**Cotton (*Gossypium hirsutum* L.):**

It is the most important cash crop of Pakistan that provides raw material for textile industry as well as for oil extraction.

**A) Crop Botany:**

It belongs to family Malvaceae.

Types: *Gossypium hirsutum* (American cotton) – used for fibre

*Gossypium arboretum* (Desi cotton) – used for cotton

*Gossypium barbadense* (Egyptian cotton)

i) Root: It has a strong tap-root system up to 200 cm deep in soil.

ii) Stem: Erect, circular and woody stem (1-5 ft high) with a number of lateral branches. Main stem carries branches and leaves but no flower. Branches are of 2 types i.e. monopodial branches (2-4 in number) which do not bear flower and fruit, and sympodial branches that directly bear flower and fruit.

iii) Leaves: Leaves are hairy with 5-7 lobes.

iv) Flower: Flower bud is called square (*gudi*). Self-pollination occurs in cotton.

v) Fruit: Fruit is called boll or capsule. Immature segments of boll upon its opening are called locules which are 2-6 in number. When boll opens at maturity, it yields fluffy mass of fibers called lint that have seeds in it. Lint + seed is called seed cotton while seed are called cotton seed. It contains 15% protein and 25% oil.

**B) Agro-meteorology:**

i) Climate: Mean temperature for cotton should be more than 27oC. Warm dry climate is best for it. Relatively high temperature (25 to 32oC), ample sunlight and adequate moisture supply is require for it.

ii) Soil: It grows well on a wide range of soils except sandy soil. Loam and clay loam soils are best for cotton production. The pH range for it is between 5 to 8. It can tolerate both the acidic and alkaline soils. Water logged and saline soils are not suitable for it.

**C) Economic Importance:**

In Pakistan role of cotton in GDP is 1% and in value addition is 5.1% Area under cotton cultivation is 2.917 million hectare, production per year is 10.074million tones and yield per hectare is 587kg. Pakistan is on 4th number in cotton production. China is first most cotton producing country in the world India and USA are on 2nd and 3rd number. Core area of cotton production in Pakistan is Multan, Khanewal, Vehari, Lodhran, Bahawalpur, Bahawalnagar, D.G. Khan, Rajanpur, Muzaffargarh, Layyah and Rahimyar Khan.

**D) Production Technology:**

**1) Seed bed preparation:** Deep ploughing should be carried out to break hard pan because its root penetrates deep into soil. Steps for land preparation are 1 rotavation, 3 cultivations and 2 plankings.

**2) Sowing time and varieties:**

a) Early sowing: 15th March - 15th May

Early sowing varieties: Ali Akbar-703, Sitara-008, Neelum-121, Tarzan-1, MNH- 886, VH- 259, BH-178, CIM-599, CIM-602, FH-118, FH-142, IR NIAB- 824, IUB-222, Sitara 11M, A -555, K2-181, Sayban-201, Tarzan-2

b) Late sowing: 15th April - 15th May.

Late sowing varieties: IR-3701, MG-6, Ali Akbar-802, GN Hybrid-2085

Recommended sowing time for Upper Punjab is April, for Central Punjab is May and for South Punjab is May and June

**3) Seed rate:** 6-10 kg/acre for bed sowing

 8-12 kg / acre for drill sowing.

**4) Sowing method:** Two methods are used for cotton sowing:

a) Drill sowing: Row to Row distance = 75 cm

P to P distance = 6-9 inches (By thinning at 20-25 DAS)

Seed depth 2-2.5 inches

After first irrigation, earthing up must be carried out in alternate rows to make beds. It is done to save irrigatin water up to 20-30% and excess water could be drained out.

b) Bed sowing:

Ridge to Ridge distance = 60-75 cm

Plant to Plant distance = 9-12 inches

After seed bed, beds are made by ridger-bed shaper which makes 75 cm wide bed furrows. Furrow depth is 7 inches. On both margins of beds, sowing can be carried out manually by labor or bed planter can be used.

In case of manual sowing, irrigation is applied in furrows and just after irrigation, 2-4 seeds are sown manually 2.5 cm above water level.

In case of planter sowing, sowing is done on the both margins of beds by bed planter. Just after sowing, irrigation is applied in furrows 5 cm below the seed.

Gap filling: After 4-5 DAS, the seeds which do not germinate, produce gaps that should be filled by sowing 5-6 hrs soaked seed ()4-5 seeds). Plant population = 23000-35000 plants per acre.

**5) Fertilizer:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Maize type** | **N** | **P2O5** | **K2O (kg/acre)** |
| For early sowing | 161 | 46-70 | 50 |
| For late sowing | 80 | 35-58 | 38 |

Whole of P and K at sowing but N in 3 splits as:

1/3 N at sowing

1/3 N at first irrigation

1/3 N at flowering

If deficiency symptoms of B and Zn appear, these should be applied through foliar application at 45, 60 and 90 days after sowing. Boric acid (17%) @ 300g per100L water (5 kg) and ZnSO4 (33%) @ 250 g per 100 L water (6 kg)

 **6) Irrigation:**

6-8 irrigations (26 acre inches)

|  |  |  |  |
| --- | --- | --- | --- |
| Sowing method | 1st irrigation | Subsequent irrigations | Last irrigation |
| Drill sown crop on flat | 30-50 DAS | 12-15 days interval | Up to 30th September |
| Bed sown crop | 3-4 DAS | 7-10 days interval | Up to 15th October |

**E) Plant protection measures:**

**A) Weeds:** These can cause up to 20-30% loss in cotton yield s due to weeds.

Important weeds of cotton are Itsit, deela, tandla, lehli, chulai, kulfa, madhana, lumb ghaas, hazardani, chibber, parthinam, makro, hulhul etc.

Physical control:

Hoeing by khurpa or kasula

Chemical control:

a) Pre emergence herbicides: These are applied before crop emergence within 24 hrs of crop sowing

1. Pendimethalin @ 1L/A both for broad leaved weeds and grasses

2. S-metolachlor @ 800ml/A both for broad leaved weeds and grasses

3. Pendimethalin + S-metolachlor (Dual gold) @ 800ml/A

4. Acetochlor+ Pendimethalin @1L/A

b) Post emergence herbicides:

1. Haloxyfop @350 ml/A for grasses

2. Quizilafop-p-ethyl 15EC @ 100-120 ml/A for all weeds

3. Quizilafop-p-ethyl 5EC @ 400-500 ml/A for all weeds

**B) Insect Pests**

1. Sucking Insects

Aphid, jassid, whitefly, thrips, mites, mealy bugs, dusky cotton bug

Spray of Confidor, Imdacloprid, Buperofezin, Acetameprid, Talstar etc.

2. Borers

Spotted bollworm, pink bollworm, American bollworm, Army worm

Spray of Karate, Cypermethrin, Spinosad, Chlorpyrifos

**C) Diseases**

Bacterial leaf blight, Cotton leaf curl virus (CLCV), Root rot, boll rot, Plant wilt

**8) Harvesting**

Its harvesting is picking of seed cotton which should be carried out when 40-50% bolls open. Pickings are done 15-20 days interval.

American cotton: 30-40 mds / acre

Desi cotton: 20-25 mds / acre