

# Cotton

## a Multipurpose Crop

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*Cotton plant has many uses, right from the stalks used for thatching the huts or adorning the walls of plush homes and offices in the form of the ply boards to the table of a common man or the rich consuming the potato chips. The waste remaining after harvest can also be used to enrich the soil. The paper discussed various benefits of the cotton available in India.*

**Key words:** Cotton, Cottonseed oil, Cotton stalk housing, Furfural, Gossypol, Lint

COTTON is known for its lint – the fibre, produced that is used in the manufacture by the small artisans as well as the large textile mills where each garment is sold at a premium price. Cotton is an important crop because this sustains nearly 60 million livelihoods and generates substantial foreign exchange through exports ₹ 2.8 lakh crores and contributes ~4% to the GDP. Cotton is a preferred choice for clothing because of its several benefits such as:

- Absorbency
- Skin friendly
- Non-allergenic
- High strength of the fabric

Apart from its fibre, every part of the plant has several uses some of them less known. The study have tried to enlist benefits of this drought tolerant cotton crop starting from the poor man's hut to the rich man's house and from the animal stable to the dining table. Europeans came to know of cotton through the soldiers of Alexander the Great, who called it a plant bearing wool, the only fabric they were familiar with.

### Cotton fibre

Cotton fibre is obtained after the seedcotton is ginned, a process whereby the lint is separated from the seed to which it is attached. The fibre has a huge market and cotton is

known for this aspect as a commercial crop. The market for fibre ranges from the textile industry to small scale cottage industry that uses it to manufacture hand-spun yarn. The very short stapled cotton is also use for manufacturing mattress and surgical industry. These aspects are discussed below.

### Lint used by the textile industry

The lint obtained after ginning is sold depending on the quality of the lint with the longer and stronger fibre ending up as a raw material for the premium textile industry and ultimately sold as products of high value; for example, Suvin - the extra-long staple (ELS) cotton variety (Table 1). The fibre from this variety is branded as 'Suvin Ratna' and sold at a premium price. Fibre of the medium staple length has various industries preparing a range of quality products of the moderate price range. The short staple length is most commonly found in the indigenous *desi* cotton varieties (Table 1). The short fibre is most sought by the denim industry and for the manufacture of products where absorbency is essential such as bath towels, napkins, handkerchiefs etc. Recently, the Cotton Research Station, Nanded, bred and released *desi* cotton varieties possessing longer fibre lengths such as PA 08 (Table 1).

### Lint for surgical cotton

This is specialty cotton with the surgical industry as its end-use. The fibre is very short and has low ash content with the most important property of high absorbency.

### Cottonseed

After the seed-cotton is harvested and ginned, approximately two-thirds comprise the seed while the remainder is the fibres. The seed that remains after ginning has several uses and it is discussed below that range from its use as an animal feed to the rich man's table as an oil.

### Cottonseed for oil

The oil is extracted from the seed and is commonly sold as Binola. Although the use of this oil was consumed more in Gujarat, it is now being realized as good quality oil because it has less saturated fat than palm oil and is rich in linoleic acid content. Therefore, the market for cottonseed oil is growing. Globally, cottonseed oil ranks second only to soybean; while in our country it ranks third after rapeseed mustard and soybean. The oil is preferred for making potato chips and also has low transfatty acids. Cottonseed provides about 17% of the country's oil production almost double than groundnut.

## Cottonseed meal for animal feed

After the oil is extracted from the seed, the meal that is left behind is used as animal feed as it is high in protein and roughage. However, since the seed contains gossypol, it is toxic and cannot be fed to non-ruminants. The hull that remains after the oil is extracted from the kernel is used as roughage. However, value can be added to the hulls by manufacturing a chemical called 'furfural', a technology that was developed by ICAR-CIRCOT.

## Cotton as a protein supplement

Our country is deficient in pulse production and therefore, there is acute protein deficiency. We also have to depend on imports of pulses. Just like the soybean that is used as nuggets or chunks; the protein rich cottonseed, after the extraction of oil, can be used to meet the protein requirements of our predominantly vegetarian population. However, the exclusion of gossypol should be done because it could become toxic if the content exceeds more than 450 mg kg<sup>-1</sup>. Presently, commercially grown cultivars have high gossypol content. This is the major hindrance to use cottonseed as a protein supplement. Recently, some cultivars have been bred to have low gossypol content, as low as 1,100 mg kg<sup>-1</sup>. However, gossypol concentration in the seed is much above the accepted limits.

## What is Gossypol?

Gossypol is a natural organic molecule, a terpenoid compound, is yellowish, is present in almost all the parts of the plant. Gossypol acts as a self defence against several pests that attack cotton. The gossypol content in our cultivars and hybrids range from as low as 1,100 to as high as 14,000 mg kg<sup>-1</sup>. Predominant of the pests is the pink bollworm that feeds on the seed and the American bollworm that feeds on young fruiting and mature fruiting bodies. The compound gossypol is known for its anti-spermatogenicity – a 'male contraceptive'. However, till date, no commercial application has been successful probably because of the cheaper synthetic drugs that are available as well as its irreversible

**Table 1.** Yield and quality properties of some desi cotton and American cotton varieties and hybrids\*

| Cultivars              | Range of seed-cotton yield<br>(kg/ha) | Fibre quality parameters |                        |            | Oil content (%) |
|------------------------|---------------------------------------|--------------------------|------------------------|------------|-----------------|
|                        |                                       | Staple length (mm)       | Fibre strength (g/tex) | Micronaire |                 |
| <i>Desi cotton</i>     |                                       |                          |                        |            |                 |
| PA08                   | 1400 to 2100                          | 27.7 to 30.5             | 20.1 to 22.9           | 4.9 to 5.0 | 20.8 to 21.2    |
| PA 255                 | 1400 to 1900                          | 27.0 to 27.9             | 18.8 to 20.6           | 4.9        | 18.0 to 18.8    |
| AKA8                   | 1250 to 1800                          | 26.0 to 27.0             | 21.1 to 22.0           | 5.1 to 5.4 | 13.0 to 16.1    |
| <i>American cotton</i> |                                       |                          |                        |            |                 |
| Suraj                  | 1800 to 2500                          | 30.3                     | 23.8                   | 3.6        | 20 to 22        |
| LRA5166                | 1000 to 1800                          | 26.5                     | 22.3                   | 4.0        | 19 to 21        |
| <i>Bt varieties</i>    |                                       |                          |                        |            |                 |
| ICAR-CICR<br>Suraj     | 2000 to 2500                          | 29.1                     | 26.0                   | 4.3        | na              |
| <i>Hybrid cotton</i>   |                                       |                          |                        |            |                 |
| PDKV-JKAL-116<br>BGII  | 2145                                  | 30.9                     | 31.0                   | 3.7        | na              |
| NHH 44 Bt              | >2300                                 | ~25.5                    | ~22.0                  | 4.2        | na              |
| <i>ELS cotton</i>      |                                       |                          |                        |            |                 |
| Suvin                  | 900 to 1700                           | >37.0                    | >31                    | 3.1 to 3.4 | na              |
| DCH32                  | 900 to 1800                           | ~36.0                    | ~25                    | 3.4        | na              |

\*Data from various published sources; na – not available

effects. Several clinical trials are underway for its potential as a drug for treating diseases such as psoriasis and cancer as well as using it as an antiviral drug for treating HIV. These studies are still in the clinical stages.

## Cotton Stalks

### Housing

In the rural areas, we still find a substantial number of the poor and marginal farmers who use the stalks remaining after cotton harvest for basic needs; housing - thatching material for the roofs. While traversing through the remote areas, it is common to see many such thatched huts where different types of materials are used to make the roof. On the other hand, the same cotton stalks can be seen in the rich man's house or plush offices adorned with the particle board made from the cotton stalks. The stalks contain about 69% holocellulose and 27% lignin and among agricultural field crops, this compares favourably with the hardwood trees and therefore is suited for the making of particle boards. Dr Pandey and Mehta of ICAR-CIRCOT, Mumbai for the first time demonstrated particle board could be made from the cotton stalks after they were made into small chips. Later research efforts were intensified and the advantages of the cotton stalk for making particle board which

resulted in some of the leading manufacturers using cotton stalks for making particle boards. The only difficulty that was faced was the transport of the cotton stalks from far-off places because of the bulky nature. However, this can be overcome by making small chips and transporting it. This requires energy. With the PM-Urja scheme, it may become a possibility to add value. However, till then, the cotton stalk utilization would be of value in and around the particle board manufacturers. Some of them who are manufacturing laminated particle boards using cotton stalks are Godavari Particle Board, Nanded; Ecoboard Pvt. Ltd, Pandharpur; Aurobindo Laminations, Nagpur. These obtain the cotton stalks from the cotton farmers' field ridding him of the exercise of uprooting and disposing it off. Further they also earn money for the stalk. Thus, the humble cotton stalk could be used for panelling in the homes or offices or providing for the basic need of the poor farmer.

### Fuel

The PM Ujjawala scheme was introduced to benefit 8 crore households to make toxic smoke free cooking. However, there are still many farmers who are yet to receive this benefit. Such farmers use it for cooking meals using the cotton

stalks. Furthermore, many in the rural areas prefer cooking food using fire wood for the reason that it imparts a special flavour to the food compared to the food cooked on gas. Cotton stalks have been converted to pellets and briquettes that can be used as high energy value fuel.

#### Composting

Farmers using the cooking gas; look at cotton stalks as waste and dispose it by burning. Such farmers could be educated to add value to the resource either by way of enriching their soil or using it as a base for mushroom. Soils can be enriched by efficient composting techniques developed to prepare high quality enriched compost at ICAR-CIRCOT and ICAR-CICR. This has been found to significantly improve seedcotton yield and was equivalent

to the farmyard manure treatment. Farmers living close to the cities could raise mushrooms on the stalks and the mushrooms could be sold to the cities where the produce fetches a premium price.

#### Linters

Small fibres that remain attached to the seed after ginning is called linters. These have many high end applications such as high quality paper, currency notes.

#### Cotton gin waste

At the ginning yards a substantial waste remains. This waste material can be converted to high quality compost and used for replenishing soil fertility.

#### Combernoil preparing surgical cotton

Although there are Asiatic cotton

cultivars most suitable for preparing the absorbent cotton; many surgical cotton manufacturers use the waste that lies at the spinning and weaving centres. This waste is called combernoil and is available at a cheaper price than the short-stapled cotton.

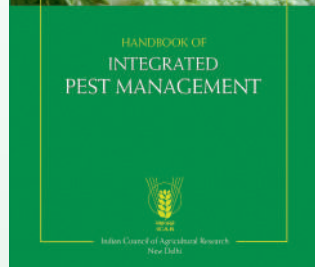
#### SUMMARY

Cotton helps in meeting all the three basic needs of man, namely, food, fibre and house. However, at the national level, it has not received the attention it deserves, because of emphasis on wheat, rice and pulses, the food crops.

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## HANDBOOK OF INTEGRATED PEST MANAGEMENT

To reverse the loss of environmental resources and also to reduce biodiversity loss, the Government of India has Integrated Pest Management (IPM) as part of the National Agricultural Policy. Integrated Pest Management emphasizes the growth of a health crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms. IPM is not new – mechanical, cultural and biological tactics were used by farmers for hundreds of years before chemical pesticides became available. Besides, there are IPM techniques that have been developed more recently and are effective in suppressing pests without adversely affecting the environment.



The task of spreading the message of IPM across is tough due to poor awareness about the subject among people in line-departments as also among the farmers. The information on integrated pest management as a whole is scattered. This *Handbook* comprehensively deals with all the aspects of integrated pest management in field crops, horticultural crops under traditional, protected systems. Information on basic strategies and tactics of different methods of management including mass production of biocontrol agents, IPM policy and pesticide registration is provided in comprehensive form.

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