INTERNATIONAL COTTON RESEARCHERS ASSOCIATION

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Content

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For Historical Cotton Innovations Newsletter:

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News

The ICAC RESEARCHER OF THE YEAR AWARD 2021

The ICAC RESEARCHER OF THE YEAR AWARD is internationally recognized as the top-most award in cotton science. It is globally accepted as the most prestigious and the highest International recognition for cotton scientists. The Award was initiated by the International Cotton Advisory Committee (ICAC) www.icac.org in 2009 and as of now it is the only International Award for Cotton Scientists.

Application Details to the 2021 Award

- Researchers from universities and public sector research organisations can apply for the award directly or through their heads of institutions.
- Researchers from all disciplines of cotton production research, including ginning, fibre quality and textile research are eligible for the award.
- Women researchers are encouraged to apply
- The deadtime for applications is 15 May 2021.
- Please send your completed form to nominations2021@icac.org with the subject 'ICAC RESEARCHER AWARD 2021 APPLICATION'.
- The winner will be announced on 31 May 2021.
- The winner will receive a shield, an honorarium of US$1,000, a certificate, and the title "ICAC Cotton Researcher of the Year" at the ICAC Virtual Plenary Meeting to be held during December 2021.
- The winner will be invited to make a special presentation at the Plenary Meeting on his/her contributions to cotton research and his/her vision for the future.

35TH INTERNATIONAL COTTON CONFERENCE, BREMEN-GERMANY

The 35th International Cotton Conference was held as a digital event on March 17-18 under the title "Passion for Cotton!" Organized by the Bremen Cotton Exchange and the Fibre Institute Bremen (FIBRE), it hosted about 90 speakers and panelists through a tight program of 14 sessions designed for visitors with different information interests such as sustainable cotton cultivation, transparency in the supply chain and corporate responsibility, along with increased yields, improved fiber quality, quality testing and standardization.

Parallel to the sessions, poster presentations and virtual rooms offered extra occasions for speakers and participants to learn more in-depth information and exchange opinions on the vast and versatile world of cotton.

The **Cotton Innovations** picked some key statements about some of cotton's future challenges and innovations heard at the event.

CLIMATE CHANGE: A STORM IN A TEACUP?

Kai Hughes,

Executive director,

ICAC. Washington DC, USA

The recent Davos conference highlighted once again the huge differences between countries on the extent of climate change and the action required to mitigate it. Despite the increasing frequency of catastrophic climatic events and temperature records being broken, policy-driven responses have been slow and even inadequate. Agriculture lies at the heart of such policies.

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This keynote speech will aim to summarise the issues facing agriculture arising from climate change and in particular its possible effects on cotton production and the cotton and textile value chain. Is it all just a storm in a teacup or do we need to make urgent decisions now in order to protect the cotton industry? The presentation isn't designed to provide all the solutions to this huge and critical topic but to generate debate amongst the cotton community and to ensure that climate change and its effects on cotton are a continuing and growing conversation that is at the very forefront of people's minds. How can we start to provide all the answers when we haven't even started to ask all the right questions?

COTTON, A NEVER-ENDING SOURCE OF INNOVATION

Thomas Schneider,

Hochschule für Technik und Wirtschaft (HTW), Germany:

"We have seen that cotton is indispensable because of its properties as a natural, innovative, renewable and biodegradable raw material that can also be recycled. The possibilities of its use go far beyond processing into clothing and, from a research perspective, are far from exhausted."

ORGANIC COTTON, MOST ASKED FOR, BUT RARE

Maximilian Daebel,

Otto Stadtlander GmbH,

Germany:

"The demand for organic cotton has increased within the last 12 months. A recent GOTS survey showed that 60% of all interviewed companies changed their sustainability policy focus on environment and health due to Covid-19. Although at the moment we are facing a severe shortage in organic cotton as major consuming markets have imposed sanctions against, for instance, fraudulent activities in Indian Organic cotton organizations that caused uncertainties in regard to authenticity. Prices have been increasing steadily over the last seven months by about 60%, and we expect this trend to continue until the next harvest in the Northern Hemisphere forecasted by November 2021."

TRACEABILITY IS KEY

Stefan Ziegler, WWF,

Germany:

"Annually approximately 25 million tons of cotton are produced, which are used to make 50% of all clothes, household goods and other commercial products. For the production of cotton, surface and ground waters are often diverted to irrigate cotton fields, leading to freshwater loss through evaporation and inefficient water management. This often has a severe impact on the environment, and more than 50% of the global cotton production area is under high physical water risk. Being able to determine geographic origin of cotton should lie in the interest of textile producer companies not only for quality reasons but also for reputational risks regarding the plants' consumptive water footprint. We carried ahead a study on undyed cotton fibers of known country of origin, explored the potential for Isotope Ratio Mass

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Spectroscopy (IRMS) and trace element analysis to be utilized as a tool for cotton fiber analysis in an attempt to reveal discriminatory information on the provenance of cotton. The research confirmed that chemical profiling can be very useful in answering specific compliance questions whether a sample comes from a specific region or not. The study has also shown that cotton production areas in high physical water risk regions, such as certain watersheds in India, China, Uzbekistan and Turkey, are characterized by distinctive chemical and isotopic signatures. However, sample efforts from those countries need to be increased to obtain a better understanding of seasonal variance of isotopic systems and trace metals' availability."

ROBOTICS IN COTTON HARVESTING

Dr. Alex Thomasson, Mississippi State Univ., USA.

Advances in computer vision, artificial intelligence, and mechatronics have resulted in the introduction of autonomous machines and mobile robots in farming. Cotton Incorporated has recently sponsored research projects focused on robotics for cotton harvesting, resulting in (1) data on potential yield and quality benefits from multiple harvest events rather than once-over harvesting, (2) the ability of a small robot to traverse a field through crop rows based on GPS and other sensors, (3) machine vision to detect cotton bolls under defoliated conditions, and (4) preliminary design of a robotic "end-effector" for removing cotton from bolls in the field.

BETTING ON CIRCULAR ECONOMY

Mary Ankeny, Cotton Inc., USA:

"We can recognize three phases describing the circular attributes of cotton. Phase one is reuse. A well-made durable cotton garment can be used for years and when not needed it can be resold.

Phase two is recycling. Textiles made of 90% to 100% cotton can be mechanically recycled and used to create new cotton products. For the Blue Jeans Go Green program started in 2006 they diverted more than 2.5 million pieces and 1,030 tons of denim waste from landfill. Moreover, there are more recycling programs through which cotton keeps its strength. Cotton can also be enzymatically hydronized back to glucose monomers that can be used to create bio-based chemicals such as acids or ethanol.

The third phase focuses in cotton's ability to return to the earth after it can no longer be recycled. Cotton products are biodegradable in soil, compost, wastewater, salt water and fresh water environments. Cotton degrades faster in cellulosic fibers and manufactured fibers like rayon and oil-based synthetics. Composed of cellulose that can be broken down to glucose, cotton is recognized as a food source, for organic microbes and end-of-soil and water. And finally cotton gives back to the earth. Growers can return the remains of the cotton plants to the soil to import nutrients to the fields. Brands and manufacturers can also play a role in the circular path and benefit by choosing cotton as a preferred raw material."

The next edition of the International Cotton Conference will be held March 30-31, 2022, coinciding with the 150th anniversary of the Bremen Cotton Exchange's foundation.

HUNDRED YEARS OF COTTON BREEDING RESEARCH IN EGYPT 1921–2021

Prof. Dr. Mohamed Negm
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During recent season, Egyptian cotton production and marketing aimed at meeting developing demands of Egyptian Cotton Spinners, as well as guaranteeing fair returns to cotton producers. Other objectives are higher yield per hectare and lower production cost. The government of Egypt directs these aspects of the cotton policy. In order for this policy to achieve its objectives, a number of technical and regulatory measures on cotton production, ginning and marketing have been taken until the lint finally reaches the spinners in the best condition.

Accident or luck

A glance at Egyptian cotton's past shows that selection of new cotton varieties in the 19th Century and the opening of the 20th Century was initiated by Egyptian and Greek cotton merchants not possessing the scientific basis of cotton breeding, and that state of affairs continued until the founding of the Ministry of Agriculture in 1913. Either through accident or luck, a cotton was discovered which did not look like anything else, possessed a good staple length, pulled strong and made a good impression on the merchant or exporter to whom it had been submitted for inspection. Very little research was made on the qualities of the fibers, and the true yield per hectare was only approximately known. The Ginning Out-Turn was treated as a matter of luck, so much the better if it was high. In brief, appreciation of a new cotton was based upon the cotton classer's judgment and the spinner's experience after use more than opinion of the grower who is attracted by high varietal yield.

Need for quality Control

After World War I, the yield and quality of Egyptian cotton declined to such an extent that the need for a centralized research station affiliated to the Ministry of Agriculture to make a serious and consecutive study of the problems of the crop was felt. Thus, the Botanical Section of the Ministry of Agriculture, "Cotton Research Institute" currently, was established at Giza in 1919. For Cotton, this meant the creation of new varieties, purification of types, maintenance of these in pure state, and their improvement if possible.

With regard to the production of new varieties, Giza 7, the pearl of Egyptian cotton in its time, selected in 1921 and made its first appearance on the market in 1930, by Botanical Section. The original plant was found in an Ashmouni field, and was possibly, in the first instance, a natural crossing between Ashmouni and Sakel.

"Sakel, A variety first introduced in 1907 by Mr. Jean Sakellaridis, a Greek broker of Alexandria, who is reputed to have selected it from an odd handful of seed cotton which he noticed to possess long silky staple; yarn as fine as 200's has been spun this cotton in 1910, which in the best example has a length of staple about 37mm."

Sakellaridis cotton variety was one of three occasions during the 19th and 20th century, when Egyptian agriculture was saved from the full consequence of the decline in quality of the major cotton type by the "hard work" discovery of a successor-the two other instances being the introduction of Ashmouni in 1860, and that of Mit-Afifi in the early 1880s

Mr. Jean Sakellaridis

However, the spread of ELS varieties did not turn the attention away from breeding a group of new high yield LS varieties with length in the 1 $^{1}/_{8}$ to 1 $^{3}/_{8}$ inch range. Giza 30 was introduced first and was released to the growers during the closing years of World War II. Its yield and Ginning Out-Turn were very high and the crop ran at a high grade.

Introduction of modern varieties

During 2010s, in the ELS category, Giza 45 has remained the distinguished superfine cotton of the world. Giza 96 caused the disappearance of improved Giza 88. two new varieties were added to this, Giza 87 and Giza 92.

Regarding the LS staple category, a new variety called Giza 97 (year 2021) was developed which exceeds its parent in yield and yarn strength. Giza 94 and Giza 95 are two newcomers to its category.

Through efforts put forth by the Cotton Research Institute in breeding new varieties of cotton, Egypt witnessed the best cotton yields in its history in the 10-year period 2010-2020 with being the highest yield 820 KG of lint/hectare.

The present commercial varieties grown in the 2020-21 season are: Giza 45, Giza 92, Giza 96, Giza 86, Giza 94, Giza 97 and Giza 95. Approximately 6% of the Egyptian cotton production is ELS cottons, while the remaining 94% is devoted to LS Cottons.

For 100 years, since the initiation of the Cotton Research Institute, Egyptian cotton breeding has been successful in ever renewing the youth of Egyptian cotton by providing the markets with new varieties surpassing the former ones in yield and spinning performance and characteristics. Thus, all our commercial varieties which prevailed from 1980s until the 2015s have become obsolete “except Giza 45, Giza 86 and Giza 92” and been replaced by new varieties possessing higher yield, better quality, and better more remunerative prices.

Cotton Research Institute-1931

GIZA 98, A NEW EGYPTIAN COTTON VARIETY CHALLENGING THE ABIOTIC STRESS

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Cotton is the most important fiber crop and is the basic input to the textile industry in Egypt and worldwide. It is obvious that growth and development of cotton in Upper Egypt usually face one or more stress.

Environmental factors that impose abiotic stress, such as drought, salinity and extreme temperature, place major limits on cotton productivity. However, many abiotic stresses are complex in nature, controlled by genetic and environment.

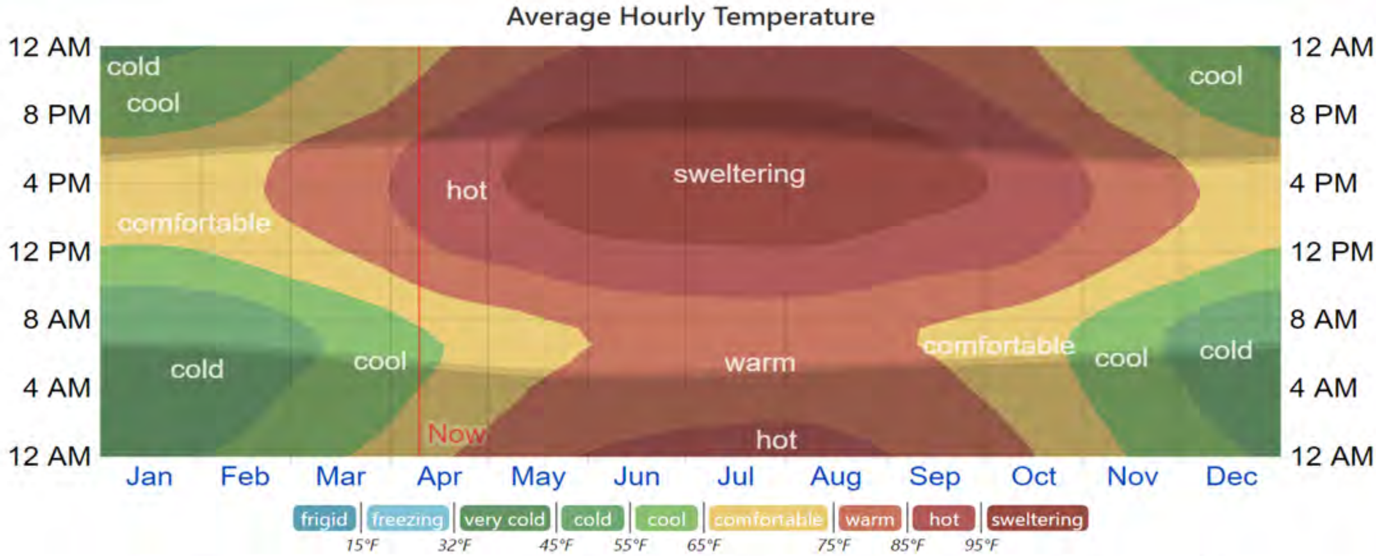
For developing tolerance superior cultivars of cotton for abiotic stress, it is imperative that the nature of the stress condition is defined and diverse range of germplasm needs to be tested for response to stress. The stress may be governed by more than one character which may include the morphological, anatomical, physiological and chemical characters. The choice of breeding approaches and methods may depend on the method of reproduction, mode of gene action, source of tolerance available and the priority assigned to goal in relation to the other agronomic traits. The direct approach based on the absolute performance under actual stress or selection for only small reduction in performance under stress and indirect approach is based on screening and selection for morphological or physiological characteristics that may be correlated with or that contribute to stress tolerance. The identified temperature resistance traits can be introduced into superior genetic background.

The temperature range 26-32°C is desirable during day time but the night should be of moderate temperature (20-24°C during flowering and fruit.

The cotton is able to tolerate short periods of high temperature up to 43-45 °C if soil moisture condition is favorable. High day temperature coupled with high night temperature causing shedding of flowers and buds and delay flowering.

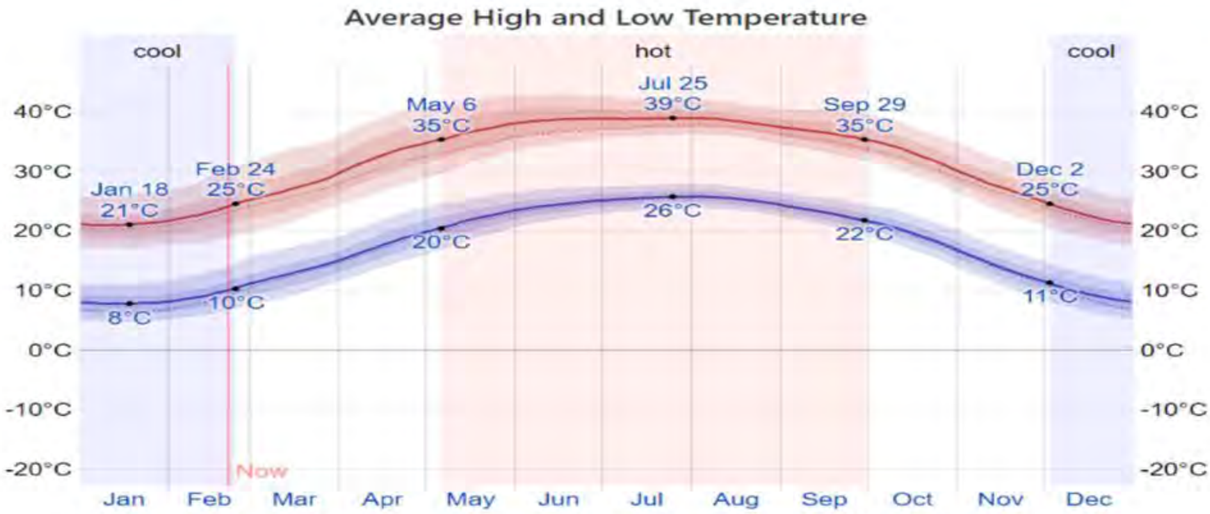
In Upper Egypt, mainly in Sohag governorate, high temperature is a single major factor, which is responsible for reducing the yield and the area of cotton production. In this scenario, it is necessary to adopt ways to improve the tolerance of cotton against abiotic stresses. The strategies for improving tolerance against abiotic stresses may include plant genetic improvement of new cotton genotypes and produce a new improved cotton variety for use by farmers. The figure below shows a compact characterization of the entire year hourly average temperatures. The horizontal axis is the day of the year, the vertical axis is the hour of the day, and the color is the average temperature for that hour and day.

Giza 98 is a new variety introduced from hybridization between the Egyptian cotton genotypes [(Giza83 x Giza80) x Giza89] and cotton strain A107 in season 2004. The superior plants in yield components and fiber quality were selected and isolated in isolation seed) was obtained in the 2018 season. Giza98 variety is now under government registration. Giza98 represents high yield potential (1800 Kg/ha lint) with 42% of GOT and acceptable level of fiber quality and spinning performance, moreover it is tolerant to high temperature and aggressive climate in Upper Egypt zones.



The average hourly temperature, color coded into bands. The shaded overlays indicate night and civil twilight.

https://weatherspark.com/y/96901/Average-Weather-in-Sohag-Egypt-Year-Round#Sections-BestTime



The daily average high (red line) and low (blue line) temperature, with 25th to 75th and 10th to 90th percentile bands. The thin dotted lines are the corresponding average perceived temperatures.

https://weatherspark.com/y/96901/Average-Weather-in-Sohag-Egypt-Year-Round#Sections-BestTime

Fiber and yarn qualities of Giza 98

Fiber length UHM	30.0
UI%	86.0
Strength g/tex	38-39
Elongation %	7.6-8
Micronaire	4.2-4.4
Color	Creamy
L.C.S.P.	1900-2200

NATURAL FIBRE PRODUCTION MARGINALLY LOWER IN 2020

Terry Townsend
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Member of Discover Natural Fibre Initiative
www.dnfi.org

World production of natural fibres was approximately 33.4 million tonnes during 2019 and about 33 million during 2020. The Covid-19 pandemic was hugely disruptive to the world economy, including consumption of natural fibres, but most natural fibres destined for harvest in 2020 had been planted by the time the impacts of the pandemic were felt. Consequently, production of many natural fibres was unchanged or even higher during 2020. However, jute production fell by one-third to just two million tonnes, the lowest since 1975. The impacts of the pandemic are having negative impacts on natural fibre production during 2021.

The value of natural fibre production at the producer level fell about US$2 billion during 2020 to approximately US$55 billion. Natural fibre prices tended to decline during the first half of 2020 on fears of disruptions to demand, but prices of many fibres strengthened during the second half of the year. The Cotlook A Index, an indicator of average prices of cotton, fell below 60 cents per pound in April 2020 but finished the year above 80 cents. Prices on the Australian Wool Exchange dropped below AUD 8.60 per kilogram in September but finished 2020 at AUD 11.65 per kg. Export prices of jute from Bangladesh rose from an average of USD 0.85 per kg during 2019 to USD 0.92 per kg during 2020. However, a reduced volume of natural fibre production resulted in a lower overall value.

Coir Fibres

An estimated 40 million households earn their livelihoods from the production of natural fibres, and when seasonal employment is included, approximately 200 million people, or more than 2% of the world population, work in the agricultural segments of natural fibre value chains.

Cotton accounted for 80% of world natural fibre production in 2020. Approximately 30 million households earned an estimated $36 billion from the production of cotton. World cotton production rose from 25.8 million tonnes during 2019 to 26.6 million tonnes during 2020. Production in the two largest cotton producing countries, India and China, rose because government measures shield farmers from the impacts of international developments. Cotton production was also higher in Brazil because prices early in 2020 encouraged increased planting. However, cotton production was down in the United States because poor weather led to a reduction in harvested area. Cotton production was down in Pakistan during 2020, reflecting an ongoing shift from cotton to sugarcane that began in 2015. Cotton production has been trending downward in Uzbekistan since the 1990s reflecting changes in government policies.

Kapok Fibres

World production of jute represented 6% of world natural fibre production in 2020. Approximately 6 million households earned about $1.3 billion from jute production in 2020, down from $1.8 billion in 2019.

Bangladesh and India. India and Bangladesh account for 96% of world jute production.

World production of flax and coir are estimated essentially unchanged at a little more than one million tonnes each in 2020, while wool production dropped to 1.03 million tonnes because of reduced sheep numbers in the Southern Hemisphere linked to a three-year drought that ended in 2020. Wool, flax and coir each accounted for about 3% of world natural fibre production. However, wool production accounted for about one-fifth of the value of world natural fibre production, or about $13 billion. Flax production was worth about $500 million and coir about $250 million in 2020.

Abaca, hemp, ramie, sisal, silk, other bastfibres and luxury animal fibres accounted for the remaining 4% of world natural fibre production in 2020 and together were valued around $3 billion, with silk alone valued at about $2 billion

World Production, Value and Employment of Natural Fibres, 2020

Production Estimated Natural Fibers	Metric Tons	Households Millions	Employment Millions	Value of Production $Billion
Vegetable Origin				
Abaca	85,000	0.1	0.4	$0.20
Bastfibres, other	200,000	0.2	1	$0.10
Coir	1,050,000	1.2	6	$0.30
Cotton lint	26,557,000	29	140	$36
Fibre crops not specified elsewhere	270,000	0.2	1	$0.20
Flax fibre and tow, ex scutching mill	1,068,000	0.01	0.05	$0.50
Hemp fibre and tow	200,000	0.2	1.0	$0.10
Jute, Kenaf & Allied Fibres	2,040,000	6	30	$1
Kapok fibre	76,000	0.1	0.4	$0.20
Ramie	57,000	0.1	0	$0.10
Sisal, Henequen and similar hard fibers	282,000	0.1	0.3	$0.40
Animal Origin				
Silk, raw	179,000	0.3	1.0	$2
Wool, clean	1,031,000	5	10	$13
Other, greasy weight*	26,235	0.1	0.3	$0.70
Total Natural Fibers	**33,100,000**	**40**	**200**	**$50**

NATURAL SILK: THE QUEEN OF FIBRES

Prof. Dr. Hosam El-Sayed
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The road for silk production passes through many stages: namely mulberry cultivation, silkworm breeding, and textile production. Each stage comprises many steps which needs professional, in various fields, such as agriculture, biotechnology, and textile chemists and technologists. The term sericulture covers the cultivation stages of mulberry, silkworm rearing and post cocoon activities leading to production of silk yarn. Sericulture offers lucrative employment, economic growth and upgrading the quality of life to the people in rural zones and consequently it plays an important role in anti-poverty programs.

Hence several nations like China, India, Brazil, Thailand, Vietnam, Indonesia, Egypt, Iran, Sri Lanka, Philippines, Bangladesh, Nepal, Myanmar, Turkey, Papua New Guinea, Mexico, and Uzbekistan have taken up sericulture to provide employment to the people in rural areas. The current annual global silk production is 180,000 M. T. and the demand for silk is increasing by 1% annually. With the increase in population and demand for fashionable clothing items due to fast changing fashion designs in developed countries, the demand for silk is bound to increase even more. For increasing the silk production, we require highly productive mulberry varieties and silkworm races and silkworm races tolerant to adverse climatic conditions and diseases which can come mainly from the sericultural germplasm resources and also from the wild relatives of *Bombyx* available in the natural habitats.

Furthermore, this work highlights the efforts exerted to overcome some problems regarding in vivo and in vitro propagation of mulberry trees, silkworm rearing, post cocoon, and textile technologists leading to economically feasible semi-mass production of silk.

THE 3-IN-1 CONCEPT: INNOVATIVE DIRECT SPINIT SYSTEMS

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During ITMA 2019 Exhibition in Barcelona, Spain, a new knitting machine named Spinit "3-in-1 Concept" was exhibited. Spinit Systems is the innovation from Mayer & Cie. that combines the spinning and the knitting processes, Figure (1). Knitting fabric is manufactured directly from the cotton fiber roving and not from the yarn. The three process steps spinning, winding and knitting are combined into one machine.
The operating principle for this machine could be summarized as follows:

1. The process starts with bobbins packages weighing 2.5 kg each, containing cotton fiber roving. The bobbins are put on the overhead creel of the knitting m/c.
2. Spinning: Then the roving are passing via electronically controlled 3-over-3 rollers drafting unit, which lessens the linear density of the fibers roving, Figure (2).

- A twin air jet false-twist spinning unit nozzle is connected straightway to the drafting unit and moves the drawn fiber bundle to the knitting zone.

3. Cleaning: Before entering the knitting unit, the cotton roving is automatically cleared of imperfections "thin and thick places" during machine running in 100% online sensor process.
4. Knitting: After entering the fiber bundle the yarn guide, the false twist disintegrates and a fiber bundle without a twist is supplied to the knitting needles. Consequently, the cotton knitted fabric wounds up through the Mayer & Cie trapezoidal spreader in a gentle way. Finally, the spinit fabric can be transferred to the dyeing and finishing process.

By the way, the single jersey Relanit type "Relative Technology" was used, where Mayer & Cie trusted in this machine to ensure a gentle loop formation process. In general, this is a compact machine with the same dimensions as the conventional one. This new technology has many advantages. The overall process has been decreased for the: number of machines, production time, capital expenditure, production costs, energy required, space, yarn storage, waste and CO2 emissions "eco-friendly".
The single jersey fabric is processed from the cotton fiber roving directly. The unique property, the so-called Spinit Look & Feel is a result of the false-twist spinning in which fibers roving are knitted directly into loops gently without twisting.

Figure (1): Spinit machine – Mayer& Cie

Figure (2): Drafting Unit.

Therefore, the products have fabulously soft, fluffy baby linen, even and high quality with a luxurious sheen and without spirality after washing. The Spinit could produce Spinit Fancy fabric with the combination of thick and thin yarn counts in one row. Also, it produces patterned designs similar to those of a jacquard m/c.

Through MDS1 knitwear design software, it can create patterns and simply handled Spinit fancy fabrics. Any new design could be loaded online or by USB stick into the machine. A wide range of fabric weights are possible to be produced “80 - 200 g/m2”, some of them can be manufactured from the same roving count and in one pattern. From another point of view, a Spin-knit machine called Corizon is another innovation from Terrot company that combines the spinning and the knitting process, Figure (3).

In this machine, yarns are spun by the side of the machine and then fed to it in the usual way. The direct spin-knit process uses an air jet spinning type. The machine has a creel type located on three sides of the machine which house the complete rovings to the spinning process.

Corizon technology is suitable for high system densities and large diameters (up to 120 feeders) with gauges from 20 to 36. This system is compatible with Terrot single jersey and double jersey machine and this is different from Mayer & Cie machines. The machine can work with elastane plaiting.

The overall process has been reduced for the: number of machines, occupied space, energy, investing cost and production cost.

What is expected in the future?

There are many questions which remained unanswered for this new technology:

1- Can this new spin-knit technology make profits for early adopters?

2- Who will buy this technology? Spinning Or knitting?

3- Will we see spinners buying this technology and going into knitting? Or will we see knitters buying this technology and going into spinning? Or will we see a new generation of textile businesspersons or ‘spin-knitters' appear? Only time will tell.

Figure (3): The Terrot direct spin-knit “Corizon”

ODOR CONTROL IN COTTON TEXTILES

Prof. Dr. Suzan H. Sanad
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Cotton Research Institute, Giza-Egypt

and outerwear are prone to developing odors, as are bed linen and towels. Body odors are the result of bacterial activity and can be described by their chemical compounds. Odor which is "Perm stink" the unpleasant smell that won't wash out of textile products has become a topic of conversation for consumers and brands alike.

Malodors are created by the breakdown of bodily secretions into various compounds by bacteria on the skin. These compounds may include methanethiol, hydrogen sulfide, propanoic acid, and isovaleric acid. They create a chemical bond with performance fibers, locking perm stink into the fabric.

Consumers are choosing to save energy by washing textile products at lower temperatures; and most performance fabrics recommend a low temperature wash. As a result, higher levels of odor-causing bacteria remain on untreated articles even after laundering.

Odor which can become problematic due to its adherence and persistence within textiles can come from many different sources, both internal and external to the human body [1]. Sources of odor that arise from the human body are secretions from the sweat glands, urine, feces, skin, and genitals. The main physiological contributors to body odor are from eccrine and apocrine sweat glands located in the axillary region, sternum, anogenital area, scalp, feet, and hands. Secretions from sebaceous glands, found in many of these same areas, also contribute to odor. Ingesting foods such as garlic and onions, as well as alcohol and some therapeutic drugs, can strengthen the odor produced by the body [2&3].

Clothing composed of natural fibers are generally perceived to be less odorous following wear than clothing made from synthetic fibers [4].

In a study examining the build-up of body odor in cotton and polyester jersey knit fabrics (both with 5% spandex), stronger odor intensity was perceived in polyester fabrics before as well as after laundering [5].

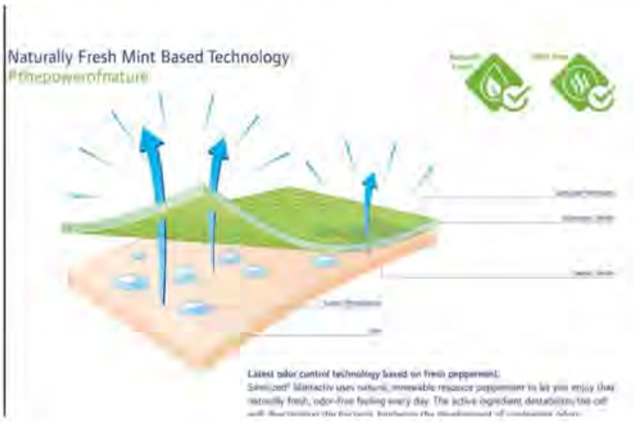
Conventional solutions for preventing malodors on textiles focus on inhibiting the growth of odor-causing bacteria through the application of antimicrobials, either built into fiber, or applied during the textile finishing process.

This type of odor treatment usually uses heavy metals like silver, zinc, sometimes copper and other chemicals. Consumers love the odor control, they don't like bacteria, but they also do not like chemicals.

The new innovation is to use natural plant extracts from peppermint plants.

The base substance is farmed in plantations: natural peppermint (*Mentha piperita*) [6]. It contains menthol, an essential oil with an antimicrobial effect. It has natural biocidal effect, which forms in cotton textiles, so it's green and its odor control at the same time.

Peppermint oil and peppermint extract is very strongly anti-bacterial, and we've managed to put this into a durable binder system that can be applied via exhaust finishing to cottons. It can also be applied via pad finishing to things like bed sheets. And once it's applied on the textiles, the textiles will resist the growth of micro-organisms that cause bad smell. This anti-odor effect lasts for up to 50 laundries, which is on par with the best-of-the-best in the marketplace.

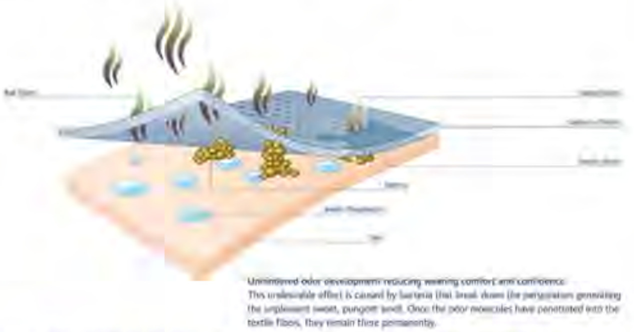


https://www.sanitized.com/wpcontent/uploads/2019/06/SAN_ILLU_Mintactiv_Comparison_Treated_EN_2019.jpg

What's clear is that no one method of odor control will work in every situation. While some brands may prefer to prove odor reduction by counting bacteria in the lab, others can now choose a more sensory approach. Meanwhile, technology providers continue to develop new solutions to the problem of stinky textiles.

Important benefit to consumers

Consumers don't really like smelly clothing, so that's an immediate benefit. But a little bit more, a deeper type benefit, is that if you have a towel that doesn't start to smell musty, you will maybe put it on the rack for an extra day or two, and the advantage of that goes quite deeper to less detergent use, less water use, so it's an indirect benefit for us as consumers – because we don't want to use more detergents and water – and also a big benefit for the environment.



https://www.sanitized.com/naturally-fresh/

The new innovation meets the specifications of demanding textile manufacturers and their brands' sustainability claims, providing reliable odor control using natural mint.

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COTTON FINISHING FINDS ECO-FRIENDLY SOLUTION IN PLASMA

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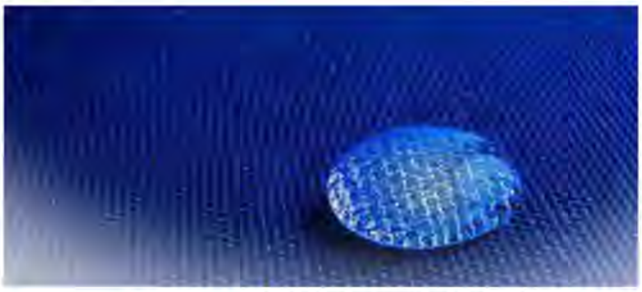
Plasma, the fourth state of matter is an ionized gas of +ve and -ve charges, which expand over a wide range of temperature and pressure. Plasma is a new technology for the textile industry. It is a novel way to add new functionalities and improved several characteristics such as dyeability, color fastness and hydrophobic properties in comparison with traditional finishing techniques. In addition, it requires less water and energy consumption and usually results in minimal fiber damage, Eman Bydoon et al. (2015).

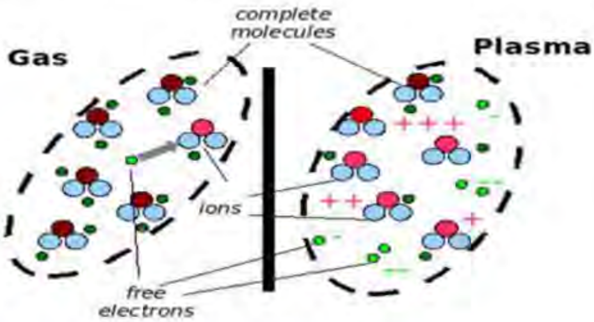
Innovation in the area of technological processes development needs research to overcome barriers that impede progression for environmental protection and safety. The textile industry should not ignore this and must meet international standards to protect the environment. So, currently many scientific groups investigate the improvement of textile fibers characteristics using plasma technology.



For example, Naebe et al. 2015, used plasma treatment to enhance the adsorption of chitosan towards cotton fabrics without using harmful chemicals. Instead, it has used helium atmospheric pressure plasma as a finishing technique to modify the surface properties of cotton fabrics, Maryam et al. (2015). Lam et al. 2011, treated cotton fabrics with oxygen plasma and wrinkle-resistant finishing agents. The results of wicking rate, contact angle and wet-ability revealed that atmospheric plasma treatment significantly improved hydrophilicity of cotton fibers. Such improvement greatly enhanced the effectiveness of post-finishing processes, Lam et al. (2015).

In another study, Malshe et al. 2012, graft polymerized a quaternary ammonium salt monomer on Nylon–Cotton (50/50) standard military fabric by using atmospheric pressure glow discharge plasma. This is to impart durable antimicrobial properties, which showed almost 100% reductions in bacterial activity, Malshe et al. (2014). Carneiro et al. 2008, further reported a significant improvement in wrinkle recovery angle of cotton fabrics pre-treated with dielectric barrier discharge plasma.

Most of the research efforts are clearly focused in the plasma desizing of cotton, Zille et al. (2014). Prabaharan and Carneiro (2005), studied the effect of plasma discharge on the bleaching of grey cotton fabric by using varying power discharge and number of discharges. To achieve a high whiteness degree the plasma discharge process was followed by treating the fabric with hydrogen peroxide, Prabaharan and Carneiro (2005).



https://www.textiletoday.com.bd/an-overview-of-the-techniques-of-plasma-application-in-textile-processing/

Compared with established finishing processes, such as pad-dry-cure or coating, plasma has the advantages of improving the wet-ability and enhancing the interaction between fibers and finishing products, Gulrajani and Gupta (2011). The use of plasma in the finishing process proves to be effective for all types of textiles with a great variety of effects and durability.

Our research group has conducted scientific work in this area few years ago as an alternative eco-friendly pretreatment suggested for improving the properties of Giza 86 Egyptian cotton fabric. In our study, different plasma gases such as argon, oxygen and nitrogen induced different kinds of morphological, mechanical and chemical characteristics on the surface of the cotton fabric. According to the results, we concluded that the plasma treated Egyptian cotton fabric wet-ability and dyeability were improved. And we found that using these non-polymerizing gases in the surface modification of textiles was dependent on the various parameters like discharge power, exposure time, nature of gas used and the nature of the substrate. Eman Bydoon et al. (2015).

We consider that all questions are possible regarding innovative research. Using plasma is a novel approach that reduces air, water and land pollution in comparison to conventional methods of textile industry. Plasma is applicable to all substrate materials, such as textiles without affecting the basic fiber properties. This makes it the perfect alternative to traditional finishing methods. Moreover, the plasma processes are dry and are performed in closed systems, thus they are more environmentally friendly and highly safe.

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TRACING THE ORIGIN OF COTTON BY USING ISOTOPE PROFILES

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The analysis of cotton fibres can be particularly challenging within cotton traceability context where discrimination of one fibre from another is of importance. Normally cotton fibre analysis examines the morphological structure of the recovered material and compares this with that of a known fibre from a particular source of interest. Analysis of the dyes which may have been applied to the cotton fibre can also be undertaken though this can be difficult and unproductive in terms of discriminating one fibre from another.

What are Isotopes?

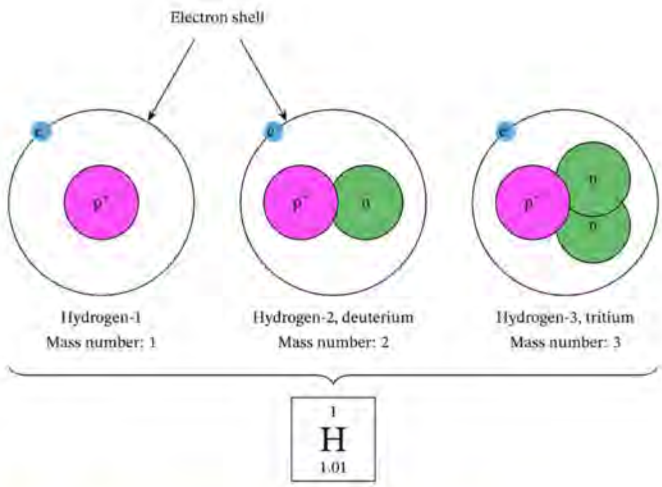
Different isotopes of an element are based on the numbers of neutrons within the nucleus. Stable isotopes are those isotopes of an element that do not decay through radioactive processes over time. Most elements consist of more than one stable isotope. For instance, the element carbon (C) exists as two stable isotopes, ^{12}C and ^{13}C, and the element hydrogen (H) exists as two stable iso- topes, ^{1}H and ^{2}H (also known as deuterium). Table 1 provides the average stable isotope abundances of the elements analyzed by Isotope Ratio Mass Spectroscopy (IRMS) investigations.

Stable Isotope Abundance and the δ-Notation

Given that isotope abundance is measured by instruments with dedicated channels per isotope (multi-collector MS), expressing natural abundances of stable isotopes in a given material as the ratio of the minor (usually heavier) over the major abundant (usually lighter) isotope of a given element (e.g. $^{2}H/^{1}H$ or $^{13}C/^{12}C$) has been adopted as the preferred notation. Since changes in isotope composition of light elements at natural abundance level are relatively minute and isotope abundances of the minor isotopes are very small, significant changes when given in atom% happen typically inthe 2nd decimal place. Similarly, changes in the ratio of heavier : lighter isotope are usually confined to the numerals in the 3rd and 4th decimal places. Due to the minute nature of these changes in isotope abundance at natural abundance level, measured isotope ratios of a given material are expressed relative to a contemporaneously measured isotope ratio of a standard of known isotopic composition. To make the resulting figures more manageable the "delta notation"(δ-) was adopted. The δ--value of the heavier isotope h of a chemical element E in a sample is defined by the following equation (equation 1) [2, 4] where R_{sample} is the measured isotope ratio of the heavier isotope over the lighter (e.g. $^{13}C/^{12}C$) for the sample and $R_{Standard}$ is the measured isotope ratio for the corresponding international reference material (e.g. Vienna Pee Dee Belemnite [VPDB] in the case of ^{13}C).

$$\delta\, ^{h}E = [(R_{sample} / R_{standard}) - 1] \times 1000$$

The results of this equation are expressed in ‰ (per mil). A positive δ value is interpreted to mean the sample has a higher abundance of the heavier isotope than the international reference standard that defines the scale for a particular isotope, while a negative δ value is interpreted to mean the sample has a lower abundance of the heavier isotope than the international reference standard. By virtue of its definition, the δ value of a scale defining international reference standard is 0 ‰. International standards that define the scale of a particular isotope are called Calibration Materials (CMs), while international standards whose isotopic composition have been certified by direct comparison with the relevant CM are called Reference Materials (RMs). CMs and RMs are certified and administered through the International Atomic Energy Agency (IAEA) in Vienna, Austria, or the National Institute of Standards and Technology (NIST), Gaithersburg, USA.



https://www.nagwa.com/en/explainers/903196983420/

Table 1 Abundances of stable isotopes of light elements typically measured with an isotope ratio mass spectrometer.

Element	*Isotope*	*Abundance (%)*
Hydrogen	^{1}H	99.985
	^{2}H	0.015
Carbon	^{12}C	98.89
	^{13}C	1.11
Nitrogen	^{14}N	99.63
	^{15}N	0.37
Oxygen	^{16}O	99.759
	^{17}O	0.037
	^{18}O	0.204
Sulfur	^{32}S	95.00
	^{33}S	0.76
	^{34}S	4.22
	^{36}S	0.014

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