

The Egyptian Cotton; current constraints and future opportunities

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Acronyms

Feddan	= 4200 m ²
Hectare	= 2.38 Feddan
Cantar	= 50 Kg
Cotton Seed Ardabb	= 120 kg
Sakel	= Sakellarides (Egyptian cotton variety)

Chapter 1

Emergence and development of Egyptian cotton

The “Egyptian cotton” is a peculiar type of cotton that is characterized by high quality, and gained a world-wide reputation for more than a century and half as being of the highest lint quality among world cottons. From the botanical point of view, it belongs to the species “*Gossypium barbadense L.*”, which originated in the New World. But from a commercial production point of view, it is the high quality cotton that has developed in Egypt and bears it in its name. Nowadays, Egyptian cotton is grown in various parts of the world, but mainly in the United States, where it is known as American-Egyptian or Pima, however, Egypt still the main producer, and the producer of the best qualities as well.

The Egyptian cotton belongs to the species *barbadense L.* of the genus *Gossypium*. This genus comprises 32 wild and cultivated species. All the cultivated cottons in the world fall under four species only: (i) *G. herbaceum L.* and *G. arboreum L.*, both are diploid (n = 13) and are known as Old World species. *G. arboreum* remains an important crop in India, whereas *G. herbaceum*, however was important in earlier times, is today confined in the drier areas of Africa and Asia for local use, (ii) *G. barbadense L.* and *G. hirsutum L.* both are allotetraploid (n = 26), and are known as New World species where they evolved. Kohel and Lewis (1): reported that the finding of cotton remains to Nubia, and at Mohenjo-Daro in the valley of the Indus in northwestern India, dating from about 2700 B.C. gave credence to the idea that cottons (*G. arboreum*) were domesticated at these sites which already knew a productive agriculture and

the arts of spinning and weaving. The origin of *G. herbaceum* is possibly in South Africa and the Sahel of North Africa and has been introduced to the Near East in ancient times where it was subsequently domesticated, and from North Africa has spread to Arabia, Baluchistan and perhaps the Sindh. For New World species, based on archeological contexts dating from about 2500-1750 B.C. in Ancon- Chillon district of Peru, the center of diversity for *G. barbadense* is northwestern South America. This district appears to be the site where cottons belong to *G. barbadense* were domesticated. With regard to *G. hirsutum*, archeological remains point to Mexico, however, the oldest evidence, from about 3500-2300 B.C. shows that *G. hirsutum* was domesticated in at least two, or perhaps three, separate areas in the region.

1. Early History - Before 1820

Before 1820, one cannot speak about “Egyptian cotton” but rather about “cotton in Egypt”, the date of birth of “Egyptian cotton” is, most probably, 1820, when the first yield was harvested. Historical evidence indicates that in the early days of human civilization, three principal countries of the east have been distinguished by their distinctive type of fabrics; China as the land of silk, Egypt as the country of flax (and linen), and India of cotton. The most ancient cotton fabrics, estimated to be 5000 years old, was discovered in the excavations of Mohenjo-Daro in Sindh (now in Pakistan), and is believed to be made of the present “desi” cotton of northern India.

Thus, it is India which had always been regarded as the country of cotton-growing and manufacturing, while, on the other hand, Egypt had always been regarded as the country of flax - growing and of the linen industry. However, Egypt’s close neighbors in the south, the people of the ancient Nubian kingdom of Meroe (500 B.C. to A.D. 300), now north of Sudan, practiced cotton growing, spinning and weaving .

The cotton the people of Meroe used to grow was probably the perennial African form of “*Gossypium arboreum* L.”, now known as “*race soudanense*” Al-Didi, (2). Pliny (3) in the first century A.D., made a distinct reference to cotton growing in what is now Sudan. The sentence, translated to English reads: “The Upper of Egypt which is directed towards Arabia produces a shrub called “*Gossypion*” by some and “*Xylon*” by others, for which reason the fabrics made from that shrub have received the name “*Xylina*”. Its fruit resembles a bearded nut, the inner fiber of which is spun like wool, it is a wool second to none in whiteness of texture. It supplies the priests of Egypt with their favorite kind of dress”. A century later, Pollux (4) wrote: “A kind of wool is made by the Egyptians from a tree, cloths of which wool one might compare to linen except as regard thickness. The fruit grows even more thickly on the tree, like a nut with three divisions. This breaks open, when the seed is dried up, and a sort of wool is taken from inside from which the thread is made. They weave this with a warp of linen”. However, Yates (5) contested the authenticity of these statements of Pliny (3) and Pollux (4), and Al-Didi (2) concluded that there is no evidence of existence of cotton in ancient Egypt. The reason why ancient Egyptians grew flax rather than cotton may be because they did not know it, the Egyptian civilization preceded that of Meroe by about 2500 years, while they knew flax as early as the year 3000 B.C. Ancient Egyptians grew flax, most probably, because of the conditions created by Nile flow and the “basin irrigation system” which favors winter crops such as flax and wheat rather than summer crops including cotton.

The introduction of cotton to Egypt is credited to the Arabs, in the seventh century, who are also credited for introduction, later on, of cotton growing and manufacturing to Spain and southern Europe. The word “cotton” in English, is derived from the Arabic word “Qotn”. The cotton they introduced was the annual “*G. herbaceum race persicum*”, probably from Syria and Turkey. The earliest indication of the actual cultivation of the cotton plant was given by Ibn al-Awam (12th century) (6). Among the other Arab writers who gave, in their books, full description of the cultural practices followed in cotton cultivation in Egypt, and also mentioned the main centers of its manufacturing into textiles, are (5) ; Al-Idrisi (mid 12th century), and Il-Safadi (mid 13th century). El-Makrizi (mid 15th century) stated that cotton is planted in the coptic month Baramudah (April) using about 5 Kg of seeds per feddan, and picked in Tout (September), and that the yield is about 2.75 Cantars.

With regard to the botany of the cottons grown in those days, Alpinus (7), by the end of the 16th century, gave the first botanical record of an Egyptian cotton plant (Fig. 1.1). The most informative description, however, was that given by Delile in the “Description de l’ Egypte” (1824) compiled by the French savants during the Napoleonic invasion of Egypt (1798-1801). Delile gave a list of three species of “Gossypium”:

G. herbaceum L.

- (a) Annum (in Delta around Samanud and Mehalla Kebir).
- (b) Frutescens (Upper Egypt: “Qotn”: Nubia, “Bennabouk).
- (c) *G. vitifolium* Carvanilles (Qotn el-shagar).



Fig. (1.1): the earliest known illustration of an Egyptian cotton plant (P. Alpinus, 1592. MOA, 1961).

Fletcher (8), after examining Delile’s herbarium, reported that Delile’s “*G. herbaceum frutescens*” belonged to the Asiatic group of cottons, entirely unlike any modern Egyptian cotton. None of the specimens of “*G. herbaceum annum*” could be found. Specimens of “*G. vitifolium*” are closely related to the present Egyptian cotton. They are labeled as having

come from a tree, or trees, 20 feet or more in height, and to which Delile gives the same native name as Alpinus applied to "*G. arboreum*", i.e., Qotn el-shagar, meaning "tree cotton". According to Hutchinson et. al., (9) and Hutchinson (10) "*G. vitifolium Lamarce*" is placed in "*G. barbadense Linnaeus*".

On the botany of cotton in Egypt, Al-Didi (2) concluded:

(i) According to Pliny (1st century), cotton grown in the Upper part of Egypt, within the limits of what is now the Sudan, is probably "*G. arboreum Linnaeus race soudanenses*". The primitive forms of "*G. arboreum*" of northern India and Pakistan are perennial. These forms spread widely both eastward and westward. It has provided material of which the common Old World perennial cotton of Africa has developed. The African form now known as "*race soudanenses*" was probably the cotton grown by the people of Meroe, who were the first in Africa to spin and weave cotton, (ii) The first cotton to reach Lower Egypt, or the Nile Delta, and to be grown there was "*G. herbaceum race persicum*", the typical annual form of "*G. herbaceum*", an old Levant cotton that was brought in by the Arabs (mid seventh century). Hutchinson (11) states that the most primitive and only true wild form in "*G. herbaceum*" is "*race africanum*". From this race, the most primitive cultivated "*race acerifolium*" was developed. In this race are included occasional perennial plants found in fields and gardens in Ethiopia, in the desert oasis of Egypt and Libya and other regions, (iii) Delile recognized "*G. vitifolium*" as growing in the country during the French occupation, but this type was not cultivated for its lint, but appears to have been grown as a garden shrub, and is now, as mentioned before, placed in "*G. barbadense L.*", the species to which all present Egyptian cotton varieties belong.

Cotton cultivation in Egypt during the period of French occupation has been reported by Girard in "Description de L Egypte" (1824) as follows: "Some cotton fields exist in almost all parts, yet the crop is peculiar to the southernmost portion of Upper Egypt, and the entire Delta. Cotton was not a popular crop among farmers, the costs of its cultivation being relatively very high and actual profits being low in comparison of most of crops. Gliddon (12) mentioned that the "belledi" (or native) cotton at the end of the 18th century was of poor quality and is reputed to have been inferior to that of the Bengal cotton, and have contained large amounts of trash because of bad cultivation and picking. The total production was about 30,000 Kantars a year, all being consumed by the local industry and mainly used for the manufacture of coarse, cheap clothes and upholstery. For finer clothes, yarn was imported or spun from cotton imported from Syria and other countries.

During the 17th century, Egypt was an exporter of manufactured cotton textiles. Masson (13) reported that in 1711, Egypt exported to Marseilles (France) from Alexandria 200 thousand pounds of cotton. The averages of the period 1783-1792 were as follows:

White cotton yarns	350,000 pounds.
Ordinary white cotton cloth	60,000 pounds.
Cairo blue cloth	40,000 pounds.

2. The Emergence of "Egyptian cotton" (1820-1882)

By the opening of the 19th century, Mohamed Aly, a man of vision and tremendous capabilities emerged on the Egyptian history theatre. Assuming power, he worked relentlessly for the renaissance of Egypt, for which he was rightly regarded by historians as the "Founder of modern Egypt". The story of Egyptian cotton begins with Mohamed Aly, but continues for decades and decades closely linked with the political conditions prevailing in Egypt as well as the world around her. The first era of Egyptian cotton history witnessed its emergence as a definite type among world cottons and its expansion to occupy an important size of world trade. It also witnessed ups and downs in Egypt's political situation and state of economic and social advancement. And, at last, it ended by the British occupation and Egypt losing its autonomous independence, and hope of better future as well, for several decades to come. This era, extending 60 years, could be further looked at as three periods according to the ups and downs of Egyptian cotton situation ; the first being that during the reign of Mohamed Aly, the second up to the American Civil War and the third up to 1882.

Origin of “Egyptian cotton”

The story of the origin of the “Egyptian cotton”, belonging to *G. barbadense*, has been a subject of lengthy debate and subject to much distortion. Livanos (14) over-simplified the story as he wrote: “The history of cotton growing in modern Egypt began in the reign of the great Mohamed Aly, who brought some Indian seed to be sown in this country. That was the first trial of rough cotton which, in those by gone days, was quite a success. Then a new seed came to Egypt in 1820, brought by an Egyptian official in the Sudan named Mako Bey el Orfalli, and was sown in his Cairo garden where Jumel, the great French specialist engaged by Mohamed Aly for the purpose of developing industry in this country, saw it . Jumel initiated the cultivation of this new growth of longer and finer staple which was largely grown in the Delta, owing to its satisfactory results. Jumel also introduced it to French mills known by his name, whereby Egyptian cotton generally is called Jumel in France until the present day”. However, the story adopted by the Egyptian Domains (15), which became the most current, states “a Turkish Dervish returning from India, brought the seed of an Indian cotton which he gave to Maho (bey) el-Orfaly, one of the notables of that time, who, in his turn, passed it to Mohamed Ali. The viceroy, encouraged by a French - man, L.A. Jumel, caused the seeds to be sown in three different localities and under the surveillance of the Dervish. The first trial is reported to have yielded 15 ardabbs of seed. Mohamed Ali is then said to have exhorted the governors of the provinces to cause extension of the cultivation of this new kind of cotton, and to have promised high rewards to those who pursued the careful cultivation of the plant and severe penalties to those who neglected to follow the instructions given”. The new cotton was known generally as “Maho” in Egypt, Germany and Switzerland, but as “Jumel” in France, after the persons connected with its first appearance, (2).

Another version of the story was given by Mengin (16), who wrote, concerning the events of the year 1823: “During this year a great agricultural revolution took place in Egypt. Upon the banks of the Nile a kind of cotton was grown known by the name of “*cotton herbace*”, a plant which was only good for decorating the divans. Moreover, there was found cultivated in gardens another kind of cotton called “*cotton arbuste*”, which was much superior to the first named on account of the length and fineness of its fiber; but this cotton was only removed from its capsules to be spun by the fingers of certain women in the seclusion of the harem. Jumel, whom the viceroy had brought from France to reorganize the textile industries, having noted the existence of a fine cotton tree in the garden of Maho (bey), the long and silky fiber of which attracted his attention, proposed to the viceroy that the plant should be tried in field cultivation. The first trials were completely successful, and the viceroy, realizing how the cultivation of this kind of cotton would increase the wealth of Egypt, encouraged its extension by every means. In a short time cotton trees covered the plains of Egypt and the culture of other products was sometimes even neglected in consequence. Egyptian cottons yielded their white and silky fiber to the spinning mills of France and England ... After a few years Egypt was able to pour out into consumption 400,000 quintals. This phenomenon astonished Europe and cotton experienced successive falls in all markets.”

From these versions, it appears that the Francs-Swiss engineer L.A. Jumel played a prominent role. Dardaoud (17) provided more information. He wrote that Jumel, who was born in Jan. 1785, arrived in Egypt towards the end of 1817; apparently he had signed a contract in Geneva with a representative sent by Mohamed Ali whereby he undertook the management of a spinning and weaving factory in Bulaq. Jumel’s stay in Egypt was comparatively short one as he died in June 1823. According to Dardaoud (17), Jumel was already cultivating “his” cotton in 1819 in a garden at Ezbekieh and in a large estate at Matarieh (the first site is now in the center of Cairo while the second is a suburb). He wrote “It is also certain that Mohamed Ali was encouraging his researches by allowing him to spend much time away from the factory and exempting him from paying the “miri”, or tax, on the land he had devoted to cotton breeding. Furthermore, in 1822, Jumel received from Mohamed Ali the sum of 125,000 piaster in cash to aid him in his work”. Experiments in the cultivation of the new cotton proceeded rapidly. Dardaoud (17) mentioned that in 1820, the experimental fields yielded three bales; a year later, output increased to 2,000 bales. Mohamed Ali gave orders that the new Long - Staple cotton

was to be cultivated throughout Egypt, In 1822, 30,000 Cantars were harvested, and the figure rose to 200,000 Cantars in 1823".Livanos (14) reported different figures of the crop being: 944,35. 108,159. 426 and 228.078 Cantars for the years 1821 1824 respectively.

Dardauid (17), noticed that, due to this high rate of propagation, Jumel "must have started with more seed than could ever have been supplied from Maho's garden alone". To this conclusion, Balls (18) added: "It seems clear from the evidence that this type of cotton (Jumel cotton) had been in Egypt, even only a few plants, for 30 years, or more before Jumel's action. It is thus very unlikely that Jumel had only one single plant with which to start work. Probably he was able to collect several kilograms of seed from gardens here and there". Clot (bey) (19) gave an account of cotton growing that confirms Mengins (16) statement that the "Jumel tree" was growing in private gardens of Egypt long before 1821, probably about 1790.

Commenting on the high rate of propagation, Balls states:

"I do not think there is any reason seriously to doubt the figures which have been given, but they tend to show that there was more of this kind of cotton available in Egypt, if only as a garden plant ... than Jamel knew about when he first had this brilliant idea of starting to cultivate it seriously".

Al-Didi (2) recalls the findings of Hutchinson (11) that throw more light on the botany of "Egyptian cotton". Hutchinson traced the origin and spread of the New World cottons to which the Egyptian cottons belong. He says that the more primitive of New World cottons were introduced into Africa in the early period of transatlantic traffic, largely associated with the slave trade. The kidney cotton, "*G. barbadense race brasiliense*" is still to be found wherever the slaves established their routes. The "*vitifolium*" and "*peruvianum*" forms of "*G. barbadense*" were established in the regions of the Niger Delta and spread inland into the forest and orchard bush regions respectively of what is now Nigeria. It is evident that Jumel's original perennial brought by Maho (bey) from the Sudan and grown in his garden in Egypt, was derived from the "*vitifolium*" stock which was established in the Nigerian forest belt, and spread thence eastwards to the Sudan along the trade routes.

Al-Didi (2) concluded that it seems then, that although the discovery of the qualities of long staple cotton was a chance one, all credit must go to Jumel for realizing its possibilities and urging its cultivation on a large scale. According to Dardauid (17) Jumel was content to point out the advantages of replacement of the "herbaceous" by "tree" cotton, and having done so, to see his faith in the new cotton justified, thus changing the whole pattern of a nations agriculture. However, in the opinion of the author, much credit should be given to Mohamed Aly, whom without his vision and grasp of the chance and strenuous efforts to make it succeeds; the precious chance of Jumel might have been lost at least for some decades.

In 1915, Balls (18) stated: "The brown, long, strong lint, readily ginned from the almost naked seed, quickly made its reputation with the spinners, an this type of lint has been typical of the Egyptian product ever since".

The "belledi" cotton continued to be grown after the introduction of Jumel cotton, but it was much diminished by 1834 and by 1840 it was almost extinct.

The emergence of "Jumel" long-staple cotton greatly stimulated interest in cotton and several varieties were brought in from various parts of the world for trial. Nankeen cotton was imported from Malta in 1822, but was abandoned on account of its poor quality (12). Brazilian seeds were imported as from 1826 and until 1860. Sea Island was tried as from 1822, the yield being not satisfactory, it was abandoned in 1838 (14), however importation continued until 1865, and continued on a small scale in 1870. From that date until the early 1920s, small experimental plots were grown without success (2). Good quality was obtained in the first year of its growth in Egypt, but general deterioration occurred in the second and third. The staple was longer on the average than that grown in America, but it was more irregular in length and not so strong.

The process of "Egyptian cotton" evolution seems to be continued beyond that of "Jumel cotton", after the introduction of Sea Island cotton and its growing, for production, or

intermittent experimentation, side by side with Jumel cotton. Sandars (20) advanced a strong argument in support of natural crossings taking place between these two cottons. His argument is as follows (2): In the year 1859, the Egyptian best cotton was to have been sold at 15-20 dollars, whereas Sea Island cotton from Egypt only reached 12 dollars. This seems to be the earliest date on which we can recognize the establishment of a newly specialized cotton, which this must be assumed to be, as it is unlikely that Jumel cotton could show a superior position with respect to price in competition with Sea Island. Doubtless in the course of this prolonged variety testing in the vicinity of the Jumel cotton, the Sea Island types being a form of "*Gossypium barbadense*" were alone of all the types introduced which gave rise to vigorous and fertile hybrids with Jumel's perennials. Out of such hybrids, annual types were selected with some of the quality of Sea Island, together with some of the vigor and cropping characteristics of the old perennial. Thus, a new race of annual "*barbadense*" cottons arose, member of a New World species but bred in, and adapted to, the Nile valley. Furthermore, the transformation of the Egyptian irrigated system, undertaken to meet the needs of a perennial cotton crop, was barely complete by the time the perennial cottons had been supplanted by a new race of annual.

Brown (21) noticed that by the early of 1820s, interest in Jumel cotton was aroused and led to the introduction of a number of varieties from other parts of the world, including Sea Island then being developed on the American Atlantic coast. He stated "The exceedingly suitable conditions for the crop gave the evolutionary process, under human guidance, a full scope, and a new type of cotton seems to have developed. This type, undoubtedly incorporating genes of Sea Island origin, is now classed, with Sea Islands, in the same species of *Gossypium barbadense*, but is recognizably different from Sea Island in several important points. The main one of practical value is undoubtedly its greater earliness. Attempts to acclimatize the true sea Island to Egypt probably went on continuously, but always failed owing to inability to ripen a crop in time. Its legacy has been a wide range of variability which is still being exploited in the variety breeding program.

The 1860s decade witnessed two major occasions that had a strong influence on the future of the emerged "Egyptian cotton". The first, a positive one, was the appearance of the "*Ashmouni*" variety about 1860. Ashmouni marked the beginning of the real cotton era for Egypt, and became the backbone of the cotton textile industry for a long time. The second was, unfortunately, a negative one, the mixing of Egyptian cotton with imported American cotton, *G.hirsutum* brought early by Darweish as well as later importations that resulted in the appearance of "Hindi weed", which caused many troubles through the history of Egyptian cotton and still a source of threat from time to time.

"Hindi" was first reported in 1866 (8), with some of examined samples appearing to be splitting-forms from hybrids with Egyptian cotton, since they varied much in the degree of hairiness and in the presence or absence of the petal spot. The beginning of the appearance of Hindi lies probably in the introduction and commercially growing of "Orleans cotton". This cotton was reported to be sown "misquawi" at Kafr Eyala and gave much higher yield than Egyptian cotton. According to Al-Didi (2); "This variety, or some other introduced American variety may be said to be the start of "Hindi weed" of Egyptian cotton, "*Gossypium hirsutum* race *punctatum*". However, Hutchinson (11) is of the opinion that the first "*punctatums*" came to Egypt from the Sudan. He states: "*punctatums*" are common in the Sudan, whence the "*barbadense*" progenitors of Egyptian cotton were taken to Egypt. It was doubtless from the Sudan, therefore, that the first "*punctatum*" contamination of Egyptian cotton came, and among Sudan specimens of Hindi weed, all gradations are to be found between the perennial shrubby "*punctatums*" and the annual, rather larger-bolled Hindi as understood from Egypt. A study of this range of material indicates that the annual habit, rather larger bolls, and rather better lint quality of the Egyptian Hindi have arisen by introgression from the Egyptian (*G. barbadense*) type, coupled with natural selection for success as a weed, that is for such advantageous characters as matching the host crop in duration and beating the host in seed germination". According to Fletcher (8), some of them appear to be splitting-forms from hybrids

with Egyptian cotton, since they vary much in the degree of hairiness, and in the presence or absence of the petal spot.

Taking all these opinions in consideration, another version of the story of Egyptian cotton evolution could be postulated. The “Turkish Dervish” mentioned by the Egyptian Domains (15), is most probably an Egyptian trader. The word “Dervish” is the Turkish version of the Arabic word “Darweish” which denotes a member of any of various Moslem ascetic religious orders, and in Egypt it is a popular man’s name regardless of its religious origin. “Darweish” seems to be working in the trade route between Assiut in Upper Egypt and the west of Sudan provinces of Kurdofan and EL-Fashir, through the Egyptian oasis Al-Dakhla in the western desert, Known as “Darb El-Arbaein”. The west of Sudan is geographically an extension of the Sahel region that extends westwards to the coast of the Atlantic Ocean, and the west African countries, where slave trade was active. Forms of *G.hirsutum* were found in Al-Dakhla oasis, seems that Darweish brought to Egypt seeds of both two species of the New World; *G. barbadense* V. *vitofolium* and *G. hirsutum* V. *punctatum*). The high quality of *G. barbadense* attracted the attention of EL-Orfaly and encouraged him to grow it in his estates under the supervision of Darweish. The results being encouraging, EL-Orfaly introduced the new cotton to Mohamed Aly who instructed Jumel to experiment with it in the newly constructed spinning mill. Jumel did a marvelous job in propagating, processing and introducing the “Egyptian cotton” to the European cotton textiles industry. On the other hand, the low quality *G.hirsutum* was abandoned but remained in Egypt where it mixed with *G.baradense* for decades. Later on, more introductions of both *G.barbadense* (Sea Island, St. Kits and others) and *G.hirsutum* were grown. Therefore, it seems highly probable that the MLS variety Ashmouni which appeared in 1860, as a selection, was a peculiar genetic composition of three origins; the original introduction of *G.baradense v.vitofolium* of relatively shorter staple but immune to Fusarium wilt, the later-on introductions of Sea Island of longer staple but susceptible to Fusarium wilt and *G.hirsutum v. punctatum* of much lower quality and usually regarded as a weed. Ashmouni sided mainly to the shorter staple and resistance to Fusarium wilt, but many of the later varieties selected from it directly such as Mit-Afifi or indirectly, such as Sakel, sided towards Sea Island with longer staple and susceptibility to Fusarium wilt. *G.hirsutum* segregates, Known as Hindi, appeared continually from Ashmouni as well as all other varieties that had a high proportion from its genetic composition, being of a much higher percentages of shorter staple varieties than in longer staple varieties.

“New cotton” cultivation and production

In the early years of the new cotton growing much had been done by Mohamed Aly to persuade growers to devote a part of their lands to cotton. The authority was necessary, therefore, he declared the government a buyer, fixing the price according to trade conditions. Thus establishing the monopoly for cotton, guaranteeing to the grower the sale of his product. Moreover, he brought from Asia Minor a number of specialists to introduce the best system in cotton culture and authorized them to visit all lands and choose those best suited to cotton which the grower was obliged to devote to cotton. These measures greatly encouraged the expansion of cotton growing. However, later on, the monopoly proved to be a check to growers interests and resulted in their neglect of their cotton farms, thus it was relaxed in the early 1850s, the grower became free to sell the surplus of production freely in the market. Few years later, (1854), the monopoly was thoroughly abolished. These reforms had a satisfactory result as showed by a steady increase in cotton production, Table (1.1).

Table 1.1 Development of cotton production during the era 1820-1882.

Year	Average production		Average price (Dollar/Cantar)
	(1000 Cantars)	(Ton)	
1820	0.9	41	16.0
1821	35.1	1590	15.5
1822-29	169.2	7665	13.5

1830-39	182.7	8276	18.4
1840-49	198.1	8974	10.4
1850-59	508.5	23035	11.1
1860-69	1 690.1	76562	27.5
1870-79	2 370.0	107361	15.5
1880-82	2 644.0	119773	14.0

The cultivation practices of Jumil cotton were briefly described by Mengin (16), Clot (bey) (19) and Bowring (22). Mengin (16) wrote that “although the plant lasted a number of years it was found that after the third year the tree increased very rapidly in size and the leaves became large to the detriment of the crop which began to diminish in quantity and the plants were therefore then pulled up and replaced by others. The first year’s yield was from one to one and a quarter pounds of seed cotton, and the second and third from one and a quarter to two pounds. Each feddan took about 1000 plants which were placed sufficiently far apart to allow of other crops, such as vegetables, being sown between the lines. When the cotton had been collected and freed from seed in a gin, consisting of wooden wheels, it was generally pressed with the feet into bales, one meter and a half high by one meter in diameter, until a press was introduced from England similar to that in America, and several were constructed following the same model. In 1833, there were six of these at Bulaq, each taking three men to work it and turning out from 18-20 bales a day”.

Clot (bey) (19) mentioned that the cotton plants “were watered every 15 days in winter, every 12 days in spring, every eight in summer ... sowing time in March and April, first picking in July”. Bowring gave similar information : Ridges laid at 1 1/4 meters and sown at 1 meter intervals, grew 1-1 1/2 meters in 1st year, less in subsequent years. Yield per tree was 1-1 1/2 lbs. in first year, 1 1/4-1 1/2 lbs. in 2nd and 3rd years, less in later years. Picking began in July and ended in December or January.

Total production of cotton lint during the period 1820-1882 is shown in Appendix 1. There seems to be some discrepancies between the figures reported by Livanos (14) and those reported by Sidki (23) and Al-Didi (2), especially with regard to the first year. However, this does not change the conclusions that could be drawn about the development of cotton production during this era.

During the first three decades (1820-1849), under the, reign of Mohamed Aly, apart from the first two years, total production fluctuated between 100 and 200 thousand Cantars except for two years where the production dropped sharply (59,255 and 56,067 Cantars), and two years of substantially high production levels (344,955 and 364,816 Cantars). The average total production, after exempting the first two years, was 169 thousand Cantars. During this period, prices, also, fluctuated, reaching a peak value of 30 3/4 dollars per Cantar, to extremely low value of 6 dollars per Cantar. The average crop was up to 182 thousand Cantars for the 1830s, and 198 thousand for the 1840s. The 1850s witnessed a substantial increase in total cotton production, with the average being 509 thousand Cantars. Prices were relatively low and during the 1850s fluctuated between 8 3/8 to 16 1/4 per Cantar.

Al-Didi (2), concluding about the progress of the Egyptian cotton up to 1860, stated : “Starting with Jumel in 1820 until 1860 when Ashmouni appeared was a period of small beginnings and slow progress. Everything about cotton had to be learnt. The spacing of the plants, the water and manorial requirements, the preparation of the soil, after-cultivation, picking the crop. All these had to be learnt by experience. Besides, many varieties of cotton were experimented with, and the water summer supply was precarious”.

The 1860s decade witnessed a substantial increase in cotton production; due to the appearance of the Ashmouni variety (1860) which coincided with the American Civil War (1861-65). Ashmouni gave a new start to cotton growing and trade. The best lands were devoted to cotton and the yield increased. The American Civil War gave a beneficial push by the rise in cotton price and the increased demand on Egyptian cotton. Livanos (14) states: “The fact was that growing conditions in America were hardened by the war and that country made restrictions for the export of cotton to other ports, causing a scarcity of raw material for

European industry. The whole world lacking cotton, prices rose to unexpected levels and Egypt, being a productive country, had, therefore, much to profit from such a situation. Her production was further extended, while the rise of prices, making cotton very remunerative, gave her considerable profits ... This period was a really flourishing time for the cotton trade as well as for Egyptian agriculture”.

In 1860, the production amounted to 596 thousand Cantars, sold at 14 dollars per Cantar, jumped in the following year to 721 thousand Cantars sold at a price of 23 dollars per Cantar. In 1864, the production attained a record figure of about two million Cantars and the price 31 3/4 dollars for Cantar. In subsequent years both production and prices fell down. By the end of the 1860s, the production was about 1.351 million Cantars and the price 19 1/2 dollars.

The sharp fall in the prices of Egyptian cotton after the close of the American Civil War caused an agricultural crisis in Egypt. Cotton production decreased sharply and total revenues gained by the country from its exportation decreased even more sharply from the peak of 37 dollars on the average for the years 1862-1865, to 21 dollars for the years 1866-69. However, Egyptian cotton by this time had already established itself firmly in world markets, thanks for its high quality which gained it an exceptional reputation in the European cotton textile industry. Locally, cotton confirmed its predominant position in the country's economy. The average total production of the 1870s decade, however the price fluctuated between 12 1/4 and 21 1/2 dollars, was 2.370 million Cantars, i.e. 50% higher than the average of the 1860s. The first three years of the 1880s witnessed a further increase and averaged 2.643 million Cantars. The following table summarizes the development of Egyptian cotton production and price:

The dramatic increases in total production were achieved under the hard conditions created by two crises that faced cotton production and threatened to undermine its growing prospects. The first one was the plague which began attacking cattle in the Delta, Roux (24). The second was the Nile river flood which was the highest for the century. Losses in 1863 were estimated as being about 200 thousand Cantars as a result of the murrain, and 100 thousand Cantars from the flood (25). A low Nile in 1864 made matters worse. The murrain and the flood, combined with the cotton growing fever, causing almost the monoculture of cotton, seriously menaced the country by the lack of grains and cereals, the prices of which attained fabulous levels which obliged the government to import large amounts in order to check this evil (14).

In the mid 1860s, apparently in accompany with the fast increase in cotton growing, a crisis in cotton growing began in 1866, with leaf worm and later on bollworm, followed by serious complaints from spinners owing to the deterioration in quality and lowering of grade. The earliest, probably, record of the appearance of the bollworm "*Earias insulana*" was that made by Byrne (26) who noticed, in November 1860 in the fields of Debaiba and Mit el mon, traces of what looked like boll worm in the pods. Later on, Joanovich (27) reported that widespread destruction of cotton bolls was first noted in September 1865. A few years later, towards the end of the 1870s, the leaf-worm began to attract attention.

About the deterioration, Al-Didi (2) quoted the official Gazette No.51 of January 31, 1875: "About 112,000 bales of the cotton exported to Britain are unsold at Bolton, and the prices are below average. Meanwhile, the British Consul submitted to the Government a note signed by 350 owners of factories and textile mills who are the major users of Egyptian cotton in Britain, warning the Government that the characteristics of Egyptian cotton have gradually deteriorated especially in the last eight years. Different varieties are mixed together, to the extent that dark cotton is mixed white. This makes it difficult to spin Egyptian cotton and reduces its price. They also said they were motivated by their desire to buy Egyptian cotton and make it attain higher prices. They submitted that among the reasons for the deterioration is the ignorance of some farmers to select good seeds, as they secure their seeds from the ginning mills which handle different varieties of cotton. They proposed that landowners and their overseers should be asked to watch out for the seeds of the different varieties and to plant each variety in a different plot of land. At the time of picking, each variety should be gathered separately, and the same thing should be done at the ginning mills and when cotton is offered for sale. Those who sell cotton with seeds should ascertain of the seed they later buy. This is

an essential agricultural maxim for land owners. It is also essential that every province should notify the owners of the ginning mills, who normally sell seeds, which seeds should be sorted out in accordance with varieties.

In response to the deterioration problem, many efforts were directed towards introducing new varieties, such as Hamouli, or Sukkary (sugar-like) (1865) which was not successful. Another variety Gallini (1867), being very fine and long stapled gained moderate acceptance. Gallini is said to have given the Egyptian cotton a push, while the old Mako-Jumel was fading away at this time, and complaints of its deterioration became general. Livanos (14) stated: "with this variety (Gallini) and the measures taken by the Egyptian Government to protect cultures, the crisis ceased and crops attained their old limits". Other varieties included Hariry (silky) (1871) and Bamiah (1873). However, Egypt was to rely chiefly on Ashmouni, which also showed a steady decline. The country needed a new cotton of better quality and yield to solve the problem. This solution has to wait until 1882 when the variety Mit-Afifi was introduced.

Ginning

The early method used in ginning as from 1820 was described by Abaza (28) as follows : "Ginning was then performed by passing the seed-cotton between two hardwood rollers 4 decimeters long and from 12 to 15 millimeters thick. These rollers were superimposed horizontally with a space of from 2 to 3 millimeters between them, and were supported by two vertical beam-sides of 25 centimeters in height which were fixed at right angles to a plank of about one decimeter in thickness and at opposite ends a small handle. The seed-cotton was then introduced, and upon turning the rollers in opposite directions, the seed was separated from the lint and fell on the entry side of the machine, while the lint itself was carried forward between the rollers ... the baling was done by means of pressing the cotton under foot, until Mohamed Aly introduced a press from England similar to that in use in America, and ordered several to be constructed locally following the same model.

Up to 1860, the bulk of the crop, about 87% of the crop was continued to be ginned by the old manual, time-consuming, inefficient methods which were a serious barrier to increased cotton cultivation, and the ginneries were able to cope with only one eighth of the crop (29). The following years witnessed a fast increase in steam-driven gin-stands. Owen (30) mentioned that by the beginning of 1863, at least one third of the crop was being ginned in "steam-ginning factories", of which there were then nearly eighty, in comparison with 24 in June 1862 and 50 in November that year. By the end of the cotton boom in 1866 there were 112 ginning factories.

Cotton seed

The cotton seed, after ginning was usually sold back to the growers, and the surplus seed, until 1850s, was generally used for fuel. After the American Civil War, cotton - seed use was generalized in Europe. Livanos (14) reported Egyptian cotton-seed exports during the years 1869,70 and 1871 as being of 787, 935 and 1,265 thousand ardebbs, and the earnings being 558, 709, and 983 thousand Egyptian pounds, respectively . Owen (30) mentioned a small portion of cotton-seed total production being crushed for extracting oil at a factory built on the edge of the Mahmudiya at Alexandria during the American Civil War.

Cotton textiles industry

According to Roux (24), the introduction of Jumel cotton provided a direct stimulus to the construction of spinning and weaving factories which could utilize it locally, especially after a number of the existing mills had already stopped working by 1822. Between 1824 and 1826, twelve more cotton factories were constructed, situated either in the main Delta cotton-growing areas or in centers like Fowha, Rosetta, and Damietta, where transport was easy. These followed in 1828 by nine in Upper Egypt. At the same time four bleaching establishments were added to the three which existed in 1821. With the exception of a few machines brought from Europe as models, no cotton-spinning apparatus was imported. Power was generally provided by animals, but later a few steam engines were imported. In 1833 the total number of Egyptian cotton factories amounted to thirty. During the period between 1829 and 1837, the output of

the spun cotton markedly increased and a sizeable amount of the materials produced; apart from the yarn sent to Trieste, Livorno, and Turkey, woven goods were exported to such neighboring countries as Syria, Arabia and the Sudan. Unfortunately, the intervention of the European alliance, led by Britain, against Mohamed Ali, put an end to the Egyptian cotton textile industry, and all the factories closed down and ceased to exist until after independence in 1930s, and thus, for almost a century, Egypt became an exporter of raw cotton and importer of manufactured cotton textiles.

End of the era

The era of the emergence of the “Egyptian cotton” came to its end by the British invasion of Egypt in 1882.

The statement of Livanos (14) worth mentioning and attention. He stated: “After the war (the American Civil War) Great Britain became the principal consumer both of Egyptian cotton and cotton-seed, her industry having taken on new life”. One also should recall that, in a deputation of six English members of parliament from the manufacturing districts around Manchester presented a memorial at the British Foreign Office deploring the inability of The Egyptian Government to stimulate the growth of high-grade cotton at reasonable prices (31). It seems highly probable that cotton was one of the reasons, besides Suez Canal and other reasons, which encouraged Britain to invade Egypt and put an end, even temporarily, to the national aspirations of the Egyptian people.

3. The British Colonial Era (1883-1920)

Under the British colonial rule, Egyptian agriculture became predominantly a monocrop cotton agriculture, with cotton being the principal crop. Improvements in all aspects related to agricultural production were directed towards serving cotton production, and almost all cotton production was aimed for export as efforts to create a local cotton textiles industry were aborted. The main changes during this period included improvements in irrigation, changes in grown varieties, insects attacking cotton becoming more injurious, and, probably above all, cotton became no longer the free play of forces that it used to be in the previous era, conscious government influence came in to take their place. These changes influenced the size of the cotton cultivated area, yield per feddan and total crop size.

On the positive side of cotton cultivation, after it had been clearly understood by growers and government that cotton offers economic opportunities not given by any other crop, the extension of irrigation to expansion of cotton cultivated area became of paramount importance. Improvements in water supply, initiated during the reign of Mohamed Aly and continued for the subsequent four decades, were accelerated. Aswan dam was built (1902) and extended (1912), as well as the barrages of Assiut (1902), Esna (1906) and Zifta (1908) were built. On the negative side, the cotton leafworm, the bollworms, the cotton seed bug, and the cotton aphids became entrenched pests.

Varieties changes

The variety Mit-Afifi, developed in 1882, came in the right time when there was a desperate need for a new cotton after the deterioration of the Maho-Jumel cotton. The advent of this variety has done more to establish the reputation of the Egyptian cotton than any one previously grown. It became in such demand that it constituted about 75 % of the total Egyptian cotton production in 1906 (and 92% of the Delta production), and even in 1910, nearly 62% of total production was recorded of Mit-Afifi (Table 1.2). Sakellarides, selected in 1901 and made its first appearance on the market in 1907, was another major occasion It had rapidly come forward for cultivation in the Delta, until it occupied 72 % of the total cotton area in 1918, and about 91% of the cotton area of the Delta. Al-Didi (2) stated: “This was one of three occasions during the century, when Egyptian agriculture was saved from the full consequence of the decline in quality of the major cotton type by the chance discovery of a successor-the two other instances being the introduction of Ashmouni in 1860, and that of Mit-Afifi in the early 1880’s”.

Several other varieties appeared during this period, the more important of which were Yannovitch, Nubari, Abbasi, and Pilion. In the same time, Ashmouni, which maintained its position as the cotton of Egypt during the period 1870-1885, has gradually come to be the cotton of Upper Egypt, i.e. the Nile Valley.

Production and productivity

The previous era ended with cotton production during the last three years (1880-1882) averaging 2.644 million Cantars. The trend of expansion of total production continued, as could be seen from Table 1.2.

Table 1.2 Cotton total production and yield during the period (1882-1919).

Years	Area Feddan (1000)	cotton area/ Total cult. area (%)	Crop Cantar (1000)	Yield (C / F)	Kg / F
1883-1884			3,131		
1885-1889			2,978		
1890-1894			4,759		
1895-1899	1 090	21.4	5,956	5.46	247.3
1900-1904	1 305	24.7	6,093	4.67	211.6
1905-1909	1 583	29.4	6,379	4.03	182.6
1910-1914	1 719	32.6	7,299	4.25	192.5
1915-1919	1 482		5,304	3.58	162.2

The first two years of this era (1883-1884) averaged 3.131 million Cantars. The subsequent five years (1885-1889) witnessed a fluctuation in total crop around three million Cantars with an average of 2.978 million Cantars. The subsequent years showed sharp increases, with the crop exceeding 4 million Cantars (1890 and 1891), and five million Cantars (1893, 1895, 1896), and reaching a peak of 6, 543 million Cantars in 1897, and another peak of 7,234 million Cantars in 1907, and 7, 663 million Cantars in 1913.

Al-Didi (2), commenting on cotton situation during the period 1880-1894 stated: Data on cotton cultivated area and yield per feddan became available only as from 1894, except for the years 1887 and 1888. During these two years the cotton cultivated area averaged 943 thousand feddans, comprising about 17.4% of the total cultivated area, and the yield per feddan averaged 3.03 Cantars. Commenting on cotton production situation during the period 1880-1894, Al-Didi (2) mentioned that while the cotton leafworm, the bollworm and other insects were probably as injurious to the crop then as later, the average yield per feddan increased, until the period of extremely high figures was reached during the closing years of the 19th century. However, the area devoted to cotton cultivation showed almost no advance. "By 1887 the area placed under cotton was still 865, 526 feddans, only 146, 529 feddans larger than it had been in 1870. In 1888 the cotton area expanded to 1,021,250 feddans, since then there was no further increase in it for another six years. The reason for this is almost certainly the sharp fall in the price of cotton at the beginning of the 1890's.

As from 1894 onwards, the cotton cultivated area followed a trend of substantial increase. It exceeded the figure of 1.7 million feddans during the four years: 1911-1914, with cotton occupying 32.5-34.9% of the total cultivated area. The average yield per feddan showed also a substantial rise reaching a maximum of 5.8 Cantars per feddan in 1897, but falling down later on reaching an extreme low level, below 4.0 Cantars per feddan, during the years 1905, 1909 and 1914. In general, the period from 1894 to 1918, may be considered the period of transforming Egypt into a large cotton farm characterized with: large area devoted to cotton cultivation and percentages of total agricultural cultivated land, and large total crops, however, the yield per feddan showed a falling-off trend especially towards the end of this period. Al-Didi (2), commenting on cotton production situation stated: "In 1896, the area under cotton was 1,050,749 feddans, comprising 20.2% of the cultivated area, from which it increased to the

maximum of 1,755,270 feddans in 1914 being in 34.9% of the total area under cultivation in that season. Although there were occasions on which the area sown with cotton in a particular year seems to have responded to a change in its price, there is little evidence to support the assertion made by Dowson and Craig (32) that as a general rule individual proprietors decided how much land they were going to employ in its cultivation on the basis of the prices ruling in the December prior to planting. During the period 1895-1908 (with the exception of 1898) the expansion in the cotton area in Lower Egypt continued from year to year regardless of fluctuations in price. And it was not until 1909 when cultivation became more or less stable, that prior considerations seem to have begun to play any sort of role, and then only with a small minority of cultivators”.

Yield per feddan deterioration

During the second half of the 1890s, the yield per feddan averaged 5.46 Cantars, and recorded a maximum of 5.80 Cantars per feddan in 1897. During the following five years (1900-1904), while the area under cotton cultivation followed an upward trend, yield followed a reverse trend. The average yield dropped to 4.67 C/F, i.e., 8.6% lower than the previous five years. The following ten years showed a smaller but continuous drop in yield except for the years 1905 and 1909 with yields of 3.82 and 3.13 Cantars respectively. The year 1909 was exceptionally bad from the climatic point of view and witnessed an unusually severe attack of leafworm, (2). From 1914 onwards there had been a very rapid drop in yield. The yield from 1914 to 1920 averaged 3.59 Cantars, and up to the year 1924 it remained below 4.0 Cantars, with years 1916, 1920 and 1921 of very low yields: 3.06, 3.30, and 3.37 Cantars respectively. The drop in yield was more pronounced in the Delta in comparison with Upper Egypt.

Several factors have been suggested to explain the decline in yield, which continued to the mid 1920s, including mainly the side effects of the increase of summer water supply resulting from the improvement of the irrigation system, insect attack, and varieties changes and deterioration.

The improvement in the irrigation system led to a tremendous expansion in the cotton cultivated area, from 1.050 million feddans in 1896, to 1.250 million feddans in 1901, to 1.506 million feddans in 1906 and to 1.828 million feddans in 1920. The new lands were probably of lower fertility. The increase in cultivated area was due: (i) partly to the conversion of basin irrigated lands to perennial irrigation, (ii) partly to the reclamation of poor salty lands in the north of the Delta, and (iii) partly to the adoption of a two-year rotation instead of the three-year rotation previously in use. Newly reclaimed lands are expected to be of lower fertility, and the two-year rotation is also expected to have at least some negative effect on yield.

Also, the improvement in the irrigation system led to a substantial increase in summer water supply and a general rising of canal levels, which in turn led to a substantial raise in the level of the water table throughout the Delta. The increase in water table reduces the depth of soil available to the roots of the cotton plant, and in some cases it led to water-logging and salting of land that was once fertile. Both effects, naturally lead to a decline in yield. Ferrar and Hurst (33), in their study on the effect of water on the cultivation of cotton at Gemmeiza during 1911, reported that “the yield of cotton increases as the depth below ground of the water table, as shown by bores, increases”. However, in a subsequent experiment, Hughes and coworkers (34) concluded that “the yield of cotton increased as the amount of water applied to the land increased”. Balls (35) came to the conclusion that: “there is no doubt in the writer’s mind that the relentless downward trend of the curve of the yield during half a century, after eliminating the four major variants (i.e., damage by leafworm, damage by pink bollworm, response to nitrogenous fertilizers, and differential yield of varieties) is simply an expression above ground of the rising water table below ground”. However, Brown (21) stated that “much discussion centered, in the earlier days of research, on the rise in water table caused by spread of perennial irrigation. Modern varieties are picked and pulled up much earlier than they used to be, when picking into November was common, and it is not now generally thought that the rising Nile has any direct influence in limiting the crop”.

Insect attack has been reported as a factor responsible for reduction in cotton yield. Al-Didi (2) discussed the part played by the insects as he wrote: "Since 1913, however, two new factors had been at work in the reduction of the yield of cotton in the first place the ravages of the pink bollworm (*Pectinophora gossypiella*), which first became serious in 1913, had caused tremendous losses estimated as being 17% of the crop in the years 1916, 1917, and 1918, when the pink bollworm was at its worst. All other insects have existed here for many years. The bollworm (*Earias insulana*), the cotton seed bug (*Oxycarenus hyalinipennis*) were discovered by Byrn in 1860 in Debaiba and Mit el-Mon, and the Egyptian cotton leafworm (*Spodoptera littoralis*) appears to have been known since 1879, and it seems safe to assume that they have had nothing to do with the general fall off in yield per feddan in the first years of this century, since they did not prevent the gradual and steady increase in yield in the period of 30-40 years from 1860 onwards, especially as there was no reason to believe that attacks of these insects have been any more serious in the 1900-1920 period than were they previous to that time".

Changes in varieties also played their part in the reduction of cotton yield. Al-Didi (2) explained this effect in the following: "the old brown cottons had been entirely replaced in Lower Egypt by Sakellarides which gave a smaller crop, but gave a higher return owing to its superior quality. Sakellarides yielded about 15% less lint per feddan than did Mit-Afifi which was introduced in 1882 and reached its zenith in 1906 when 77% of the total area in cotton was of this variety. In 1915, Sakellarides variety, which had been known since 1911, constituted 46% of the total cotton area in 1915, and 73% in 1919. This change was responsible for reducing the average yield of the whole country by about 11-12% for the period 1910-19 as compared with that in 1900-9 before the introduction of Sakellarides".

This problem of yield deterioration as caused by the rise in the water table or by other factors as well, assumed great prominence at the time (2), and two commissions (36,37) were appointed to investigate it.

The cotton commission appointed by the Khedivial Agricultural Society (36), reported that the conversion of Upper Egypt basin lands to perennially irrigated land had no effect on yield, and attributed the diminution in yield mainly to the adoption of a two-year rotation instead of a three-year rotation which impoverished the soil, as it led to there being less manure available per feddan, a circumstance aggravated by cattle plague and the working out of "Kufri" deposits. The two-year rotation is said also to have favored insect attack. The suppression of rice cultivation in Behira province was considered as a cause of a diminution in subsequent cotton yield. The commission, while admitting the deterioration of the plant as a fact, did not trace a connection between climate and yield. The commission emphasized the importance of drainage and that while there is little evidence on the cause of deterioration; it is probable that improved irrigation and drainage schemes may eventually provide the solution to the problem.

The second cotton commission (37), while avoiding conclusions regarding water table and its bearing on the reported deterioration of the cotton yield, came out with many important recommendations to be implemented by the government, the most important of which : (i) improving the drainage system in many parts of the country, (ii) the return to the three-year rotation, (iii) intensification of the annual campaign against the cotton worms, (iv) further research in : the rise in water-table, the correct use of manure, and the production of new varieties of cotton, and (v) the creation of a Department of Agriculture to co-ordinate all efforts aimed at halting a further diminution in yield.

In response to this report, a Department of Agriculture was established in 1910, which became of a Ministry rank three years later. Research into means of improving cotton strains and production was intensified and "The Cotton Research Board" at Giza was established later on. The government became increasingly active in providing farmers with pure seed and in 1913/14 the quantity distributed amounted to over a quarter of the country's requirements. Extensive drainage schemes were executed in the north of Delta.

Cotton exports

In accordance with the substantial increase in cotton production, and the absence of a national cotton textiles industry, exports of lint and seed increased substantially, with Britain being the main importer with its share being about 50% (21). Cotton lint and seed occupied an increasing share in the total exports of Egypt, as could be seen from Table 1.3, (38). On the other hand, imports of cereals increased from 771 thousand pounds during 1885-89 to 4.242 million pounds in 1913, and fertilizers, required for cotton, from 20 thousand to 720 thousands.

Table 1.3: Exports of cotton during the period 1885-1914, in Egyptian pounds.

Period	Total exports (million pounds)	Cotton (Lint and Seed) (million pounds)	Percentage of Cotton (%)
1885-89	11.043	8.900	81
1890-94	12.913	10.190	79
1895-99	13.308	11.104	83
1900-04	18.335	15.994	87
1905-09	24.129	21.971	91
1910-14	31.662	29.498	93

Seed and lint processing

According to Schanz (39), by 1906 there were seven oil mills in operation, as well as 20 other smaller soap and oil plants with 16 presses or less. Consumption rose from an annual average of 23 thousand ardabbs (2760 tons) between 1885/86 and 1889/90 to 824 thousand ardabbs, (98 thousand tons), or about a quarter of the crop, in the years 1910/11 and 1912/13. About 80% of the oil produced was either used as food or exported to neighboring countries in the Ottoman Empire, where it enjoyed a protected market. Most of the remainder was utilized by the Egyptian soap industry. The husks, shells, and other residues were made into cotton seedcake, almost all of which was exported. In 1913, the value of Egyptian cottonseed oil exports was 38 thousand Egyptian pounds, and that of cotton seed-cake 296 thousand pounds.

With regard to the cotton textiles industry, Schanz (39) reported two attempts to initiate a spinning and weaving industry in 1899, both were supported by London and Liverpool capital. The first was "The Egyptian Cotton Mills Co. of Cairo", with a capital of 160,000 Egyptian pounds, 20,000 spindles, and 360 looms, and the second was "The Anglo-Egyptian Spinning and weaving Co. of Alexandria", with a capital of 150,000 Egyptian pounds, 20,000 spindles, and 500 looms. The former was liquidated in the year 1907, and the machines were sold and sent to Aleppo. The latter was little more successful. It was never able to pay a dividend, and in 1912 it was refloated by German merchants of Alexandria with reduced capital and renamed "The Filature Nationale d' Egypte". The factory used mainly cheap cotton from Upper Egypt or from India, and spun only low counts, i.e., 16s to 20s, with occasional 30s. About 20% of its yarn production was sold to the Egyptian hand-loom weavers; while the remainder was made into plain shirting's and either sold locally or exported to Turkey.

Total local consumption of cotton lint during the first decade of the 1920s amounted to about 23 thousand Cantars each year, i.e. less than 0.4% of the total production. During the second decade, it rose to 41 thousand Cantars, i.e. about 0.7% of the total crop.

4. The Early Independence Era (1921-1951)

While the second era of the history of Egyptian cotton was characterized by the fast increase in crop size and cotton occupying a predominant role in the Egyptian agriculture, however yield showed a downfall trend, the third era, extending for almost three decades, witnessed further increases in crop size, improvements in yield, changes in varieties, and probably above all, an increase in reliance on organized scientific research to remedy the problems of yield and quality deterioration, and establishing a solid base for further impotents.

Also, during this era, seed processing was expanded to the maximum and a flourishing national cotton textiles industry came into being.

Variety changes

The important feature of this era was the breeding activity being taken over by the organized governmental research institutions. Apart from Ashmouni, Sakel and the short lived Pilion, Fuadi and Casuli and some other varieties, of minor importance bred, through selection, by private initiatives, and Maarad which was bred by the "Royal Agricultural Society", all other varieties were bred by the Ministry of Agriculture.

By the opening of the 1920s, Sakel was the predominant variety occupying about 77% of the total cotton cultivated area, and contributing also about 77% of the total cotton production. With Ashmouni occupying the second place, about 20% of the total cotton cultivated area. In 1921 Sakel yield was in the lower level, 3.37 Cantars per feddan, but sold at 45% premium over Ashmouni, which was nearly of the same yield as Sakel. This premium, however, decreased sharply in subsequent years reaching 11% in 1923 and increased suddenly to 70% in the following year, decreased again and fluctuated between 54 and 21%. During the 1920s, four varieties disappeared completely : Mit-Afifi, Yoanovitch, Abbasi and Nubari, and five new ones appeared ; Pilion, Nahda, Maarad, Fuadi and Casuli. However, Sakel and Ashmouni remained the predominant varieties occupying 46% and 44% of the total cotton cultivated area respectively.

During the 1930s, Sakel was falling- off rapidly, and by the end of the decade it was occupying only 4.2% of the cotton cultivated area. Five of the new varieties ; Pilion, Nahda, Fuadi, Casuli and Giza 3 did not last till the end of the decade. The successful variety Giza 7, introduced in 1930, expanded rapidly. By 1939 Ashmouni was the predominant variety followed by Giza 7, occupying 48% and 37% of the cotton cultivated area respectively, with the other newly introduced varieties; Sakha 4, Giza 12 and Malaki occupying the rest (15%).

The 1940s decade witnessed the disappearance of the famous Sakel after being in cultivation for more than three decades, as well as Giza 7 after being in cultivation for eighteen years. But it witnessed also the introduction of the famous varieties; Karnak, Menoufi, and Giza 30, while Ashmouni remained the predominant variety. In 1950 Ashmouni occupied about 43% of the cotton cultivated area followed by Karnak (35%), Giza 30 (19%) and Menoufi (2.9%).

Production and productivity

Except for the years of World War II when the area allocated to cotton cultivation was strictly restricted by law as from 1942 and slowly relaxed in subsequent years, the cotton cultivated area remained generally above 1.5 million feddans, and reached the figure of 2.082 million feddans, in the year 1930. The total crop achieved a record in the second half of the 1930s, with the year 1937 recording the highest ever recorded crop of 10.867 million Cantars (Figure 1.7). This high crop resulted from the large cultivated area (1.978 million feddans) and a record yield (5.50 C/F). The record average yield may be attributed to the newly introduced (1930) high-yielding variety Giza 7 which was covering 26.3% of the total cotton cultivated area, while the low-yielding Sakel was occupying only 8%, Ashmouni 58%, and Maarad and Fuady 4.0% each.

Yield per feddan, which was at its lower level in 1920 (3.30 C/F) and 1921 (3.37 C/F), started to take an upward trend, nearly regaining its late 1890s level by the late 1930s. Fikry (40), surveying the causes which led to the increase in yield up to 1937, grouped those under two headings: (i) The introduction of new varieties, and (ii) the agricultural improvements. He reported that it was difficult to state with reasonable accuracy to what extent each of these two groups of factors have been responsible for raising the yield, however, he had the impression that varieties were responsible for about half of that increase. The increase in yield was in accordance with a decrease in the area cultivated by Sakel. The year 1920, marked the highest relative share of Sakel in total production, and since 1920, the production of Sakel declined and other varieties began to displace it, and, on the national level, the average yield has continuously increased.

Fikry (40) stated: "Reverting to the part played by the introduction of new varieties in increasing our yield per unit acre, I do not want you to form the idea that this increased yield is as brilliant and financially remunerative as it at first appears to be. There are neutralizing forces which must be considered. These new better-yielding cottons have nearly all taken the place of our illustrious Sakel. The majority are of lower market price. You can, therefore, readily see that our gain in yield does not mean a corresponding financial gain. Part of that yield-increase, and sometimes the greater part of it, has to compensate for the drop in market price due to difference in quality.

Table 1.4 Cotton production, yield and local consumption during the period 1920-1949.

	Area (1000 Feddan)	Crop (1000 Cantar)	Yield		Local Cons.(1000 Cantars)
			C/F	Kg/F	
1920-24	1.645	6.181	3.66	165.8	56
1925-29	1.761	7.838	4.43	200.7	56
1930-34	1.679	7.145	4.27	193.4	177
1935-39	1.754	9.208	5.19	235.1	513
1940-44	1.190	5.874	5.29	239.6	868
1945-49	1.316	6.907	5.24	237.4	1154

The other group of factors suggested by Fikry (40) covers improvements that do not entail additional expenses, and thus the increase in yield is naturally an increase in profit, such as; the advance in the date of sowing, the sowing of cotton plants at narrower spaces and the use of good seed, and improvements that involve an increase in cultivation expenses which includes; the application of manures, combating of insect pests and additional watering. These latter improvements may result in profits for the farmers.

The high yield of 1937 has been more or less maintained during the subsequent twelve years, however fluctuating widely, between a low level of 4.67 Cantars (212 Kg) in 1938 and 6.06 Cantars (275 Kg.) in 1948. The three years 1949-51 showed a substantial decline in the yield which was attributed mainly to severe attack by cotton leafworm whose appearance has always been sporadic. Thus this era ended with a yield level in 1951 of 3.96 Cantars (179 Kg.) which is nearly the same of the 1920s.

The cotton textiles industry

The new beginning of the Egyptian cotton textiles industry was by the end of the 1920s, when "Bank Misr (Bank of Egypt)" established "Misr Spinning and Weaving Company" at EL-Mehalla EL-Kubra. The mill started with 22000 spindles and 484 weaving looms and was concentrating mainly on coarse counts. The first piece of cloth was produced in 1930. The company is nowadays the largest textile mill in Egypt and probably the largest integrated textile mill in one location throughout the world. A sister company "Misr Fine Spinning & Weaving Company" was established few years later at Kafr-EL-Dawar, near Alexandria, and extremely well equipped technically for the production of medium and fine counts. In 1938, "misr-Beida Dyers" company was established.

Local consumption increased very rapidly, from about 56 thousand Cantars (2.54 thousand tons) during the 1920s, to 177 thousand Cantars (8.02 thousand tons) in the first half of the 1930s and jumped to 513 thousand Cantars (23.24 thousand tons) by the second half of the 1930s, to 1 154 thousand Cantars (52.28 thousand tons) by the second half of the 1940s which is equivalent to 16.7% of the total crop. This increase meant that the local industry had become a big client of raw Egyptian cotton, and thus could relieve export problems if they arose. Also, it altered the components of the crop available for export (23). As

the largest proportion of the local consumption, about four-fifths, was Ashmouni and Zagora and the lower grades of other varieties, the shorter staple portion of the crop and the lower grades were practically eliminated from exports.

By the end of the Second World War, based on the assumption that there is always a local market for its products as well as the availability of a local raw material, which sometimes looked as though it was in burdensome surplus, it ran into troubles. These troubles stemmed mainly from its obligation to use Egyptian cotton, while a high proportion of its products could be produced, in competitive countries, from cheaper cottons. The possibility of importing the relatively cheaper Indian or American cottons for the local mills and export more of the Egyptian cotton has been much discussed but it was not accepted. The local industry needed tariff protection to be able to compete, even in its home market, and the government extended this protection.

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Chapter 11

The future of the Egyptian cotton and cotton in Egypt

The Egyptian cotton, production, processing and trade, after more than eighteen decades of being a national asset, seems to be at cross-roads in its country of origin "Egypt". If the current policies of its production, manufacturing and trade continued, we have to expect more deterioration and losses for the national economy. But if we managed to study the current situation and future prospects carefully and with open mind understanding of the opportunities made available by the economical progress at local, regional and world-wide levels, we will, undoubtedly realize that the future of the "Egyptian cotton" and "cotton in

Egypt” and especially the Extra-Long Staple category, under the rules of WTO has dramatic positive potentialities. However, this optimism is conditioned by an appropriate strategy with its main goal being achieving substantial degree of competitiveness in agricultural production, manufacturing and trade, generated properly and pursued persistently, and sets of policies and programs are implemented effectively.

The objective of this book is simply to contribute a new thinking to open a new page in the history of the “Egyptian cotton” and “cotton in Egypt”. By cotton in Egypt we mean both Egyptian cotton varieties belonging to *G. barbadense* and Uplant varieties belonging to *G. hirsutum*.

A necessary historical background

Broadly speaking, cotton passed five definite stages each of which has its distinctive features and its own strategy, some were for the benefit of the Egyptian people and some were for the benefit of the others, these are:

1. The first stage: under a strategy of national renaissance led by Mohamed Ali, the founder of modern Egypt based on the nearly emerged high quality Egyptian cotton, a fast increase in cotton agricultural production and processing were accomplished. In 1820 cotton production was 45 tons of lint, in 1828 the production exceeded 9150 tons and 33 factories of spinning, weaving and dyeing were established using locally made machinery after importing the machinery for only one factory. Egypt became a big exporter of raw cotton and cotton fabrics.
2. The second stage: Just before British occupation of Egypt in 1882, lint production exceeded 130,000. Tons, mainly for export.
3. The third stage: under British occupation (1882-1920), Egypt became a farm of one crop-cotton. Total production during 1910-1914 reached 365,000.00 tons, completely for export mainly to Britain. The local textile industries completely disappeared.
4. The fourth stage: after independence (1921) and up to 1952 revolution. Expansion of cotton production and beginning of establishing a national cotton industry were the main features.
5. The fifth stage: contemporary stage, this period started with a concentration on cotton improvement in agricultural productivity and production and expansion of the national industry. The role of the government increased until it became the sole responsible for cotton production, improvement, trade and industry. By the early 1990s, the government followed a new policy of liberalization. The immediate impact was a reduction in cotton cultivated area, total production and manufacturing.

Table 1: Total cotton production, consumption and productivity in the world and Egypt.

Year	Total Production 1000 ton		Consumption (1000 ton)		Productivity (Kg/Fa)	
	World	Egypt	World	Egypt	World	Egypt
1950-1959	179.2	7.6	177.2	1.7	2.26	4.3
1960-1969	219.4	8.4	220.3	3.1	2.58	4.9
1970-1979	265.5	9.1	262.5	4.7	3.34	6.4
1980-1989	326.1	8.2	334.3	6.1	3.86	7.7
1990-1999	384.8	5.9	379.0	4.5	4.85	7.29
2000-2007	456.2	4.94	454.0	2.7	5.76	7.80

In planning for the future, we have to remember that during the period 1980-1984:

- The cultivated area of cotton was 456,000 hectare.
- The yield per hectare was 1003 Kg.
- Total production was 457,000 tons.

- Cotton was the main source of finance for industrial development, provided hundreds of thousands of work opportunities, national sufficiency of clothes, substantial proportion of edible oils for human and feed concentrates for animal production (meat and milk).
- Egypt occupied the seventh position among cotton, yarn and fabric exporters.
- In 2008, dramatic reduction in production took place.

Now, by the end of the first decade of the 21st century:

- The cultivated area diminished to less than 125,000 hectares, a figure no one expected.
- Productivity, yield per hectare, remained stagnant throughout the last 28 years, between 840-960 Kg/ha.
- Local consumption diminished (does history repeats itself?).
- Increased dependence of the local industry on imported cotton lint, and local consumption of clothes on imports to levels unprecedented before in Egypt history.
- Local cotton industry continued its retreat in a time the textile industries of the developing countries are growing.

This situation had a negative impact on the local situation and led the country to the cross-roads: To follow the road of increased production, processing and export, the road chosen by many countries such as Turkey; or to follow the current road towards more deterioration?

We have to realize that “Egyptian cotton” (in Egypt) faced severe hardships during the last two decades and that its center of gravity migrated from Egypt to other countries, especially to the United States, which benefited from the problems of Egypt. We also have to realize that more difficult situations wait us in the coming years, would competition increases and our competitors will not allow us, if they are able and will do every effort to prevent Egypt from returning back to the market?

Understanding the real negative impact of the situation on the national economy presses towards active thinking based on knowledge and science towards developing a future plan of action. We admit that the cotton theater had witnessed during the last years many changes on the local and international levels which undoubtedly had many negative effects on Egypt up to now, however it could be reversed to a positive path in the future. If we acted to correct the conditions that led to the situation;

1. At the national level:

- The adoption of agriculture liberalization which affected the various field crops differently according to change in productivity, prices and production cost, and accordingly led farmers to be more unwilling to grow cotton, besides ignoring the farming consolidation system and the ineffectiveness of the plant protection program.
- The stagnation of productivity, yield/feddan, at 7-8 Cantars/feddan (840-960Kg/ha) for a very long period because of various reasons, and the inability of farmers to realize an increase so as to meet the rise in production cost, at a time the Pima cotton producers succeeded in raising their productivity to 11-12 Cantars/feddan (1320-1440Kg/ha) for more than 10 successive years.
- Incomplete liberalization of cotton trade and incomplete establishment of organizations that insures correct implementation.
- Absence of clear policies in the industrial sector and absence of clear vision for the future, besides many other difficulties and the continuity of the gap between the quality levels of Egyptian cotton and the requirements of industry at the current situation.

2. At the international level:

- The establishment of WTO; however its rules could be beneficial for Egyptian cotton if applied strictly to all producers, especially USA and European Union, and if we managed to improve our work and policies especially increasing local manufacturing activities and improving our competitiveness of national textiles depending on the high levels of quality of Egyptian cotton.

- Fast advances in the technologies of agricultural production, manufacturing and trade. In the agricultural production sector, it seems that the most important advances deal with improving quality, reducing production cost and the application of genetic engineering. In the field of genetic engineering, it seems that up to now it does not represent threats or benefits to the Egyptian cotton as it is limited to plant resistance to some insects and tolerance to herbicides. The real threat comes from the possibility of producing varieties through interspecific hybridization that combines the high yield potential of *G. hirsutum* varieties (Upland cotton) and high quality of *G. barbadense* varieties (Egyptian cotton). In the field of industrial advances, there is no doubt that there are many developments in spinning, weaving, dyeing and finishing, and ready made garments which are not limited to improving machinery but extended to production a continuous flow of new products, all these developments require careful follow-up of cotton producers. In the field of trade, the progress is continuous in procedures and marketing.
- The fast progress in many of the producing countries, especially in manufacturing, and consequently the increase in competitiveness. What is required from Egypt is not to stand still watching the changes around her what is wanted is to act and move towards solutions to the current problems in the near future and towards a much better and prospectus situation in the foreseeable future.

Objectives for the future

First of all, we have to acknowledge that Egypt's population is expected to reach 90 millions in 2020, and 127 millions in 2050, and that cotton is the most appropriate for clothing under the climatic conditions of Egypt. Also, demand for cotton will increase at the international level in conformity with the general tendency to return to nature, and for Egypt it is the main source of vegetable oils which its current self sufficiency does not exceed 10%, and above all cotton is a heavy user of work force which Egypt suffers badly from lack of jobs and high unemployment for its active population.

In the introduction of the book we stated that in 1952, the date of revolution, cotton was facing a real confusing situation because of two main problems: the first problem: a growing national cotton textile industry but is threatened by bankruptcy. The cheapest raw cotton available to it (Ashmouny variety) was of a higher price (under free market situation before 1952) than what is required for an industry based on coarse and medium yarn counts and moderately cheap fabrics, while competitive industries use for the same products cheaper raw cotton. The second problem was marketing, especially exporting, which was mainly in the hands of foreigners. When the government adopted the policy of nationalization and complete control of cotton production, marketing and manufacturing, a totally new situation emerged; the problem of the industry with cotton prices was concealed and a new marketing system was consolidated.

Recently: A totally new environment and conditions emerged at local, regional and worldwide and at theaters; political by ending the state of war under which the country lived for decades, by adopting the free market economy and joining the World Trade Organization "WTO" and socially by the willingness of the population for better standard of living and security of jobs. World-wide changes added a lot, politically and in the frame of technology. Thus, change became a necessity to conform to the world. The government issued the laws of cotton trade liberalization but it appeared to be a return back to what was before the nationalization rather than a move towards a better future. It was not part of a comprehensive strategy dealing with cotton. Accordingly it contributed to the confusion from which the cotton situation suffered and which will continue until the development of a comprehensive strategy for cotton production, manufacturing and trade.

We raised a question or rather inquiry: what does Egypt need from cotton-or what Egypt should need from cotton in the coming years? The answer requires a careful study in the light of seven facts related closely to cotton:

1. Egypt has an unemployment problem, and cotton; agriculture and manufacturing can contribute much in accomplishing a solution for the problem and with much fewer investments than other sectors.
2. Cotton has a relative advantage in Egyptian agriculture, especially under the current situation of WTO and Egyptian cotton has a relative advantage among world cottons especially Extra Long Staple cottons.
3. Egypt has a wide and ready to a large extent industrial base, a relatively large human cadre, and many organizations for research and development.
4. The world textile market is very large and still growing.
5. The added value in the successive stages of cotton processing industry varies widely, yarn has a double price of raw cotton, fine yarn prices are much higher the coarse and medium count yarns, knitting products and ready made garments have prices mostly several times yarn prices and may reach ten times in those made of extra fine cotton.
6. Egypt is approaching a stage of sizeable improvement in people's average income and standard of living, besides the continuous increase in population which means increase in consumption. If local production does not grow at least at the same rates, the country will be compelled for more imports.
7. Egypt's investment or making use of available opportunities was very limited and poor especially if compared with other countries. If Egypt did not reach and quickly, to a right and successful equation for conformity between agriculture and industry, the national industry will face the problems of being unable to compete, locally and internationally, under the rules of free trade.

We reached the glaring fact: Egypt now is on a cross-road, it has tremendous opportunities if acted correctly, and tremendous problems if continued according to the current procedures. What Egypt needs is a completely new procedure based on comprehensive thinking that explores the future and acts on its constraints, and then, Egypt has to develop a new strategy appropriate for the future, that define clearly the following:

Firstly: What it needs from the "Egyptian cotton"? Do it needs and it does need, an increase in production, say to 10 million Cantars "500,000 tons"? which it used to produce before twenty five years, or does it need more? What is the productivity level that ensures reasonable income for the farmers? Ten Cantars per Feddan (1200Kg/ha)?, more? And how this level could be achieved?

Secondly: Is it better for Egypt to let the industry to continue at its current construction? Or it is better, or may be must; change, even gradually, to fine yarns and high quality products of higher prices and added value? If it accepts the first option, the industry will face the economically difficult problem of the no economic suitability of Egyptian cotton to many products and then, it will face the problem of bankruptcies which it faced after the Second World War. Could the solution of this problem be in increasing imports of raw cotton exposing the local agriculture to the dangers of new insects? Besides the local industry will not be able to compete with foreign industries. If it chooses the second option, it definitely will make better use of the relative advantage of Egyptian cotton. Some people may say the size of high quality textile market is limited, and small, but the other part of the fact is that it is growing besides the world production of high quality raw cottons is also small and limited. Why Egypt does not become the main producer of high quality cotton textiles? Is it possible?

Thirdly: Do Egypt need- or it is really in its advantage – to export large amount of raw cotton?, or to process all the raw cotton it produces?

And we added: We have to think about the future- from now even we are in the heart of the crisis-what is needed is not to return the cotton back to its previous position as the changes locally and internationally are much greater than our capability to achieve the goal. What is needed, and which we can accomplish if we acted correctly is:

1. To make cotton a source of support to the Egyptian national economy.
2. To maximize the economical return of the unit of cultivated land (Feddan) and the unit of irrigation water (cubic meter), by increasing the value of production (here we stress on using the monetary or production in dollars per unit cultivated land and irrigation water. Production by Cantar is not valid because Egyptian cotton varieties vary widely in lint price) and decreasing production cost.
3. To maximize the competitiveness of Egyptian cotton in the agricultural sector so as farmers can realize reasonable income form growing cotton.
4. To achieve a real use from the quality of Egyptian cotton through expanding an industry of high quality textile constructions of higher position and price in world markets. We know that the share of high quality cotton textiles among world textiles is small however it is growing in conformity with the increase in incomes in advanced countries besides world production is relatively small. Why Egypt does not become the main center of this industry? There are many encouraging signs of increasing investment of local and international sources in this industry in Egypt, which we have to encourage and push forward through appropriate means. Here the agriculture should be ready prepared and able to expand production of high quality cotton and we have to assure the world that we are able and keen to do that. Also, we need a strategy for cotton that refuses the policy of “divorce” between agriculture and industry that have been adopted and implemented during the last ten years. We want a policy of “Integration” between agriculture and industry within the frame-work of excellency that maximizes benefits under the rules of WTO.

If we want to move out of the current vicious circle of deterioration and we have the will to create a better prosperous future we have to admit man important facts including:

- The first fact: cotton had witnessed a dangerous retreat during the last few years that resulted in large economical losses and the loss of many great opportunities, and that the main reason for this deterioration is our way of dealing with cotton such as taking hasty incorrect decisions, failing to adopt and implement long range policies and failing to correct any wrong policy in the right time. We have to know clearly that Egypt will be a big cotton importer if this retreat continued.
- The second fact: Egyptian cotton is “a heavenly gift” to Egypt. Egypt realized benefits from cotton when it was prepared and able to do that and others made the most benefits when it was unable. The opportunity to make unprecedented highly needed benefits still stands.
- The third fact: The strategy based on close ties of agricultural production, manufacturing and trade that was adopted by Mohamed Ali (founder of modern Egypt-1820) and Talaat Harb (leader of Egyptian economy renaissance-1920s) is the most optimum under current world situation after some modifications.
- The forth fact: Our current way of thinking that is based on non-coherent partial solutions that have no vision of the future is doomed to failure. What is highly needed is a new way of thinking and vision that conform to world situation.

Handicaps constraints that should be examined on the road to the better future

There are several subjects that represent important handicaps and that should be studied and dealt with correctly so as to prepare the base and pave the road for moving ahead for the better future, we are not going to discuss these points but will suffice by touching three of them: (1) the conformity between agriculture and industry, (2) the stagnation of yield or productivity, and (3) the role of research organizations.

(1) Quality conformity to industry needs:

It is a fact that cotton is produced to be spun, and that the natural client of raw cotton is the spinner, i.e. the textile industry. For Egyptian cotton, there are two clients; the national industry and the foreign industry. Production of Egyptian cotton, therefore, has to conform to the requirements of these two clients.

The contemporary Egyptian cotton textile industry, as mentioned before, emerged by

the early 1930s shortly after independence. Similar to other developing countries, in Egypt, the cotton textile industry was the first to capture attention for several reasons: the relatively simple technology, labor intensive, availability of local market, and, especially in the case of Egypt, availability of the local raw material which sometimes looks as though it was a burdensome surplus. It expanded rapidly, consuming mainly the MLS category and the lower grades of the other higher quality categories, i.e. the cheaper portion of the Egyptian cotton. These types of cotton were in conformity with the requirements of the predominantly coarse and medium counts yarns producing industry. As the expansion of the industry continued, it found itself increasingly obliged to use a relatively dear raw material for the production of textile constructions for which competitors would use a cheaper cotton. This situation, naturally, placed the Egyptian industry against a difficult position of being practically unable to compete not only in foreign markets but also, in its own home market. The situation compelled the industry to ask for protection, mainly tariff protection, which the government has not been reluctant to give, regardless of the fact that it raises cloth prices to the local consumer.

After the 1952 revolution, the national textile industry grew further and at a faster rate, but on the same quality bases, i.e. predominantly coarse and medium counts yarns and cheap constructions. Protection measures became much stiffer. The cheaper portion of Egyptian cotton, i.e. MLS and lower grades of other categories was fully exhausted. When the MLS category disappeared by the late 1970s and was replaced by LS dearer varieties, the discrepancy between the requirements of the national industry and the available cotton from the quality point of view widened. However, under government control and monopoly of the cotton sector, and the virtual absence of free market conditions, the situation was not looked at as a problem. In many instances the use of high quality cotton for the production of popular clothes gained support on the basis of higher durability of such clothes and thus longer serviceability which is of special importance to the poor people.

Nowadays, Egypt adopted the free-market policy and the regulations of the World Trade Organization. Eventually it started the liberalization of the cotton sector, and the subsequent privatization of the government owned companies in trade, ginning and manufacturing. The problematical issue of nonconformity between local production of high quality cotton and national textile industry requirements of predominantly low quality cotton came to surface. The national industry has to buy Egyptian cotton at world market prices. When these cottons are used to produce high-count yarns there would be no problem. But the question here is how much of yarn production is of high counts? Available information mentions 15%, this means that only 15% of the total consumption of raw cotton could be from LS and ELS categories. On the other hand, 85% of the yarn production, i.e. coarse and medium counts, should be spun from cheaper MLS cotton. Using LS high-priced cotton for spinning these yarns would be a burden on the industry that makes it uncompetitive in local as well as world markets which could mean placing it in a "suicidal situation". To solve this dilemma and establish state of conformity between agricultural production by type and national industry consumption, three options could be put forth:

- Adjusting raw cotton production to the current requirements of the national industry: the national industry is now well established on the bases of production of predominantly coarse and medium counts yarns, with a raw cotton consumption capacity (of about 6.5 million Cantars in the 1980s and 3-4 million Cantars in recent years). It will continue on the same path in the future on the assumption that an economically viable industry should be based on a wide range of products, besides world market for fine yarns and constructions is believed to be limited. A marked shift to finer yarns and constructions is not possible because of several considerations such as investments requirements and personnel and organizational capabilities. Accordingly, the majority of required raw material would be of MS and MLS cottons. These should be either produced locally or imported. In this case, the agriculture should reintroduce MLS type varieties of substantially higher yield potential, to compensate farmers for loss in price due to lower quality, to be grown in Upper Egypt. If this is not possible, the agriculture should re-think of upland cottons of even higher yield potential than Egyptian type MLS varieties because of

further loss in quality and subsequently in price. If this option is adopted it could mean the diminution of the Egyptian-type cotton production (for local consumption).

- Upgrading the national industry into a predominantly fine spinning and high quality constructions industry. Egyptian high quality cotton gives Egypt a comparative advantage over other cotton producing countries. If the industry is modernized to make full use of the available raw cotton it will increase substantially the added value from cotton manufacturing. The world demand for high quality cotton products is relatively small, but world production of ELS cottons is small as well. Why Egypt does not specialize in this portion of the industry? Investments will be needed, but investments will be needed also for rehabilitating the working mills and for establishing the new mills needed for production expansion. Personnel have to be trained-it is not a major problem. Efforts are to be done to open markets. Why not? Under free market conditions, strenuous efforts have to be done to be more competitive so as to live, otherwise perish. This is true for coarse and medium counts yarns and constructions as it is true for the finer ones. In this option the agriculture has to strive to reduce cotton production costs through generation and transfer of better and appropriate technology so as to provide the industry with not only higher quality cotton but also a raw material at competitive prices.
- Two industries. It may be better to look at the Egyptian cotton textiles industry as two fairly separate industries. (a): A mainly export-oriented fine spinning industry based on ELS and LS cottons, and (b): local consumption oriented industry based on MLS locally grown cotton. The first one should be given every support to grow at a fast rate so as to be the main industry. The second one may need no further expansion especially since cotton coarse and medium counts yarns and constructions are abundant in world markets at relatively low prices which are strong competitive to Egyptian production. Gradually, Egypt could be a center of fine spinning and high quality constructions industry based on locally produced high quality cotton.

An important factor that should be taken into consideration is the downward trend of prices of raw materials including cotton. It is, therefore, in the best interests of the national economy to move forward steadily to process almost all local production of raw cotton into final end products and, accordingly, minimize export of raw cotton. These products should be of the highest added value.

There is no doubt that the success of the textile industry in Egypt depends on the conformity between agriculture and industry. They are complementary. A successful agriculture means the availability of raw cotton of appropriate quantities, quality and prices in the right time. The national industry is the main and assured client of the Egyptian cotton and its success means its ability to consume the local production of raw cotton and at reasonable prices. More recently, a new opinion came strongly with the idea of "divorce" between agriculture and industry. Many responsible persons supported this approach without careful thinking, let the agriculture produce whatever it likes to produce regardless of the requirements of the local industry as long as it is beneficial for it, and let the industry buy its requirements locally or imports even the Egyptian cotton is not sold or exported as long as this policy is advantageous for it. The results came quickly, neither the agriculture succeeded as it suffered from price difficulties of exports nor the industry succeeded as it suffered from import problems, besides its loss of the reputation of the Egyptian cotton. Parallel to these two losers was the Egyptian consumer who has to buy textile products of lower serviceability without feeling a change to lower prices. We have to think more carefully about the merits and demerits of "conformity" and "divorce". Many people criticized the excessive intervention of the government in cotton subjects. They may be right after the changes in the economy system and world conditions. But the disappearance of the government is definitely not the right policy. The correct policy is the wise intervention or role. More recently we heard about the intervention of the USA and almost all the developed countries governments when this was required to solve the economic problem. In Egypt case, and especially in the case of cotton production, manufacturing and trade, a reasonable government intervention is highly needed if

not a must to supervise these three sectors besides research and technology generation and transfer so as to accelerate development of the national economy for the benefit of the population.

3. Yield stagnation and continuous increase of production costs:

Yield per feddan reached its maximum in the early 1980s, but retreated shortly afterwards and stagnated at 7-8 Cantars/feddan, while the main competing cotton (Pima achieved 12 Cantar/faddan. There is no doubt that most of the progress in productivity achieved in the past was a result of research and development, i.e., technology generation and transfer of technology, besides preparing the farming theatre for its use. Also, there is no doubt that achieving further improvements has to rely heavily on generating appropriate technologies and its effective transfer, and in parallel meeting the requirements of the farmers. Such technologies should aim at effecting real increases in yield, improvements in quality and reductions in production cost, so as to make cotton more competitive in the national agriculture, as well as industry and trade. Inside and careful assessment of the current situation of technology generation and transfer would reveal an urgent need for reappraisal and adjustment, as a prerequisite for achieving yield and quality outstanding improvements.

There is a general belief based on the research carried out by the Cotton Research Institute, that cotton yield could be increased to 10 Cantar/feddan using the regular varieties, if production conditions are corrected. But it could be noticed that almost all the cultivated varieties are ageing, the newest one was introduced to farmers in 1996. These varieties ought to be replaced by younger ones of better yield potential but this, unfortunately did not happen. The situation of introducing new variety to raise the roof of productivity has been stagnant, similar to actual yield, for about two decades. This situation should be studied and changed. Similarly production practices should be examined carefully. There is a wide gap between the yield potential of the current ageing varieties and the actually achieved, that should be ended, which due to various factors probably the most important of which are the nearly disappeared system of land holding consolidation which should be re-instated and maintained through appropriate means acceptable to the farmers, the size of each consolidate should be not less than 50 Feddans under which an appropriate rotation would be possible.

The system of variety zoning has been adopted in the mid 1950s and remained since unchanged however, there are some doubts about its reliability simply because it is difficult to choose the appropriate zone for a variety or a variety for a defined zone based on a very limited number of field experiments. There seems to be a real need for re-investigating the efficiency of the system. Also, decisions are always taken according to yield per feddan while the varieties vary widely in their lint price. ELS varieties are of much higher prices than LS varieties especially those of Upper Egypt.

The national industry repeatedly asks for varieties comparable to Upland cotton in price and quality and stresses the need for re-introducing the MLS and MS varieties ceased to be grown since the early 1980s. Is it possible to produce varieties of higher yield and lower quality and accordingly lower price according to the currently used method of breeding from *G. barbadense*? i.e., the "Egyptian cotton". If this is possible theoretically as many breeders argue since more than thirty years, how long does it take? In our opinion, as this seems to be impossible unless an unexpected break-through is achieved through genetic engineering, the only approach that could be used is experimenting with Upland cotton "*G. hirsutum*" in Upper Egypt, only Upper Egypt, Delta should remain exclusively for grow *G. barbadense* especially ELS, we cannot ignore the fact that the lint of the varieties of Upper Egypt is of about 15% higher price than the price of Upland cottons but the latter is of about 50-60% higher yield, and if we added the lower production costs of Upland especially picking and irrigation, the difference in monetary value becomes about 60%. Many experiments were carried in the past especially during the late 1980s but because of differences in opinion no decision was taken. What we need now is a new experimentation carefully planned and implemented. Also many people propose a new way of thinking about the zoning map. Why, if prove successful, specify

in Upper Egypt for Upland varieties and medium count yarn production and medium quality textile products for general population use, and the Delta for *G. barbadense* varieties, mainly ELS, and finer spinning and high quality textiles for export? Of course, it is a fact that for any major change, there are many opponents who supports strongly maintaining the status-quo a careful study is needed. Many changes took place since the 1980s, the most of which is the increase in cost of manual picking; the Upland has a clear advantage as its boll weight is about 5-7 grams compared to 2.5 grams for Egyptian cotton. Also, Bt cotton was applied successfully to *G. hirsutum* varieties, but till now it is not the same case for *G. barbadense* however it may be so in the future (but still many objections for Bt cotton use due to the currently used system of Egyptian agriculture).

Conclusion

Under the rules of WTO and the expected situation of local and world conditions, cotton provides very prosperous opportunities for the Egyptian economy, through both substantial amount of jobs and exports that could easily exceed five billion dollars, but cotton nowadays faces several problems, and, then, any thinking for the future should in the first place concentrate on the opportunities that could be seized, besides in the same time solutions for the current problems.

The highly required, now and in the future, improvement of the role of cotton in Egyptian Economy, under the current and future expected world conditions could be achieved if its potentialities are used effectively. This necessitates a new organization of the agricultural, manufacturing, trade and export activities that ensures effectiveness in policies and their implementation and realizes: increased productivity and decreased production costs so as to be beneficial for the farmers, modernization of the industrial sector so as to make better use of the comparative advantages of the Egyptian cotton and expansion in production based on better quality accompanied by reducing exports of raw cotton, and modernization of the trade sector locally and in the world markets.

Achieving new prosperous cotton requires:

First: establishing a new and comprehensive strategy for cotton agricultural, production, manufacturing and trade.

Second: establishing “Egyptian Cotton National Council”

The creation of an organization, preferably affiliated to the Ministry of Agriculture, which brings together the various activities concerned with cotton and scattered in numerous governmental and non-governmental institutions is becoming a must if Egyptian cotton is to follow the right course towards prosperity. Broadly, the ECNC could act as an umbrella that supports and coordinates the activities of the numerous institutions in agriculture, industry, trade, and scientific research. The goal of the strategy of such organization could be “to improve the Egyptian cotton production and manufacturing competitiveness to create conditions that lead to making Egypt the main producer, processor and exporter of high quality cottons and cotton textiles, and to ensure the prosperity of cotton farmers and processors”. The ECNC will be expected to review and examine the current situation of the various institutions, locates points of weakness and strength and finds ways to readjusting these institutions and activities making the best use of available resources and opportunities. It will concentrate on research and extension and training, and thus will not provide direct subsidies and will conform to WTO regulations. Besides, it will perform the function of policy making in support to the concerned ministries.

To achieve its objectives, ECNC should incorporate three main programs:

- 1- Agricultural production program with its main emphasis on: (i) increasing yield per feddan to ten Cantars within short period of time and more than ten Cantars afterwards, increasing cultivated area to one million feddans, and accordingly increasing total production to at least ten million Cantars (ii) reducing production costs, and (iii) adjusting quality categories to ensure best conformity with the requirements of the industry.

- 2- Industrial production program with its main emphasis on restructuring the national industry to be a fine-spinning high-quality constructions industry mainly export-oriented.
- 3- Trade and exports promotion program, besides improving local trade in cotton, an aggressive export effort is needed. There is no doubt that “A carefully orchestrated, sophisticated promotional program for Egyptian cotton is required. The program should incorporate a licensing system and brand (logo) for textiles made from Egyptian cotton.

The ECNC is apparently the most appropriate organization that could enable Egyptian cotton to command a distinctive position in world markets. Only concerted, well-planned, well-coordinated and effectively implemented and regularly monitored, efforts in the framework of an ECNC could make such objective a reality.