Chapter 6

Cotton

Gossypium barbadnse L.

Malvaceae

Prepared

by

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Cotton

INTRODUCTION

Cotton is grown chiefly for its fiber which is used in the manufacture of cloth for mankind. It is also used for several other purposes such as for making threads for mixing with other fibers and for extraction of oil from cotton seed. All these uses give a high industrial value to this crop and as such a handsome remuneration to the growers.

At present cotton is grown all over the world, i.e. in India, USA, Russia, China, Brazil, Egypt, Pakistan, Turkey, Mexico and Sudan are leading cotton growing countries.

Four Independently Species

African-Asian diploids (13 pairs of chromosomes):

- G. herbaceum
- G. arboreum

New World tetraploids (26 pairs of chromosomes:

- G. barbadense
- G. hirsutum

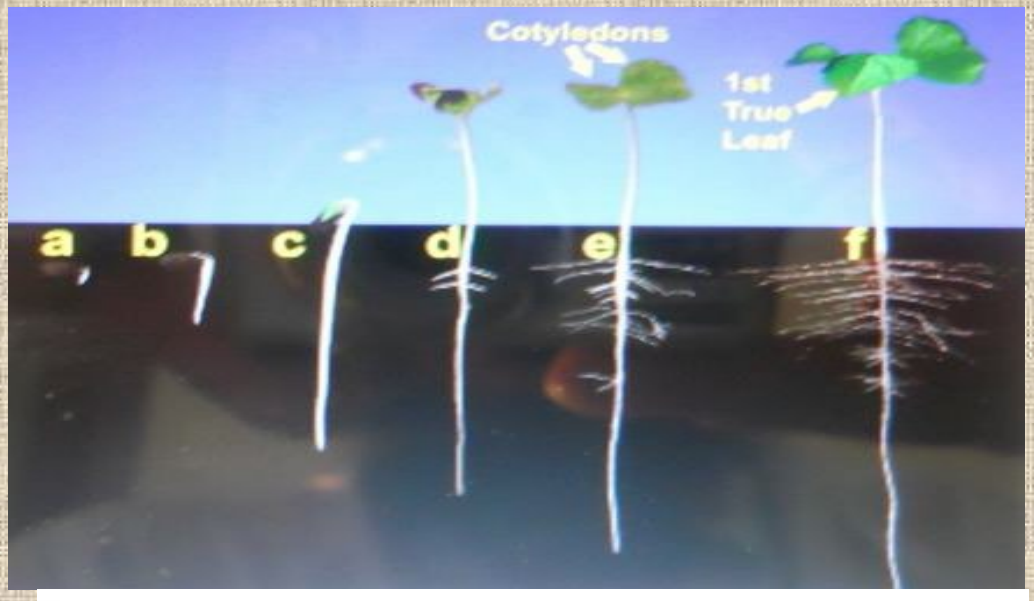
Statistical of Production

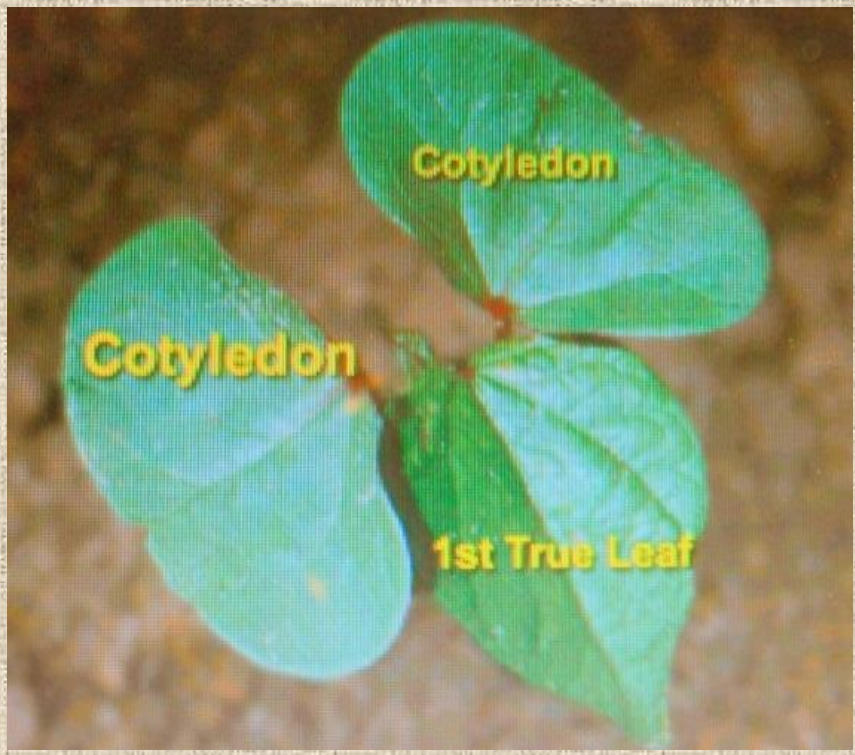
- The world total planted area from seed cotton was 32.97 million hectares produced about 74.35 million tons with average of 2254 kg/ha.
- The highest harvested area from China cultivated 3.62 million hectare, and highest production also from China was 17.14 million tons. The highest productivity per unite area from China was 4730 kg/ha.
- In Egypt, the total cultivated area was 91000 hectares produced about 300000 tons with an average 3296 kg/ha. (FAO State, 2017)

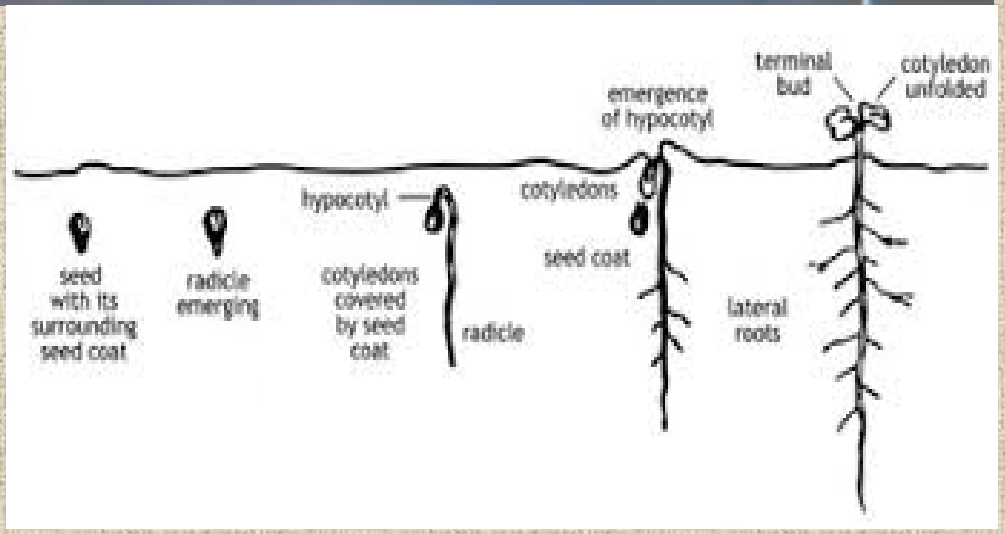
Germination and Seedling Development

Germination begins as the seed absorbs water and oxygen through its chalaza after planting. The water swells the dormant tissues and cell growth and division begin to take place.

The radicle emerges through the micropyle, turns downward and grows deeper into the soil, providing a taproot that will supply water and nutrients throughout the life of the plant. Lateral roots and taproot collectively make up the basal root system. As the plant matures, the roots continue to spread and probe deeper in the soil profile for water and nutrients. Therefore, the distribution of roots tends to match the most fertile soil zones.





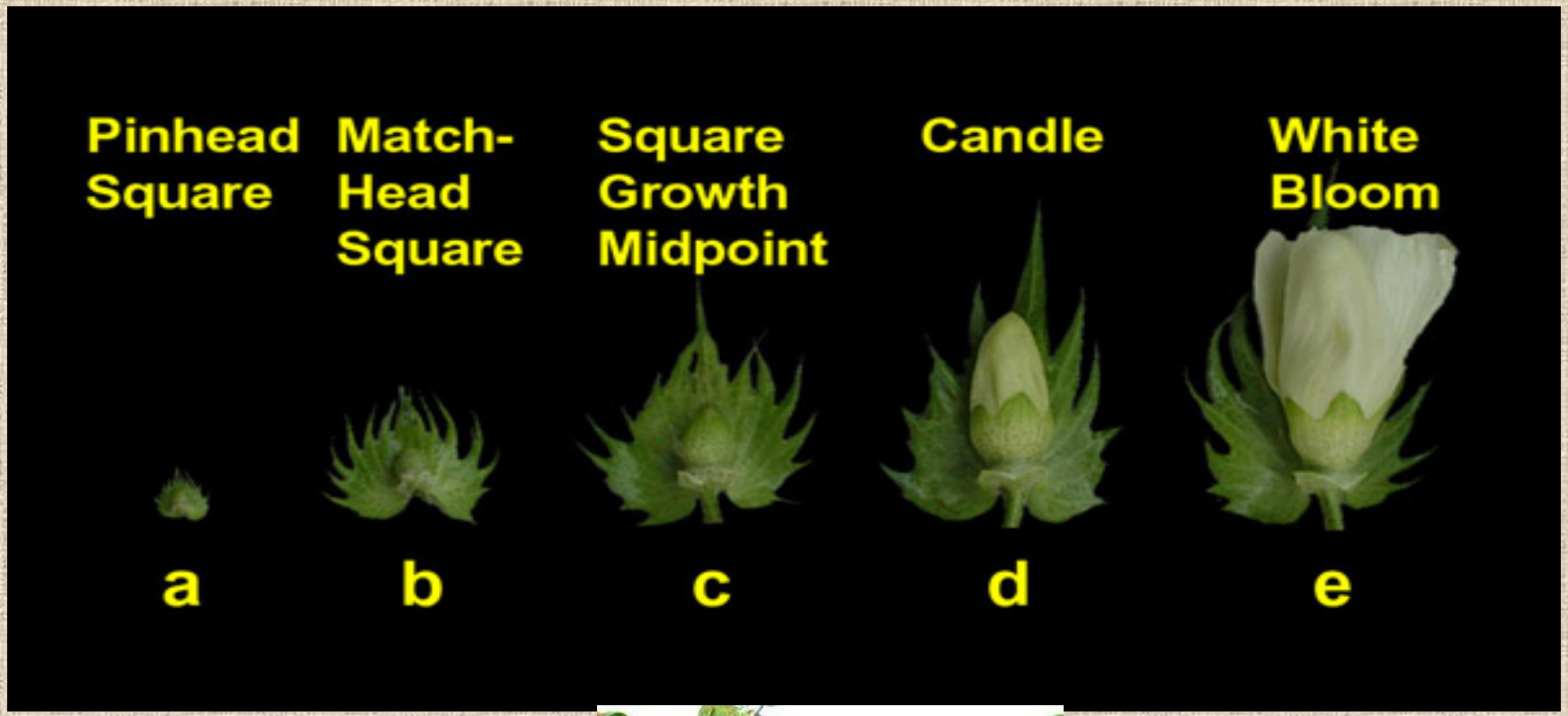


Germination Stage

The Cotyledons and First True Leaves

The cotyledons serve a dual role in germination. Before they unfold, they supply stored food to the germinating seedling. After the cotyledons unfold, they produce chlorophyll, become green, and produce energy through photosynthesis. A week or so after seedling establishment the first true leaf appears above the cotyledons.

Formation of the Cotton Bud From Square to Bloom

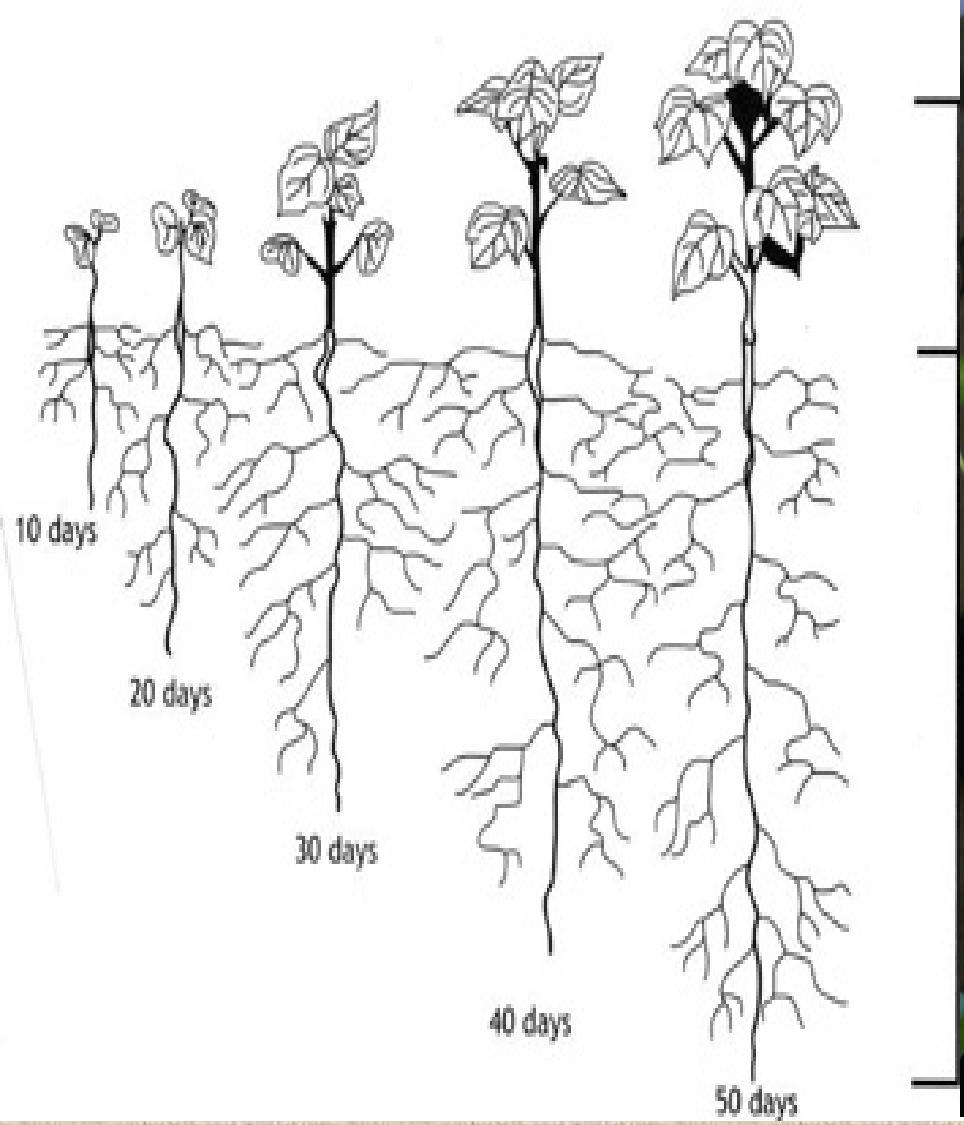


Signs of reproductive growth begin to appear about four to five weeks after planting with the formation of the floral buds or squares in the terminal of the plant. During the 21-day period from square to bloom, there are several recognized developmental stages of the cotton flower bud. A “pinhead” square is first stage at which the square can be identified. The next stage of square growth is “match-head” or “one-third grown” square. Just prior to the time the flower opens a candle shape can be seen. This period of square development prior to bloom is called “squaring.”

Vegetative Growth

The first vegetative structures that appear on the main stem are main stem leaves. Leaf photosynthesis does not remain constant as the leaf grows and develops. A cotton leaf reaches its maximum photosynthetic capacity at about 20 days of age, after which it declines. Main stem leaves and branches form at points of attachment on the main stem called nodes. Premature aging of the cotton leaf canopy due to water stress, low fertility and other stresses further reduces the photosynthetic capacity of the crop.

The stem-like structure that connects the leaf with the stem is called a petiole. Leaves that arise directly from the main stem are referred to as main stem leaves, while leaves that arise from the fruiting branch are referred to as subtending leaves.


10 days
20 days
30 days
40 days
50 days

Development of Branches

The branches on a cotton plant can be classified as either vegetative branches (monopodia) or fruiting branches (sympodia). Vegetative branches, like the main stem are referred to as monopodia (meaning "single foot") since they have only one meristem. Because vegetative branches have only one meristem, they grow straight and erect much like the main stem. Vegetative branches can also produce fruiting branches.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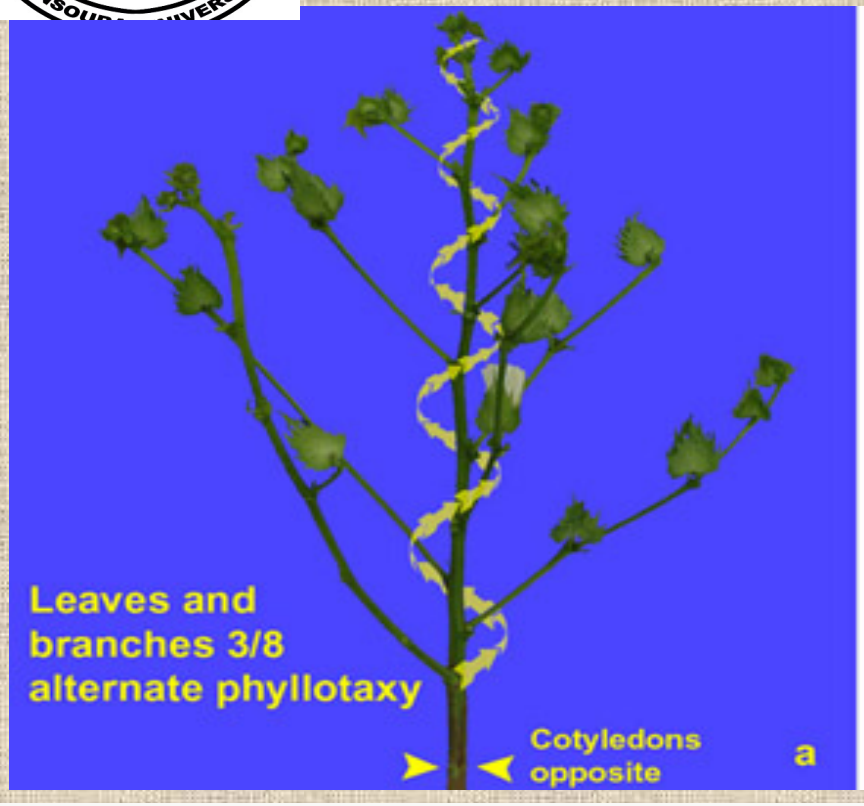
Flowering and Fruiting

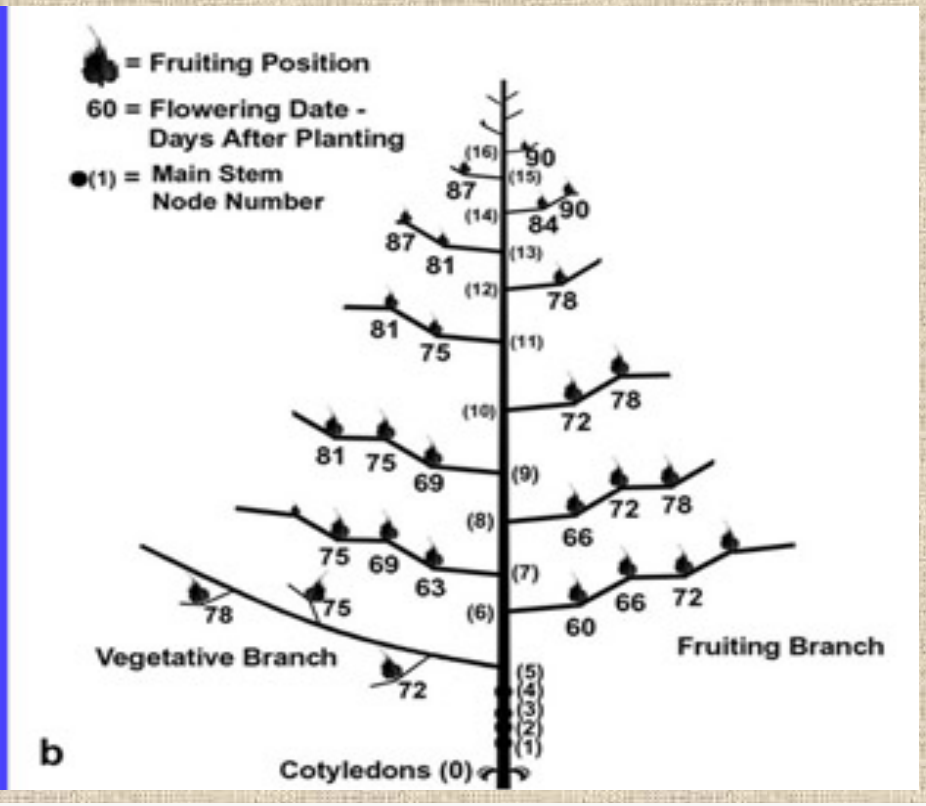
The cotton flower buds take 18-24 days to develop into a flower. Flowers are bisexual. The fruit is enlarged ovary called boll, containing 24-50 seeds. The cotton fiber (fluffy mass) is an elongation of an epidermal cell of the seed coat. The long growth is called lint while short growth is called fuzz. The lint or staple is the economic part for which the crop is grown.

When a pollen grain reaches the stigma, it germinates into a pollen tube. The pollen tube grows through the style, the micropyle and into the ovule chamber, where fertilization takes place. Anything that reduces egg or pollen viability or tube growth in a flower adversely affects the final yield for that boll.

Pollination of that flower usually occurs within a few hours after the white flower opens. On the second day the flower will have a pink-like color and a red color on the third day. Approximately 5 to 7 days after a flower appears it usually dries and falls from the plant exposing the developing boll. After pollination boll begins to develop and it takes under optimum conditions approximately 50 days to open. Boll development can be characterized by three phases: enlargement, filling and maturation.


Day 1
a
Day 2
b
c
d
Days 3–4
Days 5–7





(a) A defoliated cotton plant shows the alternate phyllotaxy of branches. Each branch is of a turn around the stem from the branch below it. The branches form from the axils of main stem leaves.

(b) A diagram of the general timing of flower emergence from buds on the fruiting branches by fruiting position.

Seed Hairs

- Unicellular outgrowths of the epidermis of the seed or seed coat
- Unique convolutions and spiral twists causes the fibers to cling together when spun

Climatic Requirements

Cotton is a tropical as well as subtropical crop and its cultivation is restricted up to an altitude of 1000 m from sea level. It is a long day crop. Seed germination takes place when average temperature range is 16°C and vegetative growth is satisfactory at 430 C. It is a warm season crop and grows well in areas having annual rainfall of 50 cm with heavy showers at the time of ball formation.

Cotton is very sensitive to fluctuations in atmospheric temperature and rainfall. A very low temperature below 16 °C at the time of sowing results in poor germination, whereas high temperature results in etiolation (falling of buds) and poor crop-stand. Humid and warm climate during plant growth periods is favorable for insects, pests and diseases that cause much damage to quantity and quality of its fiber. Heavy rains and stagnant water is harmful at all the stages of its development. A heavy rain during fruiting stage encourages the boll shedding.

Soil

Basically the best soils for cotton are those which have the capacity of water holding and retention of moisture. Medium loams to sandy loam fertile soils are best for cotton cultivation. It can be grown on red, light red and ashy colored loam soils. Alkaline and saline soils are not suitable for cotton cultivation; moreover insufficient drainage is also harmful for its growth.

Varieties

Extra Long Staple Cottons:

Giza 84*(Giza 74*Giza 68): (currently Giza 92)

A new variety represents the highest level of fiber strength in the world (50-53 g/tex). Fine and mature (mike value = 3.6, MR = 0.93). Having high spinning potential better than Giza 70, white color and luster is its merit. Surpasses Giza 70 and Giza 88 in productivity. It was already grown in 85 acres in 2009 season and is expected to be expanded to a larger area in the future.

Giza 77* S6: A promising cross represents the highest level of quality in extra long-extra fine cottons; just like Giza 45 in fiber quality, spinning potential, spinning performance, but has double its productivity. It is very fine but mature (mike value = 3.0, MR = 0.93); its fiber strength is very high (49.0 g/tex) with very low short fiber content. Giza 77*S6 is already under seed increasing and multiplication.

Delta Long Staple “LS” Cottons:

Egyptian cotton breeders have directed more efforts towards enhancing fiber quality of the Delta LS cottons. They are very successful in increasing the Upper Half Mean length, uniformity and strength of these cottons, being characterized by the maximum length of the LS category. In addition, the strength level is very close to the strength of the ELS cottons which enables the Delta LS cottons to compete with the ELS cottons in spinning performance and yarn quality.

Giza 89 * Giza 86): A promising cross represents higher yield potential (1600kg/ha), higher spinning potential, spinning performance and yarn quality than Giza 86. This promising cross represents a high level of fiber strength (46 g/tex), fineness (4.3 mike value), length (33 mm), uniformity index (88%) and white lint color is among its merits. It is ready to occupy a part of the cotton area in

Middle and Upper Egypt Long Staple Cottons: (Giza 90*Australian): A promising cross that showed higher yield potential than both Giza 80 and Giza 90 (1700 kg/ha). It is of better quality than Giza 90, and it is early mature and tolerant to high temperature. The cross isolated in 2007 and could be released after three to four years.

Giza 90/Giza 91: A promising cross that showed higher yield potential (1600 kg/ha) and acceptable levels of fiber quality and spinning performance. Moreover, it is tolerant to high temperature and aggressive climate in Upper Egypt zones.

Giza 83*(Giza 75* 5844* Giza 80): A cross under evaluation. The trials indicated that it is of higher yield potential than Giza 80 and Giza 90 (1620 kg/ha), and fits the requirements of the local textile industry.

Land Preparation

Various field operation are necessary before planting so as to get optimum soil conditions at the same time enabling plants to establish easily. Cotton is a deep rooted crop which needs fine good tilth and well prepared field for successful germination and growth of crop. To get this, plough the field with deep plough then harrowed with planking each time to make the soil loose, fine, leveled and pulverized. Remove all the stubbles of the previous crop left in the field.

Seed and Sowing

Proper seed selection and timely sowing of cotton are important key factors to influence the cotton yield. These are described here as under.

i. Seed Selection

Seed selected for sowing should be free from diseases, pests, cuts or damages etc. The quantity of the selected seed depends upon the variety, soil fertility, climatic conditions and management of the crop. Seed rate for drilling is 8 – 12 kg and for ridges sowing 4 - 6 kg per acre is recommended.

ii. Seed Treatment

Delinting is done with concentrated sulphuric acid or mechanically. This kills the hibernating larvae and helps in even distribution of seed while sowing. Delinted seed is treated with fungicide Actara ST 70 WS, Dividend Star 036 FS and Dynasty CST 125 FS or with any other suitable fungicide.

iii. Time of Sowing

The quality of the mature cotton fiber is influenced by the time of sowing. If cotton sowing early or late, results in reduction in fiber characters. In southern parts of the country cotton sowing is started from April and then upward to the northern parts ends in May.

iv. Method of Sowing

Before cotton sowing seed should be soaked in water for about 9 to 15 hours. Early in the morning it should be rubbed (if seed is fuzzy) with sweet soil or ash to enable the seeds to separate from each other. There are two methods of cotton sowing drilling and ridges. Drilling is mostly done by mechanical seed drill and ridges sowing by hand.

v. Gap-Filling

Gap-filling i.e. planting seedling of cotton in those places, where seed has not germinated or is weak and less vigorous, Healthy seedlings from the places where plants are in excess are pulled out without damaging the roots, soaked in water for two hours and again planted in places of gaps to get uniform crop stand in the field.

Fertilizer Application

The dose of nitrogen, phosphorus and potassium can be increased or decreased keeping in view the fertility of soil.

Phosphorus and Potassium fertilizers were added during seedbed preparation. Phosphorus at rate of 150-200 kg/fed a Calcium superphosphate and Potassium as potassium sulphate at rate of 50-100 kg/fed were added according to soil fertility.

Nitrogen fertilization as Ammonium nitrate fertilizer at rate of 60-80 kg N/fed according to cultivar. Nitrogen fertilizer must be added at three equal portions, the first one after thinning, the second dose before the third irrigation and the third dose before the fourth irrigation.

In sandy soil nitrogen in the form of urea must be used.

Irrigation

Cotton is a deep rooted crop and the effects of excessive or less irrigations are not visible immediately. The growers have to be very careful while applying irrigations which depend upon the frequency and system of irrigation. The most critical stages for irrigation are early flowering to first boll opening and maturity.

The first irrigation after 3-4 weeks from planting because there is rains water in this time in Egypt. Irrigation frequency each 12-15 days according temperatures and must be done in the morning or at end of the day and before night.

Weed Management in Cotton Fields

Seed cotton yield is the product of interaction of several agronomic and environmental factors. Among agronomic factors weed control is very important for profitable seed cotton yield. Weeds reduce the yield both directly and indirectly. Directly they compete with the crop for space, water, light and nutrients. Indirectly they give shelter to insects and disease casual organisms. Nature has given certain peculiar (unique) characters for their existence in the fields. Weed seeds stay dormant for very long time, germinate earlier, their seedlings grow faster, flower earlier, form seeds in abundance and scatter seeds before maturity of main crop. In Egypt, hand hoeing used to weed control. Hand hoping 3-4 times before the first, second and third irrigations were used.

Chemical Weed Control

To control using herbicides on both summer or winter weeds in cotton field by using Tryiflan 48 % at rate of one L in 200 L water/fed after seed bed preparation or Cobex 48 % and or Cotoran 80 %. Regarding to grasses weed we can use Fuozled Super 12.5.

Cotton Yield

Cotton varieties, scientific management of production and climatic conditions all tremendously account for yield and quality of cotton flux and its lint.

Yield of cotton 8-12 Kentars/fed (kentar=157.5 kg) i.e. lint's cotton + seed, differed as cultivar, sown date and soil fertility.

thank you