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ttonseed proteins multifunctional polymers

ottonseed kernels can provide a high quality dietary source of protein. CIRAD has carried out major research in this field. Proteins extracted from the kernel may also be processed into biodegradable materials to replace petroleum-based plastics. CIRAD aims to gain insight into the film-forming and adhesive properties of these proteins and develop innovative industrial manufacturing processes using known techniques.

Cottonseed structure

Whole cottonseeds consist of a kernel (60% of its weight) and a cellulose shell (40%). The seed contains 20-30% proteins and 20-30% oil, depending on the cotton variety. Seeds that are not set aside for planting are generally ground to extract edible oil and highprotein seedcake to serve as cattle feed.

Cottonseed with linters.

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Whole cottonseed. © J. Lecomte



Kernel, © J. Lecomte



Shell, © J. Lecomte

Cottonseed proteins for consumption

Cotton plants naturally contain gossypol, a polyphenol that is toxic to humans and monogastric animals. This compound cannot be completely removed during industrial or small-scale oil extraction processes-cotton proteins are thus fed only to polygastric livestock. Some so-called 'glandless' cotton varieties do not contain gossypol, so the derivative protein products can be consumed by humans and all animals.

Research conducted by CIRAD and African partners revealed

that cotton kernels could be processed to obtain very nutritional high-protein (over 50%) flour. The protein was studied and compared to reference proteins from milk (casein) and soybean. This cotton flour can also be used in the preparation of products to feed recently weaned or malnourished infants. Further studies also showed that cotton flours without gossypol are readily accepted by African consumers in traditional dishes (sauces, nougats, cakes).

CIRAD has been conducting research on glandless cotton varieties for around 30 years, so it is fully qualified tosupport institutions planning on using deriviative



Sections of glandless (without gossypol) and glanded (normal) cottonseeds. © J. Lecomte

products to fulfil a specific food demand. Glandless cotton can be grown as a cash or food crop, and for its fibre. However, to ensure success, all stakeholders in the subsector must implement agricultural techniques that are specifically adapted to these varieties, while also complying with the health standards.

From cottonseed proteins to biomaterials



Lettuce seeds coated with cottonseed proteins (with and without dye). © J. Lecomte

Biodegradable materials made from natural polymers or polymers derived from plant sources could replace certain petrochemical plastics. As part of an EU project, CIRAD and partners have just demonstrated that cottonseed proteins and seedcake can be used to make flexible and rigid films, composite materials, and seed coatings.

These materials are obtained via common industrial techniques (calendering, extrusion,

thermomoulding, coating). CIRAD, through ongoing research under industrial partnerships, is striving to develop products that are fully satisfactory while tailoring the properties of the materials to their end uses and assessing their shelflife under actual usage conditions.

> Biodegradable film made with cotton flour. © CIRAD

For further information

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