING TIPS CARRIER - I	1
18	KP 018	CUTTING TIPS CARRIER - II	1
19	KP 019	TIPS HOLDER	1
20	KP 020	KAPAS GUIDE	5
21	KP 021	SPRING HOLDER STATIONARY	1
22	KP 022	COVER SPRING HOLDER	1

S.No.	Item No.	Description	Qty.
23	KP 023	IS 6761 - M4 x 16-N	2
24	KP 024	IS 1364 HHS(Grade A)-M4 x 16-N	4
25	KP 025	NUT	1
26	KP 026	FAN COVER	1
27	KP 027	IS 1364 HHS(Grade A)-M4 x 10-N	4
28	KP 028	BEARING - 6901	1
29	KP 029	BEARIING SUPPORT	1
30	KP 030	SWITCH	1
31	KP 031	CIRCUIT BREAKER	1
32	KP 032	CABLE	1

3.3. Operating Manual:

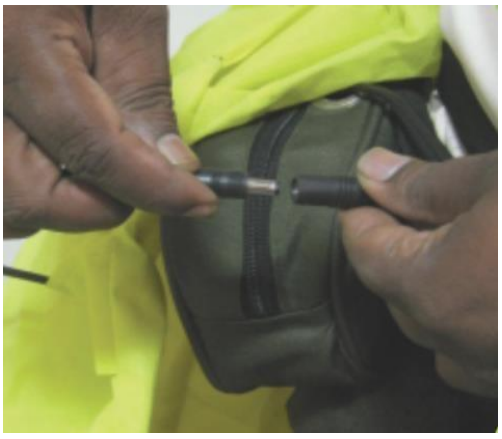
3.3.1. How to connect and use:

i. Place the Battery in the BatteryPouch as shown in the pictorial and take the socket connector of the battery and lane out through the eyelet on the upper side of the battery pouch.

ii. Fasten the battery pouch around the waist as shown in the pictorial

iii. Tie the Collection bag around the waist below the battery pouch and fasten it in front as shown in the pictorial.

iv. Pass the cables of the machine through the loops provided in the bag mouth connect to the connector of the battery. Loops are provided on the both end of the neck to assist left and right hand operator.



v. Fix the kapas collector elastic with the machine outlet as per pictorial.

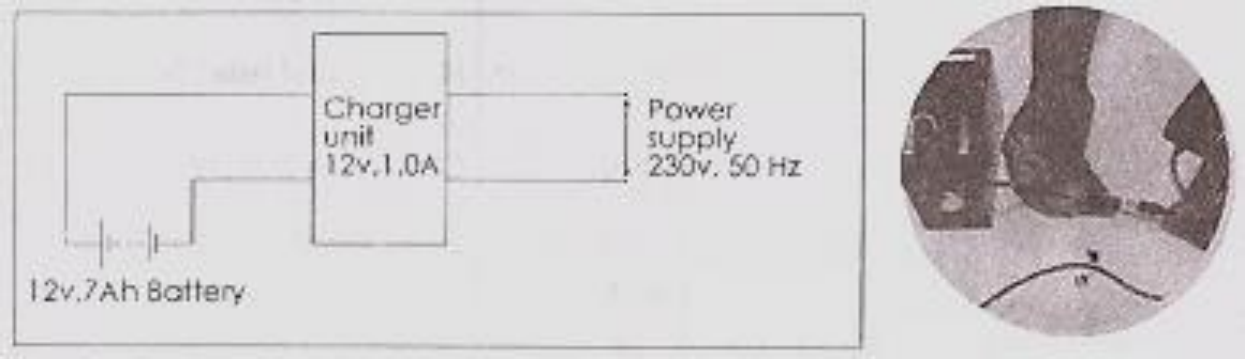
vi. In the Machine Press the switch on the Kapas plucker to start it.

vii. At regular interval of picking, raise the hand for clearing the arm of the kapas collection bag to ensure smooth in flow of picked kapas. The Zipper at the bottom of the kapas collection bag can be opened for unloading picked kapas.

3.3.2. How to use:

- Put on work clothes.
- Put the battery in the back bag.
- Connect the battery with the power line.
- Fix the Kapas Plucker at the mouth of the collection bag.
- Turn in the power.
- Unzip the collection bag and collect the kapas.

3.4 How to Charge the Battery:



Once the charger is attached to a sealed lead acid battery and plugged in, the charging process will begin. The charger will subject the lead acid battery to three steps of charging.

i. In the first step, the charger will enter the 'boost' mode. During this step, the charger is in the constant current mode with the current rate remaining at its maximum value.

ii. In step two, the battery will be nominally 80-95% charged, and the charger will switch into time controlled/constant voltage mode (current is no longer being provided at its maximum rate). The charger will continue to provide a constant voltage until the time interval is completed.

iii. The third and final step will place the charger in float/standby mode as the

battery will be fully charged. Because the charge voltage is at a standby level, the charger can continue to be connected to the battery, Should the battery be used, the charge can return to rapid charging (Step 1).

3.4.1 Battery care:

Keeping lead-acid batteries properly charged is the key issue to maximise the performance and lifetime of the battery. Overcharging will lead to loss of water in the electrolyte and subsequent corrosion of the uncovered parts of the battery plates, whereas the lead-acid ($PbSO_4$) that is not removed from the battery plates due to systematic undercharging will start to crystalline eventually making part of the plates inactive. Both negative effects will result in irreversible damage of the battery plates. The way in which the recharging process is performed is directly related to the reliability and lifetime of the battery system.

3.4.2 Maintenance

When not in use:

- Keep the Kapas Plucker clean.
- Store in a cool and dry place.
- Recharge the battery at least once in every month.

Chapter 4

INSTRUCTIONS DURING SHIFT CHANGE OVER

4.1. Taking Charge of Duties While Starting Of Shift:

- Come at least 10 - 15 minutes earlier to the work place.
- Discuss regarding the issues faced by previous worker with respect to the quality or production or spare or safety or any other specific instruction etc.
- Understand process running on the machine.
- Ensure technical details are mentioned on the job card & display in machine.
- Check the cleanliness of the machines.
- Charge the battery before starting work.
- Question the previous shift operator for any deviation in the above and bring the same to the knowledge of the shift superior.

4.2 Handing Over Charge at the end of Shift:

- Properly hand over the shift to the incoming operator.
- Provide the details regarding process running on the machine.
- Provide all relevant information regarding the stoppages or breakdown in the machine, any damage to the material or machine.
- Get clearance from the incoming counterpart before leaving the work spot.
- Report to the shift supervisor about the quality / production / safety issues/ any other issue faced in the shift and leave the department only after getting concurrence for the same from supervisor.

Chapter 5

IMPORTANCE OF HEALTH AND SAFETY

5.1. Health and Safety Instructions:

- To minimize exposure to hazardous chemicals appropriate personal protective equipment, such as Hand Gloves, Safety Glasses, Gum Boots, Masks, Head cap, etc., should be used.
- Never handle chemicals with bare hands
- Training should be provided on handling of solvents and other harmful chemicals, and how to deal with accidental spills, contact with skin and eyes, and ingestion of chemicals.
- Report any service malfunctions in the machine that cannot be rectified to the supervisor.
- Store materials and equipment at their designated places.
- Minimize health and safety risks to self and others due to own actions.
- Monitor the workplace and work processes for potential risks.
- Do not carry any metallic parts during machine running as there are chances of fire and damage to machine parts.
- Take action based on instructions in the event of fire, emergencies or accidents, participate in mock drills/ evacuation procedures organized at the workplace as per organization procedures.
- Hazardous waste must be disposed of properly in accordance with manufacturer's guidelines (MSDS) and national policies.
- Exit passageways and stair cases must never be blocked with obstacles and all stairs should have hand rails.
- Employees should be given access to safe drinking water as well as a clean area for meals.
- Emergency exit doors should never be locked.

- Proper lighting and ventilation need to be ensured and machinery must be well maintained to avoid accidents.
- Sufficient fire extinguishers should be made available and signs should be placed in prominent places so that people are aware of their presence.
- There should also be signs saying “No Food and Drink’ in areas such as the laboratory, store room and factory floor, and any other areas where it is not safe to consume food.
- Hazardous chemicals should be clearly marked in an appropriate language and with clear symbols that people have to be trained to recognize and understand.
- Sins should be placed near inflammable substances stating that it is not permitted to smoke or have open fires.

5.2. Safety Instructions:

- Always clean the machine before each and every production
- Check the machine conveyor path for any tools/ any objects before starting the machine.
- Do not touch the moving parts while machine in running condition.
- Avoid frequent handling of facemask until necessary.
- During cleaning ensure the machine is in off condition.
- Do not run the machine with choking material/facemask.
- Don’t run the machine with the ultrasonic horn in high temperature.
- Avoid touching the belt or moving parts while running.
- Wear gloves, shoes, ear plug, face mask, caps and aprons during machine operation.
- Do not blow the air while machine is running.
- Avoid frequent handling of sanitary napkins until necessary.
- During cleaning to ensure the machined is turned off.

- ❖ Do not run the machine with choking material/napkin.
- ❖ Keep the SAP container remains close always.
- ❖ During cleaning the machine remove the SAP and Raw materials from the machine.
- ❖ Use the emergency exit to get outside from the work place immediately when the conditions are going out of control.
- ❖ Use the correct type of fire extinguisher based on the fire type by the trained person.

Figure: Proper usage of Personal protective equipment

Figure: Emergency exit sign board

Figure Fire extinguishing equipment used in the industry

Safety Gloves Safety Shoes