



## An Overview of factors affecting on cotton production

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## ABSTRACT

Cotton is well prominent as “white gold” important cash and precious crop in overall cotton growing development counties. The yield of this crop is depending upon the environment in which it is grown and management practices of the cropping system. It is noted after review of various publications of scientists that several factors are responsible which affecting cotton production, selection of cultivar should be according to environment in which it is grown, soil preparation, seed rate, plant spacing, sowing/planting dates and timely irrigation are the important factors which effect on yield. Whereas, nutrients management and crop protections are the key factors which directly affecting the plant growth and development ultimately directly responsible for decreasing yield. Along with these factors modern technology and farmer’s education play a vital role for producing quality cotton production and management of farms. Therefore, suggested that farmers should apply better management practices and follow proper time management as per practices and apply timely appropriate inputs for crop growth and development and crop protection measures for sustainable cotton production.

**Key word:** Cotton, production factors, cultivar selection, sowing time, nutrients, crop protection.

**INTRODUCTION:** Cotton that is well prominent as “white gold” is an important cash and precious crop in overall cotton growing development counties. The yield of this crop is depending upon the environment in which it is grown and management practices of the cropping system. Cotton yield is stagnant for the last several years. Factor responsible for the stagnant cotton yield production include: unnecessary raining during the sowing time, high temperature fluctuation from beginning up to the flowering stage, delay in harvesting wheat which is also resulting in decline of area under the crop, incidence of cotton leaf curl virus disease, system of soil, adversaries of water application, outbreak of insect pests and the major cause for low production is inappropriate adapting of production technology in overall major cotton growing areas. Along with that; there are many other social as well as economic problems facing cotton production including: uneducated farmers who producing cotton, improper tillage operations, delay in sowing and plant density, outbreak of insect pest and diseases, climate change, inappropriate use of irrigation water, lack of supply plant nutrients at the right time, high input cost, small landholdings, no innovation adaptable by farmers through small experiments, lack of interaction between extension departments and farmers, uncertainty in the market rates and the cost of production is the most significant factor among them.

Cotton can exactly be considered as an internationally trade crop that plays a crucial role for elevating country’s economy. A better cotton growth guarantees with the appropriate coordination of different agronomic practices and judicious use of various inputs and among these, appropriate sowing date is an important phase which effects on fiber characters and yield. Because cotton is an important fiber crop and occupies a key position in the world’s trade and economy of Pakistan (Soomro *et al.* 2014). According to (Khan *et al.* 1986, Hassan 1991 and Nabi 1991) observed that financial resource, inputs cost, lack of experienced with modern technology and lack of linkages with

market are the major cause of low yield in cotton. They also found that sowing and cultivation cost, fertilizer, seed, irrigation, pesticide are also major factors which affecting on production of cotton. Iqbal *et al.* (2001) found that proper and timely use of seed, weedicide, fertilizer and pesticide have greatly influence on cotton production. It these can be available timely then ultimately yield will be increased. Bakhsh *et al.* (2005) reported that several factors positively affecting towards cotton production viz. land preparation, fertilizer, plant protection, irrigation and seed rate as well. Anwer *et al.* (2009) suggested that many factors affecting on cotton production viz. quality seed, fertilizers (DAP and Urea) and irrigation water has significantly affect towards produce higher cotton yield. Nadeem *et al.* (2014) conducted research and explored the factors (education, fertilizer, land preparation, plant protection measures, irrigation and seed) which affecting on cotton production. The various factors might be responsible for stumpy crop yield in the country which is discussed as below.

**Cultivar selection:** Selection of an appropriate cultivar according to the environment for particular zone is primary factor for the cotton production; because only suitable cultivars can be produce required yield, as it is suggested by the scientist; who evolved it as per climatic adoptability such as temperature, wind, light and humidity etc. Certified seed from public and private sector is passed through field inspection, tested at laboratory from seed certification department which meet the varietal purity standards and free from the certain weed seed and other crop mixture and diseases as well. A large number of farmers sowing cultivar which is not recommended and uncertified, their germination percent is very low, if germination percent is good then after maturation very low quantity of bud, flower & boll setting. Some of the variety after sowing emergence different types of plants in field some of them have dwarfed while others tall with different characteristics. Low categories of seed which have heavy insect

pests and diseases outbreak. Pesticide and fertilizers expenses more and final maximum yield at per hectare, that income giving loss to farmers, because the inputs cost is higher than the income of per hectare. Similar theories presented by [Kalhoro et al. \(2001\)](#) screened out the best genotypes and recommended superior variety according to the central climatic conditions. [Jatt et al. \(2007\)](#) reported best cultivars CIM-446 and TH-3/83, as compared with others and suggested in the agro-climatic condition of Jamshoro for commercial cultivation. [Khan et al. \(2007\)](#) presented findings that cultivar Karishma and CIM-1100 have the best performance for parameters which were studied and hence recommended as the most suitable commercial cotton cultivars for agro-climatic conditions of D.I. Khan. [Sial et al. \(2014\)](#) conducted experiment to evaluate the best cultivars according to central climatic zone of Sindh and suggested CRIS-342 and MNH-786 has a best genetic potential to perform better and hence it is recommended that these cultivars are best suited to cultivation in given climatic condition.

**Soil preparation:** Cotton crop required a soil which has excellent water holding capacity and aeration with good drainage as it cannot survive excessive moisture and water logging. Consequently, healthy plant growth and development require soil conditions that have sufficient moisture and temperature in soil, and least root penetration resistance through deep ploughing. Sufficient tillage system can make perfect seedbed conditions i.e. temperature, moisture and penetration resistance for germination of seed, growth and development of plant and without hindrance of root growth. Whereas proper land leveling helps in saving irrigation and other inputs because of uniform leveling in the field. Similar findings proposed by [Khan et al. \(1986\)](#) and [Hobbs et al. \(1992\)](#) who also suggested deep tillage to decrease compaction below the plough layer and for conserving moisture. [Ali et al. \(2010\)](#) suggested that bed planting method proved to be superior to ridge and flat plantings. [Gursoy et al. \(2011\)](#) found results that for improvement in yield and plant growth ridge tillage is considered as a good agronomic practices for the reason that it provide good physical conditions in soil. [Ali \(2013\)](#) observed that cotton yield was significantly influence through different practices of tillage, whereas higher yield can be produced through deep ploughing as compared with minimum tillage. For plant growth and development, seed germination, unimpeded root development and ideal soil conditions i.e. temperature, moisture and penetration resistance can be created with effective tillage system ([Tisdall and Hodgson 1990](#); [Taylor and Brar 1991](#); [Materechera and Mloza-Banda 1997](#); [Theodore and Gemtos 2002](#); [Atkinson et al. 2007](#) and [Krause et al. 2009](#)).

**Seed rate and plant spacing:** The appropriate recommended seed rate is very essential for optimum plant growth and yield. It depends upon the variety, soil type, method of sowing and cultivation practices. A recommended seed rate is 15-25 kg per hectare for genetically pure and high germination cultivars by various scientists through research and practical experiments. The most favorable seeding rate for cotton products can be easily adjusted during various cropping system without yield penalty or causing great complications in growth management. However, farmers using stumpy seed rate due to which plant population remain low in the field and ultimately cause of low yield. Whereas plant spacing is very crucial for cotton production, because excess and low plant population ultimately

decreased in the per hectare yield. The recommended plant spacing is mandatory for better cotton production which is plant to plant 30 cm depends upon the selection of variety either bushy or compact type and row to row distance should be maintained 75 cm. Same findings presented by [Ali et al. \(2009\)](#) recommended that maximum seed cotton yield can be produced through maintaining proper plant spacing. [Ali et al. \(2010\)](#) suggested that cotton growers are advised to adopt bed planting method with 22.5 cm plant spacing to maintain 59260 plants for maximum yield.

**Sowing/planting date:** Proper sowing time is an importance factor because delayed sowing time is one of the major reasons for low yield. Planting crop too early emerging with poor crop standing the results of lower yield potential and alternately, planting too late commonly becomes very vegetative and difficult to manage and also resulting in lower yield as well. For optimal cotton production proper time of sowing need to be followed which minimizes the external factors which affecting on crop. At farmers level it was also observed late sowing of cotton crop because of unavailability of pure seed at sowing time, irrigation and fertilizer are additional reasons and ultimately getting poor growth and decrease in yield. Therefore, it is recommended that proper time of sowing/plating should be followed to avoid external factors, proper growth and development for getting high yield. Similar studies have been done by various scientists, [Brown et al. \(1992\)](#) and [\(1993\)](#), [Silvertooth et al. \(1993\)](#) and [Unruh et al. \(1994\)](#) several phase of cotton production system i.e. growth and development patterns, yield and insect pest management can rightly be influence with planting dates. [Soomro et al. \(2000\)](#) recommended that May 15 sown crop result increased bolls plant<sup>-1</sup>, boll weight and seed cotton yield and further observed that cotton sown earlier or later than its optimum time showed a steadily decreased in its yield. [Arain et al. \(2001\)](#) reported that maximum seed cotton yield was produced when cotton was sown on May 1<sup>st</sup> at Nawab Shah Sindh Pakistan. [Arshad et al. \(2001\)](#) studied the effect of planting dates on fiber characters and suggested that when sowing time was late, staple length, fiber maturity and fiber strength were drastically decreased. [Mahmood-ul-Hassan et al. \(2003\)](#) presented findings the yield of cotton is mostly associated with sowing dates as boll weight and formation of bolls which are interred linked with the yield. [Wrather et al. \(2008\)](#), [Ali et al. \(2009\)](#), [Baloch et al. \(2010\)](#), [Awan et al. \(2011\)](#) and [Deho \(2012\)](#) presented research findings that optimal time of sowing/plating increase the cotton yield with attributing traits and fiber quality parameters, while it decrease when delayed. [Soomro et al. \(2014\)](#) reported that sowing to cotton crop at appropriate time produced maximum yield and yield contributing characters, whereas early or late sowing effect on decreasing yield gradually after 30 days interval.

**Irrigation:** Irrigation water is production tool as fertilizer and tillage which provide supplement to crop plant. Deficient water and uninterrupted drought cause remarkable losses to farmers. For sustainable crop productivity there is essential to supply of irrigation water frequently as per crop need. In case one or two critical growth stages go without irrigation during lifecycle of the crop, it results in significant reduction in crop production. According to [Hake et al. \(1992\)](#) irrigation use enhance the yield, quality and profit stability. [Shafiq \(2002\)](#), [Maqsood et al.](#)

(2006), Saleem *et al.* (2010) and Mubeen *et al.* (2012) reported that various growth and yield parameters are associated with irrigation and usually six irrigations are most important for producing maximum seed cotton yield. Ertek and Kanber (2003) reported that seed cotton yield and boll number increased linearly with irrigation water amount. Karam *et al.* (2006) found that cotton lint yield was inversely associated with irrigation amount. Onder *et al.* (2009) recommended that the highest seed cotton yield can be produced through full irrigation intervals at all growth stages of cotton crop. Hassan *et al.* (2011) found that the highest seed cotton yield was obtained with full irrigation, if deficiencies occur which effects on yield. Similar results reported by various scientists Yazar *et al.* (2002); Pettigrew (2004); Aujla *et al.* (2005); Bakhsh *et al.* (2005); Mert (2005); Jalota *et al.* (2006); Chun-yan *et al.* (2007) and Anwar *et al.* (2009).

**Nutrients:** Mostly agricultural soils contain very low organic matter. Moreover, nutrients deficiencies is widely reported because of harvesting of exhaustive crops year after year, high temperature, low rainfall, high cost and imbalanced use of fertilizers. Application of fertilizer in a balance amount with standard methods and at appropriate time keeping in mind the soil nutrient status, soil moisture, crop type and crop growth stage can increase yield up to 25-75 percent. According to Wahab (1985) on the basis of soil testing in Pakistan that generally deficiencies of nitrogen, phosphorus and occasionally of potassium occur in soils, which are cause of low yield. Marschner (1986) suggested that for internal part of chlorophyll molecule, nucleic acid, and protein and growth regulators nitrogen acting leading role. Power and Schepers (1989) presented that the requirement of nitrogen fertilizer effect on many factors which are yield, nitrogen mineralization and nitrogen concentration. Elayan (1993) found that the yield and its components can be increased by applying increasing nitrogen levels. Bauer (1994) reported that nitrogen management is a key aspect of cotton production, both limited and excess can reduce cotton yield. Furthermore presented that phosphorus and potassium deficiencies can also reduce yield by limiting plant growth. Whereas, excesses of these nutrients in soil interfere with the uptake and utilization of micronutrients and can reduce yield through micronutrient deficiencies. Malik *et al.* (1996) found that phosphatic fertilizer results were variable in most areas, whereas cotton crop shown marvelous response at the application of nitrogen fertilizer in all type of soils. Gill *et al.* (2000) reported that positive and economical response of cotton crop with phosphorus fertilizer application. Bukhsh *et al.* (2005) suggested that more use of fertilizer contributes towards maximum seed cotton yield and enhance their crop production by applying appropriate combination of N:P:K. Makhdom *et al.* (2001) presented that due to application of phosphorus fertilizer seed cotton yield significantly increased. Saleem *et al.* (2010) recommended through practically that earliness and seed cotton yield can be achieved by using higher dose of phosphorus fertilizer. Ali *et al.* (2011) presented that zinc and boron foliar application proved as the best balanced fertilizer dose for higher seed cotton yield. Similar results presented by various scientists Marcus-Wyner and Rains (1982); Hussein *et al.* (1985); Constable and Rochester (1988); McConnell *et al.* (1995); Jin *et al.* (1997); Sawan *et al.* (1997); Vieira *et al.* (1998); Ahmad (2000);

Bronson *et al.* (2001); Katkar *et al.* (2002); Shah *et al.* (2003); Dar and Khan (2004); Singh *et al.* (2006); Abid *et al.* (2007); Kumbhar *et al.* (2008) and Ahmed and Irshad (2011).

**Crop protection:** The most important concern for cotton crop throughout season is weeds, insects and diseases which cause severe economic losses each year in the form of reduced yield and fiber quality. In addition, pest control through the purchase of pesticide and the use of other weed control practices is a major expense for cotton producer. Lack of quality control, high cost, adulteration, timely unavailability and lack of education and the use of faulty equipment's by untrained labour are the major constraints responsible for the ineffectiveness of pesticides, fungicides or weedicide (Bauer 1994).

**Weeds:** The most noticeable way weeds reduce cotton yield is through competition with cotton plant for light, nutrients and water. Weed competition is very severe when plants are young. Studies have shown that weeds must be controlled at initial stage after cotton emergence or significant yield reduction can occur. Some weeds also serve as alternate hosts for insects, diseases and nematodes (Bauer 1994). According to Schwerzel and Thomas (1971) weeds consume excessive potassium, nitrogen and magnesium 3-4 times as compared with crop. Anderson (1983) observed that weeds are severe threats for crop production by reducing yield and quality of crop as competing for water, nutrients, light and carbon dioxide. Askew *et al.* (2002) found through field trial that seed cotton yield can be increased if weeds controlled by the application of effective herbicides. Gianessi and Sankula (2003) presented that weeds are quite different as compared other pests that create problems for crop production, because weeds are relatively stable, as outbreak of insects and disease are sporadic. Ali *et al.* (2005) stated that maximum seed cotton yield can be obtained by controlling weeds with suitable application of weedicide and inter-culturing. Cheema *et al.* (2008) reported that the application of weedicide as pre-emergence were given maximum seed cotton yield with minimum weed density. Whereas, the lowest seed cotton yield was recorded with high weed density. Henderson and Anderson (1966); Rajeswari and Charyulu (1996); Van Chin (2001); Johnson *et al.* (2004); Ware and Whitacre (2004); Vasilakoglou *et al.* (2005); Shah and Khan (2006) and Chinnusamy *et al.* (2013) reported similar findings that due to weeds, seed cotton yield will be reduced.

**Insects:** Yield reduction by insects can be caused by attacks on vegetative plant parts that lead to delayed or reduced growth. Insect attacks on reproductive structure reduced yield by decreasing the number of bolls harvested. Defoliation by some insects can reduce boll size and may cause plant death and also reduce fiber quality (Bauer 1994). According to several researcher; (Ali 1992) reported that 18.78% cotton yield decline by attacking Jassid. Khan and Khan (1995) and Malik *et al.* (1995) reported that up to 38.7% yield losses was noted due to sucking pests. Aslam *et al.* (2004) noted that seed cotton yield is being decreased by attacking thrip, whitefly and jassid. Xingyuan *et al.* (2004) presented that if insecticide is not applied for sucking insect pests; it ultimately cause as yield losses. Amjad and Aheer (2007) observed that sucking insect pests plays important role for yield reduction. Jothi (2007) presented that the pest pressure, particularly of bollworms, due to which crop losses in cotton becomes very high. Dhawan *et al.* (2008) observed that yield losses are due to sucking insect

pests in cotton. [Shahid et al. \(2015\)](#) found that due to insect pest there were significant decline in seed cotton yield and staple length.

**Diseases:** Disease agents (fungi, bacteria and viruses) reduce cotton yield by decreasing stands, retarding crop growth, and causing boll rot, root rot and CLCuV etc. Quality of harvested cotton is reduced when diseased bolls or plant are harvested with the rest of crop. Development of cultivar that is resistant to or escapes these pest organisms is a major focus of disease control in cotton ([Bauer 1994](#)). Numerous species of fungi can cause seedling diseases, but the primary agents are *Rhizoctonia solani*, *R. bataticola* (*Macrophomina phaseolina*) *Pythium spp.*, *Phoma exigua* (Ascochyta) and *Fusarium spp.* Further suggested for prevention against these disease are exclusion of the pathogen from area quarantine, use of resistant varieties/cultivars, cultural practices, time of sowing is also important, irrigation management, excessive application certain organic manure like poultry manure will induce high vegetative growth, field sanitation is another essential part of disease management, incorporation of composts in to the soil is a fundamental cultural practice in organic cotton production. i.e. (a). successful competition for nutrients by beneficial micro organisms. (b). antibiotic production by beneficial micro organisms. (c). successful predation against pathogens by beneficial micro organisms. (d). activation of disease resistant genes in plant by composts. Chemical control with an effective fungicide and biological control ([Chidambaram, 2007](#)). According to the report of [Raney et al. \(1971\)](#) yield losses in the order of 1.5% caused by cotton bolls rot, in a particularly dry year, while in the next year these losses increased to 14% due to higher humidity and temperature. [Jiskani \(1992\)](#) reported that the cotton crop record revealed that root and boll rot diseases of cotton were considered as most severe and destructive, but since last decade, cotton leaf curl virus (CLCV) found to be most important disease. [Mahmood et al. \(1996\)](#) found that CLCuD caused average reduction in plant height (40.6%), number of bolls per plant (72.5%) and boll weight (33.8%) in cotton crop. [Khan and Ahmed \(2005\)](#) found that CLCuD is a crucial disease causing massive losses to cotton production. [Allen \(2006\)](#) presented that fusarium wilt is mainly common disease on farm level and averagely 6.7 percent infected plants are found during 75 percent crop survey. [Iamamoto \(2007\)](#) reported that bolls rot causing 20-30 percent losses in cotton productivity, whereas it losses first boll position in affected plants which produced best quality of cotton fiber. [Iqbal et al. \(2014\)](#) reviewed status of CLCuV disease and presented that for cotton production it is very crucial threat of this disease, it belongs Begomovirus genus and family Geminiviridae, transmitted through whitefly. Due to CLCuV disease extremely yield reduction was observed.

**Modern technology:** Management practices with modern technology at farm level increase productivity which is important to allow farmers to move farm subsistence to market-driven farming that requires changes in crop selection, cultivation, harvesting, marketing, transportation and adaptation of new technologies. Modern techniques for plant protection measures are required for effective control of diseases, insects and pests to avoid crop losses. [Bukhsh et al. \(2005\)](#) for adaptation of improved technology education acts an important role and builds maximum productivity level. At the

farm educated or skill farmer apply various practices regarding production technology; furthermore, they will be in better position and to be familiar about existing marketing situation locally and nationally about farm inputs and outputs. According to earlier worker [Wu \(1977\)](#); [Dhakai et al. \(1989\)](#); [Raza and Ramachandran \(1990\)](#) and [Lin \(1991\)](#) reported that education improves the management skills of farmers, who tackle such issues on efficient and effective way and through modern technology implementation yield will be increased.

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