

EXTRACTION, PROFILING AND USE OF COTTON-SEED OIL

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Though India is one of the leading cotton growing countries as far as area under cultivation is concerned, the average yield level is around 440 kg/ha, which is lower than the world average of 717 kg/ha, mainly due to greater dependence on rainfed cultivation practices, thereby depriving the cultivators of adequate returns commensurate with their inputs. Hence, other ways of fetching remunerative returns to the farmers are to be explored. For this, various byproducts of cotton have to be utilized judiciously so as to generate additional income to the farming community.

Cotton, the king of fibre crops, is mainly cultivated for its lint and dominates the textile world due to some of its inherent characteristics. India has about 9.1 million ha under cotton cultivation and is the only country where all the four species, viz. *Gossypium arboreum*, *G. herbaceum*, *G. hirsutum* and *G. barbadense* as well as inter- and intra-specific hybrids are cultivated. The production of cotton during 2004-05 has been around 24 million bales of 170 kg each.

COTTONSEED

Cottonseed is one of the important byproducts of cotton, the use of which has not been exploited to the fullest extent. The seed collected after ginning is used for extraction of oil. The ginned seed is covered with small fuzzy fibres known as linters. These are removed by delinting machines. Thereafter, the seed coat (cortex) is removed by dehulling to get kernels, which contain mostly storage proteins, oil and a toxic pigment, gossypol. The approximate constituents of cottonseed belonging to different species are given in Table 1.

Table 1. Constituents of cottonseed of different species

	Whole seed			Kernel		
	Linters	Kernel	Hulls	Oil	Oil	Protein
<i>G. arboreum</i>	5.9	52.0	43.0	19.6	32.5	33.8
<i>G. herbaceum</i>	4.3	53.0	45.0	19.1	31.3	34.6
<i>G. hirsutum</i>	10.5	55.0	35.0	21.3	33.7	35.5
<i>G. barbadense</i>	-	61.0	39.0	21.8	30.8	36.6

Oil

Traditionally, whole cottonseed is used as cattle feed in our country. However, the increase in demand of edible oils has necessitated processing of cottonseed for its oil. About 68 lakh tonnes of cottonseed produced in our country can yield about 10 lakh tonnes of oil. Cotton seed contains about 19-22% of oil depending on the species. The oil content in kernel varies from 30.8 to 33.7% depending on the species.

In Indian, major portion of cotton seed oil extraction is carried out in the unorganized sector and is by direct crushing of whole seed. The yield and quality of oil is inferior and much oil is lost in cake. However, the organized sector generally adopts the modern scientific process of oil extraction which comprises cleaning of seed, delinting, dehulling, crushing/screw pressing of kernel, followed by solvent extraction of meal. This result in higher yield and quality of oil and meal.

Crude cottonseed oil which contains varying amounts of free gossypol and gossypol like pigments which are toxic to human-beings and have to be removed by refining to make it suitable for edible purposes. Refining is generally done by neutralization with caustic alkali, followed by bleaching and deodorization, etc.

Refined cottonseed oil

It is one of the few oils which is in 'Ok food' list of American Heart Association (AHA). The oil is nutritive, safe and suitable for human consumption as it is certified by AHA. It contains 50% linoleic acid, which is essential fatty acids and is not biosynthesized in our body. These fatty acids are essential for synthesis of various hormones without which the internal vital organs of our body can not function properly. It does not allow blockening of coronary arteries by forming hard pellets of cholesterol. In view if above two qualities, it can be made compulsory to be used in the form of blend either with other oil or with hydrogenated vanaspati or it should be supplied in the form of encapsule.

The keeping-quality of the oil is comparable to groundnut and safflower oils and its nutritional value is around 9 k cal/g. The average digestibility of cottonseed oil is 97% and could be compared with that of soybean, safflower and sunflower oils. Cottonseed oil with practically no gossypol is pale yellow in color, rich in vitamin E, and can be used directly as a cooking medium and also for the manufacture of vanaspati, soap, etc.

The CIRCOT is actively involved in research on scientific extraction of oil from cottonseeds. A pilot plant for scientific extraction of cottonseed oil has been set up at Ginning Training Centre of CIRCOT at Nagpur under Mini-Mission II of Technology Mission on cotton. The plant has capacity to process 100 kg of cotton seed per hour. It comprises seed cleaning system, delinting, dehulling, expeller unit, and oil refining facility. Regular research activities are being undertaken for performance evaluation of new varieties of cottonseeds in respect of oil extraction. Apart from research work, the facility is utilized for imparting training to entrepreneurs and farmers to enlighten them about the advantages of scientific processing of cotton seeds for oil extraction.

Industrial application of cottonseed oil

Crude cottonseed oil is used in pigment industries, soap making and as lubricating oil. Refined cottonseed oil is mostly used for manufacturing *vanaspati*, margarine, edible oil etc. It can be used for production of acetoglycerides for food brominated oil which is used as wetting agents and for production of cloudy flavoured soft drinks. It is also used as fat for intravenous nutrition as a tallow substitute and for production of palmitic acid and byproducts plasticiser. The fatty acids from these are obtained and distilled to make several fat derivatives.

The major fatty acids present in cottonseed oil are palmitic, oleic and linoleic. If distilled we get fraction rich in linoleic and oleic. Full hydro-genation gives a mixture of palmitic and stearic acid in the ratio of 3:7. This could be fractionated to get palmitic rich fraction and stearic rich fraction.

Indian Scenario of Cottonseed Production		
	2004-05 season	2003-04 season
Bales of cotton (170 kg each)	205.0 lakh bales	165.0 lakh bales
Cottonseed production @ 333 kg/bale	68.3 lakh tonnes	54.9 lakh tonnes
Retained for sowing direct consumption	11.5 lakh tonnes	11.5 lakh tonnes
Marketable surplus	56.8 lakh tonnes	43.4 lakh tonnes
Production of washed cottonseed oil (11%)	6.3 lakh tonnes	4.8 lakh tonnes
World's cottonseed production: China 27%, USA 12%, India 11%, Former Soviet Union 10%, Pakistan 9%.		

CONCLUSION

In India about 68 lakh tonnes of cottonseeds are available as byproduct of cotton and utilized for extraction of oil. At present nearly Rs 9300 crores worth of oil is imported to meet the demand of oil in the country. Cottonseed which is presently available for oil extraction is about 10 million tonnes and it can produce about 0.15 million tonnes of oil. This will reduce the import of oil considerably. The processing of cottonseed in a scientific manner results valuable products in generation like linter, hull, oil and cake which can be utilized for manufacture of industrially important products. All these products are of immense importance for the country and can open up avenues for rural industries and employment apart from fetching additional income to farmers. Hull and cake can be used for cattle feed as well as for various other industrial purposes. Oil can be used for edible purpose, for production of vanaspati, salad oil, margarine and soaps etc. Linters for production of pulp and paper, microcrystalline cellulose, etc.