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A Review on the Sustainable Cotton (*Gossypium hirsutum*) Production

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Abstract:

Cotton (*Gossypium hirsutum*) is an important, indeterminate non-food cash crop and a significant source of foreign exchange earnings for Pakistan. The crop generally cultivated over 7 to 8 million acres per year in Pakistan. Pakistan is the fourth-largest producer of cotton in the world and the third-largest exporter of raw cotton. Cotton accounts for 7.3 % of the value-added in agriculture and about 1.6 % in GDP. About 1.3 million farmers cultivate cotton over 3 million hectares, covering 15% of the cultivable area in the country. The overall average per acre yield of Cotton in Pakistan is very low as compared to the other countries i.e. China, USA, India, Brazil, Turkey, Egypt, and Iran. From the past few years in Pakistan due to BT cotton variety, some of our farmers are taking handsome yield. This paper describes an idea to the readers how they can increase the yield of cotton by managing the critical stages of cotton production on time to obtain a bumper crop.

Keywords: Cotton, Seed, Fertilizers, Weed removal, Pesticide, and Irrigation.

INTRODUCTION

Cotton has different names in different languages; in Urdu language, it is called Kappas. The botanical or scientific name of Cotton is (*Gossypium hirsutum*) and it belongs to the family of Malvaceae (Ahmed *et al.*, 2018). Cotton is an annual or perennial herb or shrub reaching up to 2 meters in height. The cotton crop requires a warm and humid climate for its growth and development however, it grows well in subtropical regions (Arshad *et al.*, 2019). The ideal temperature for the cultivation of Cotton ranges from 25 °C to 30 °C.

The stages involved in the cultivation of cotton crop are as follows;

1. Land preparation
2. Seed sowing
3. Weeding / intercultural operations
4. Pest and disease management
5. Flowering and boll formation
6. Harvesting and yield.

Well-drained and loamy soils rich in organic matter with suitable soil pH range between (6 to 8) are best suitable for the cultivation of cotton crop (Bourland, 2004). The soil should be ploughed to attain a reasonable depth of 10 to 20 cm with varying plot sizes. The land should be prepared by giving 2 to 3 ploughs along with crushing of mudstones after each plowing. The plowing can be done with the help of a disc plow or chisel plow (Arshad, 2015).

LAND SELECTION

For the cultivation of cotton crop fertile clay soils, with good leveling and drainage is required. Cotton may also be cultivated in clay loam and loamy sand soils. Saline, Sodic, Saline – Sodic, waterlogged, and poor drainage soils are not suitable for cotton cultivation. Optimum soil pH for cotton is between 5.8 – 6.5 (slightly

acidic). The soil should be high in organic matter. To identify the existing nutrient level in the land and proper fertilizer dosage soil test is necessary (Carvalho *et al.*, 2004).

The identification of the exact nutrients present in the land is only possible by soil testing. In Pakistan, many government and private organizations are giving soil testing services to farmers. These organizations are not only providing the results of soil parameters but, they are also giving the fertilizer recommendations, its proper time, and the methodology of its application. Some mandatory soil testing parameters are given below

- pH
- EC
- Soil texture
- Nitrogen
- Phosphorus
- Potassium

Hard Pan Removal and Land Leveling

The land must be prepared in such a way that all the remains of the previous crop, mudstones, etc will be finished. For uniform irrigation, the land must be leveled. As the roots of cotton crop penetrate straight into the soil i.e. 3 – 4 ft in one complete season therefore, it is necessary to perform a chisel plow and Raja hal operation into the soil. It will not only open the hardpan of the soil but also enhance the water movement and retention into the soil. The extraction process of the nutrients by the roots from the soil will also enhance (Gemotos *et al.*, 2002).

Nowadays, due to water shortage and warabandi problems in Pakistan, our farmers are giving special concentration on leveling their land. It will help in giving uniform distribution of water and fertilizers to the crop. Farmers use tractor with rear blade and laser land leveling

techniques to level their land. By using the laser land leveling technique, we can level a huge number of lands in a small interval of time.

Land Preparation

The seedbed must be prepared by using 3 – 4 operations of the cultivator and after each operation give leveling deck (Sohaga) operation as well. The seedbed must be prepared according to the conditions of the ecological zone, soil texture, and structure. The cultivator operations may be increased or decrease depending upon the soil conditions. If the soil condition is still hard then use the rotavator operation to break the mudstones into small minute particles. By using rotavator operation the surface of the land not only becomes soft but also the remains of previous crops (if any) will also mix in it. Due to which there will be no difficulties during sowing operation.

Before preparing furrows and ridges some farmers are providing green manuring to their land to enhance the nature of Nitrogen and organic matter percentage in their land (Gemotos *et al.*, 2002). About 25 – 30 days before mix all the green grass/legumes into the soil in a moist condition. To speed up the decomposition process, apply $\frac{1}{2}$ bag urea during the mixing of green grass/legumes. Within 10 days or according to the soil condition applies irrigation to the land. Make 2 $\frac{1}{2}$ to 3 ft wide ridges at 2 $\frac{1}{2}$ ft distance per acre. The distance of furrows and ridges may vary. The height of the ridges must by 0.664 to 0.833 ft. In Punjab and Sindh province the wideness of ridges is 2 $\frac{1}{2}$ and 4 ft respectively. For uniform distribution of water and fertilizers, the ridges and furrows must be straight (Iqbal *et al.*, 1994).

Seed Selection

Good seed will give you good yield therefore, the delinting of the seed is necessary. For the cultivation of cotton crops always use pure, healthy, and clean seed. The good quality seed will not only give you maximum germination but also provides you maximum and

healthy plants. Some farmers make their seed from the previous stock and they delint all the seeds (Khan *et al.*, 2019).

Seed Germination

Before sowing it's better that you must know the seed germination rate. The germination rate must be around 75 %. If the germination percentage is less than 75% then increase the amount of seed per acre for reliable results. Seed rate requirement per acre:

- Drilling = 6 to 10 kg per acre
- Dibbling = 6 to 8 kg per acre

Seed treatment plays an important role in cotton production. Before sowing always treat your seed with a suitable chemical that may protect it from the initial sucking pest attack. For seed dressing use either metal seed dresser / earthen pots or polythene bags. Do not leftover treated seeds either for human consumption or as animal feed.

Cotton Seed Sowing

There are generally two methods of cultivation Cotton i.e. (a) Drilling, and (b) Dibbling. Plant to plant distance must be 6 – 7 inches. Sowing can be done by hand or planter. If the seed is sown by hand then the sowing depth must be 1 inch above the wet soil. If the seed is sown by planter then first we have to sow the seed a/c to dryland farming and then we have to provide 1st irrigation in such a way that the height of water will be below the 1-inch depth of seed sown (Arshad *et al.*, 2017). After 4 – 5 days, the seeds will germinate and we can easily identify the vacant portions in the field. Wherever you find vacant portions in the field do re-sowing in that portions.

Sometimes it has been observed that during monsoon season due to heavy rainfall there are chances of natural degradation (Karand) of the upper surface of the land. In such conditions do all the sowing operations from the beginning?

Cotton fertilizer requirement

Good quality cotton requires a proper and suitable dosage of fertilizers. Always use the fertilizer dosage recommended by the experts according to the conditions and texture of your soil. Nitrogenous fertilizers are used from the day of germination to boll formation and flower development (Latif *et al.*, 1994). Phosphorous fertilizers are used to have plants with strong roots, a good quantity of bolls, and it also helps to get good quality fiber. Potassium fertilizers are used during fiber development in bolls and during flowering.

Weak/excessive plants removal

To get a good yield of cotton, the maintenance of distance between plants is very necessary. This will be only possible by removing weak or excessive plants manually. This process should be done during 20 – 25 days of sowing or before 2nd irrigation. After weak/excessive plants removal operations the per acre plantation will be:

- BT Variety = 14,000 – 35,000
- Traditional Variety = 23,000 – 35,000

Weeds and extra grass removal

Weeds and extra grass removal is very necessary operation throughout the cotton production. This can be done manually, artificially, or traditionally. Do this operation after every irrigation process or rainfall. Due to this operation the moisture reserves in the soil, improvement in aeration, and all the fertilizers will be consumed by the crops. We can also use herbicides to control the weeds and extra grass.

Irrigation Requirement

On-time irrigation with proper irrigation requirements will give optimum results in

attaining good healthy plants. For BT Variety cultivated on ridges and furrow give first irrigation after 2 - 3 days and remaining irrigations after 6 – 9 days. For Traditional Variety cultivated on ridges and furrow give first irrigation after 3 – 4 days and remaining irrigations according to the land and climatic conditions after 7 – 10 days. Water requirements during the development of buds and flowers are more in cotton crops. Stop giving irrigation before 15th October in case of sowing wheat as a 2nd crop (Sial *et al.*, 2015).

Cotton pest control

Cotton crop is very much attractive to many pests. Two types of pests mainly attack the cotton crop i.e.

- Sucking pests
- Worms

Sucking pests mainly attack the leaves due to which the plants start wilting. Worms mainly attack the buds, flowers, bolls, etc due to which the per acre yield decreases. If there will be CLCV (Cotton Leave Curl Virus) attack on the plant then remove that plant. Keep one thing in mind don't use pesticides without any need because it will increase the resistance power in pests. Only spray at that time when the damage exceeds the ETL limits. Use only those sprays which are registered by WHO. If the operator feels uneasy, he must discontinue spraying at once. The operator should not spray more than 4 hours at a stretch in a day. The operator should not take upon spray work with an empty stomach (Qaimkhani, 2008).

Types of Pests

- Vertebrate pests (parrots, mice, bats, jackal, etc)
- Insects, mites, and disease.
- Difference between sucking and chewing pests.

- Household pests (cockroach, bed bugs, and termites).
- Animal's pests (ticks and mites).

Cotton picking

Cotton picking is an important operation if its picking or storage is not up to the mark so there will be a decrease in its quality. Picking must be done when the crop is fully ready. Picking operation must be done in dry conditions and placed it on a dry and clean place. Always choose those bolls which are fully developed. Don't pick cotton during heavy dust climatic conditions. Place different varieties of cotton in different warehouses to protect the fiber and seed quality. After final picking of cotton release the cattle in the field so that the cattle may eat the remains of the cotton crop i.e. bolls and leaves.

Suggestions for Enhancement of Yield of Cotton Crop

- Soil Testing and application of proper fertilizers.
- Grow certified high yielding varieties (B.T Cotton etc).
- Regular field visits and scouting of pests.
- Increase of crop intensity.
- Credit facility to growers through Banks.

CONFLICT OF INTEREST

There is no conflict of interest.

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