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Evaluation of growth stimulants on growth and yield of cotton (*Gossypium hirsutum* L.)

Waqas Ahmad, Nazim Hussain
Department of Agronomy, Faculty of Agricultural Sciences and Technology, Bahauddin Zakariya University Multan, Pakistan.
**Corresponding Author: Waqas Ahmad, Email: ahmadwaqasgill@gmail.com*

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ABSTRACT

The field experiment was performed at Adaptive Research Farm Karor, Layyah by sowing cotton variety (MNH-886) @ 25 kg ha^{-1}. The experiment was conducted by Randomized Complete Block Design (RCBD) with a factorial arrangement and 3 replications. The fertilizer NPK was applied as per recommendation and standard agronomic practices were given at a proper time. The maximum cotton seed germination (m^{-2}) was 37.00 with soaking the seed in potassium chloride solution. A maximum number of plants m^{-2} was (32.667) in treatment soaking seed in potassium chloride solution. Whereas a minimum number of plants m^{-2} were (20.66) in the control treatment. Maximum plant height (cm)was observed in treatment soaking the seed in potassium chloride solution. Whereas minimum plant height was recorded in the control treatment. Maximum monopodial branches were observed in treatment soaking the seed in potassium chloride solution, followed by soaking the seed in water for 12 hours (hydro-priming) which is statically at par with soaking the seed in calcium chloride solution. Whereas a maximum number of sympodial branches were recorded at soaking the seed in potassium chloride solution (23.33). Seed priming of cotton seed with water and salts have no effect on the number of squares, flowers, open bolls plant^{-1} and boll weight (g). Maximum average yield was (2700.00 kg ha^{-1}) in treatment soaking seed in potassium chloride solution. Whereas minimum seed cotton yield was (2338 kg ha^{-1}) in the control treatment. Maximum seed cotton yield was (901.07kg ha^{-1}) in treatment soaking seed in potassium chloride solution. Whereas minimum seed cotton yield was (773.70kg ha^{-1}) in the control treatment. Maximum seed lint yield was (1797.7 kg ha^{-1}) in treatment soaking the seed in potassium chloride (KCl) solution. Whereas minimum seed cotton yield was (1545.6 kg ha^{-1}) in the control treatment. Maximum seed index was (9.0167gm) in treatment soaking the seed in potassium chloride solution (KCl). Whereas the minimum seed index was (7.6133gm) in the control treatment. Seed priming of cotton seed with water and salts have no effect on the uniformity index (%), UHML fiber length, and micro narie value. Maximum GOT (%) was (46.033%) in soaking seed in potassium chloride solution (KCl). Whereas minimum GOT was (42.863%) in the control treatment.

INTRODUCTION

Agriculture plays an important role in the development of countries like Pakistan. Since the time of independence of Pakistan, it is the main livelihood for the people. Now a day's mechanization has become more important in Pakistan as compared to agriculture. Agriculture has also played a major role in the improvement of the industries. In 2007 21% of GDP of Pakistan depends upon agriculture (World Bank).62% of the population of Pakistan lives in rural areas and most of them are directly or indirectly linked with agriculture. Cotton (*Gossypium hirsutum* L.) is the main cash crop and foreign exchange for Pakistan and most developing and agricultural dependent countries like Bangladesh and India etc. Cotton (*Gossypium hirsutum* L.) is the main fiber crop of the world. In 2003 about 20% of the overall cotton area was grown as a Bt. Cotton (James, 2003). In 1947 the total cotton production area was 1240 thousand hectares with an overall production of 194000 metric tons and the average yield was of 157 kg ha-1. In 2009-2010 total cotton area was 2820 thousand hectares with an average production of 715 kg/ha, cotton has 7.3% of value-added in agriculture and 1.6% to GDP (Govt. of Pakistan, 2009).

With indeterminate growth habit, the cotton plant is perennial and has been adapted to annual cultivation due to the great efforts of plant breeders. Cotton is the main textile fiber crop and inception of addible oil in Pakistan. Cotton provides raw material to 1139 ginning units, 503 textile mills and over 5000 oil expelling units. Today latest upland cotton varieties are high yielding, day length neutral, annual plants and high perennial cotton was regained by the compact and more yielding annual crop (Munro, 1987). However, the genuine yield was less than the genetic potential of the varieties resulted from consecutive cropping that lessened the productivity of the soil. Tsidale (1993) said that continuous cultivation of land leads to a decline in the fertility and organic matter of the soil. Against the broad economic importance of the crop and applicable climatic and natural resources in the area, the use of fertilizer to maximize the yield and attention given to the development of fiber characteristics in the area was essential. Besides, presently there is no information on the fixed rate of nitrogen fertilizer that can give optimum yield and enhance fiber quality with profitable production on the environment prevailing at Pakistan and nearby areas. The rapidly increasing human population and the need for further cloth is anticipated to affect the fiber requirement of the people and the textile industry. It is, however, critical to interrogate the fertility status of the soil in relation to nitrogen response on yield and quality of cotton.

In cotton synthetic fertilizer especially nitrogen has a wide impact on production encouragement by controlling cotton growth and abscission of squares and bolls (varma, 1982). When nitrogen is applied at a rate of 190 kg/ha as compared to 143 kg/ha the yield is higher (Abdul-Malik et al., 1997). When nitrogen is applied at a rate of 50 kg per hectare it increases the protein content (Patil *et al*., 1997). Although its great importance, production and productivity of cotton are mainly affected by a biotic and abiotic factor that causes to low average national yield 1.1 t ha^{-1}. On irrigated farms yield potential is 3.5 to 4 ton per hectares while the average yield is 2 to 3 ton/ha (EARO, 2006). Less soil fertility and not use of improved varieties are basic factors influencing the production of cotton in both ways either quality or quantity (Yayock, 2002). Favourable application of nitrogen plays a key role in determining a wide range of cotton plant yield variables including plant size, fruiting intensity, boll retention rate, boll size and total boll number per plant (Sing et al., 1998). However, these conditions tell us that some farmers of the crop are planning to buy and apply the fertilizer while others are replacing the cotton land to other crops and, hence, the continuation of the varieties in the production system was at risk. Instead of improving the fiber quality, researchers have a main focus on yield in past. A proper understanding and appreciation of soil fertility and other agronomic factors that affect the lint yield of commercial cotton varieties are of paramount importance. This article reports the effect of growth stimulants on the growth and lint yield of cotton varieties.

Cotton is a Warm seasonal (tropical) crop. It can be profitably grown in regions with optimum rainfall, but the economic yield cannot be obtained in the regions with rainfall less than 500 mm. for higher yields 50 cm of rainfall is necessary. In general, temperature more than 35 degrees C are not favourable for cotton-growing, however, when the moisture supply is favourable, the cotton plant survives at very high temperature (up to 43-45 Co) for short periods. If there is a high temperature for a long time, the yield will decrease badly. Throughout the growing period, high light intensities are essential for satisfactory vegetative development, for minimal shedding of buds and bolls and hence for higher yields. Cotton Crop can be grown up to 1000m altitude.

Cotton can be grown on a wide range of soils and can be grown on a great variety of soils like black cotton soils. Alluvial soils are best for maximum cotton yield. Soil structure and texture along with favourable air and moisture is requiring for cotton growth. Shallow soils are not suited for deep-rooted crops such as cotton, so soil depth is also an important factor. Cotton is not extremely perceptive to soil reactions, so it can be grown on a variety of soils with pH ranging from 5 to 8 and above. Cotton mainly knows as fairly tolerant to salinity. It has been noticed that uptake of Sodium in cotton is less from its abundance and availability in soil and water as was shown by the low accumulation of sodium in both tops and roots. This shows that the relatively high salt-tolerance of cotton may be at least partly due to the presence of some selective mechanism that implements cotton roots to restrict sodium absorption. Cotton is commonly cultivated on sandy loam to loam soils with optimum irrigation facilities.

Seed invigoration implies an improvement in seed performance by any postharvest treatment that focused on improvement in germinability, storability and better field performance. One method of improving seed germination in the field has been through the use of pre-sowing treatment such as seed priming (Heydeker *et al*., 1973). Hydro priming is used to improve germination, increase treatment shows greater germination across a wide range of environmental condition as temperature, then unprimed seed (Valdes and Bradford,1987; Ellis and Butcher,1998) and adverse field conditions such as salinity (Wiebe and Muhyaddin,1987) under low water availability (Frett and Pill, 1989) Hydro priming just increase the seed germination but not improve the dead seed (Canliffe,1998). The objective of this research is to test whether seed priming methods by using water treatments would affect seed germination and vigour of high performing. Therefore, this study was conducted to assess the effect of growth stimulants (KCl and $CaCl_2$) on the growth and yield of cotton.

MATERIALS AND METHODS

Experimental site

The field experiment was performed at Adaptive Research Farm Karor, District Layyah, Punjab, Pakistan in the year 2015-16 to evaluate the growth stimulants on growth and yield of cotton under Agro-climatic conditions of Layyah.

Growth conditions

Cotton variety Bt.MNH-886 was sown with a seed rate of 25 kg ha^{-1}. The experiment design is a Randomized Complete Block Design (RCBD) with 3 replications. The fertilizer NPK was applied as per recommendation and standard agronomic practices were given at a proper time. The cotton crop was cultivated on May 21, 2015. The seed was taken from Central Cotton Research Institute Multan (CCRI). The pre-emergence weedicide pendimethalin 33% was sprayed on bed-furrow in dry conditions with the ratio of 2.5L/ha. The plant to plant distance was 22.5 cm while row to row distance was 75 cm. When the cotton plants reached 20 cm thinning was done to obtain the required number of plants population. After 7 days first irrigation was done because plants needed the water. The four treatments; T1 [Control (dry seed sowing/un-soaked seed sowing)], T2[Soaking seed in water for 12 hours (hydro priming)], T3 (Soaking seed in $CaCl_2$ 2% solution for 12 hours) and T4 (Soaking seed in KCL 2% solution for 12 hours). Fertilizers were used in the following rates; DAP =2 bags/acre, SOP = 1 bag/acre and Urea = 1 bag/acre.

Growth parameters

The Germination percentage was calculated by the following formula:

$$Germination\ \% = \frac{Number\ of\ germinated\ seed}{Total\ seed\ number} \times 100$$

Five plants were selected at random from each plot and were measured in centimetres with the help of measuring tape by placing it along the axis of the plant and the average was taken. The number of plants per square meter that emerged was recorded daily. Monopodial and sympodia branches of ten randomly selected plants from each plot were counted and an average number of monopodial and sympodial branches per plant was calculated. About two months after planting, flower buds called squares to appear on the cotton plants. In another three weeks, the blossom opened their petals change from creamy white to yellow, then pink and finally, dark red. After three days they wither and fall, leaving green pods which are called cotton bolls. The number of squares, flowers and boll were counted from ten randomly selected plants according to age and then the average number was determined. Staple length in millimetre was taken from three samples in each plot and then converted. It was taken three times in each replicate and then averaged. Staple strength was calculated in 1000 pounds per square inch (unit) from each plot of all the treatments and average was taken.

Yield parameters

Weight of five bolls (seed cotton +hulls) was taken from each replicate of all the treatments and then the average was taken in grams. Weight of lint was calculated from a sample of 100 g seed cotton after the ginning process from each replicate and then averaged in grams. It was calculated by weighing 100 linted seed of cotton

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obtained after ginning of produce from each plot to be called a seed index. The yield of seed cotton in kg/ha was calculated by taking picking from each plot and converting it on a hectare basis.

Ginning out turn (%)

For ginning outturn (G.O.T.) sub dried samples were ginned separately with ginning machines. Ginned lint obtained from each sample of standard weight (100 g.) was weighed and (G.O.T.) percentage was calculated by the following formula.

$$G.O.T = \frac{Weight\ of\ lint}{Weight\ of\ seed\ cotton} \times 100$$

Statistical analysis

The data were subjected to statistical analysis separately by using of analysis of variance technique. The difference among treatment means was compared by using the least significant difference test at 5 % probability level (steel *et al*., 1997).

RESULTS AND DISCUSSION

The field experiment was performed at Adaptive Research Farm Karor, District Layyah, Punjab, Pakistan in the year 2015-16 to evaluate the growth stimulants on growth and yield of cotton under Agro-climatic conditions of Layyah. Cotton variety Bt.MNH-886 was sown with seed rate 25 kg $ha^{-1.}$ The experiment design is a Randomized Complete Block Design (RCBD) with 3 replications. The fertilizer NPK was applied as per recommendation and standard agronomic practices were given at a proper time.

Growth parameter of cotton

Effect of different growth stimulants on germination (m^{-2})

Data presented in table 1 showed a significant difference among all the treatments regarding cotton seed germination at Adaptive Research Farm, Koror. The maximum cotton seed germination was 37.00 in treatment soaking the seed in potassium chloride 2% solution. Similarly, seed germination was (26.667) in the control treatment. A significant difference was found in treatments hydro priming and soaking the seed in calcium chloride solution.

Data presented in table 2 showed a significant difference among all the treatments regarding the number of plants m^{-2} seed. The maximum number of plants m^{-2} cotton was (32.667) in treatment soaking seed in potassium chloride 2% solution. Whereas a minimum number of plants m^{-2}were (20.66) in the control treatment. A significant difference was found regarding the number of plants m^{-2} in treatments hydro priming and soaking the seed in calcium

Data presented in table 3 showed a significant difference among all the treatments except control regarding plant height (cm). Maximum plant height (165.67 cm) was in treatment soaking seed in potassium chloride solution, whereas minimum plant height (148.67 cm) was in the control treatment. (Table 3.1). Significant differences were found regarding plant height in treatments.

Data presented in table 4 showed non-significant difference among all the treatments regarding the number of monopodial branches/plant. Maximum monopodial branches were observed in treatment soaking the seed in potassium chloride solution, followed by hydro priming which is statically at par with treatment soaking the seed in calcium chloride solution minimum monopodial branches were in the control treatment (table 4).

Data regarding a number of sympodial branches $plant^{-1}$ presented in table 5 showed a significant difference among treatments applied. A maximum number of sympodial branches/plant were recorded in treatment soaking the seed in potassium chloride solution (23.33) which is at far with treatment soaking seed in calcium chloride solution, whereas a minimum number of sympodial branches $plant^{-1}$were in the control treatment (18.33) followed by hydro priming (21.00).

Our results that maximum cotton seed germination (m^{-2}), number of plants m^{-2} and plant height with soaking the seed in potassium chloride solution are in agreement with Basra *et al.* (2005), Farooq *et al*. (2007) Farooq *et al*. (2009) and Rehman *et al*. (2011). These results are in partial agreement with Harris *et al*. (2011) and Umair *et al*, (2012), because they reported that KCL is the best and promote germination.

Yield Parameter of Cotton Crop

Data regarding the number of squares $plant^{-1}$ presented in table 6 showed non-significant differences among all the treatments. Therefore, it is concluded that seed priming of cotton seed with water and salts no effect on the number of squares,

Data regarding the number of flowers presented in table 7 showed non-significant differences among all the treatments. Therefore, it is concluded that seed priming of cotton seed with water and salts no effect on the number of flowers (table 7).

Data regarding the number of unopened bolls plant^{-1}presented in table 8 showed no significant differences among all the treatments. So, therefore, it is concluded that seed priming of cotton seed with water and salts no effect on the number of unopened bolls plant^{-1}.

Data regarding the number of opened bolls plant^{-1}presented in table 9 showed non-significant differences among all the treatments. So it is concluded that seed priming of cotton seed with water and salts no effect on the number of opened bolls plant^{-1}.

Data regarding the number of boll weight (gm) presented in table 10 showed non-significant differences among all the treatments. So it is concluded that seed priming of cotton seed with water and salts no effect on boll weight (gm).

Data presented in table 11 showed significant and non-significant differences among the treatments regarding average yield kg/ha. Maximum seed cotton yield was (2700.00kg ha^{-1}) in treatments soaking the seed in potassium chloride solution whereas minimum seed cotton yield was (3238kg ha^{-1}) control.

Data presented in table 12 showed significant and non-significant differences among the treatments regarding seed cotton yield kg ha^{-1}. Maximum seed cotton yield was (901.07kg ha^{-1}) in treatments soaking the seed in potassium chloride solution whereas minimum seed cotton yield was (773.70kg ha^{-1}) control.

Data presented in table 13 showed significant differences among the treatments regarding lint yield kg/ha. Maximum seed cotton yield was (1797.7kg ha^{-1}) in treatments soaking the seed in potassium chloride solution whereas minimum seed cotton yield was (1545.6kg ha^{-1}) in the control treatment.

Data presented in table 14 showed significant differences among all the treatments regarding seed index (gm). Maximum seed index was (9.0167gm) in treatments soaking the seed in potassium chloride solution whereas the minimum seed index was (7.6133gm) in the control treatment. These results are in line with Azeem *et al*. (2015), Farook *et al*. (2007), Ruan *et al*. (2002) and Afzal *et al*. (2008), but crops are different in research studies. Moreover, Haris *et al*. (2001), Umair *et al*. (2012) and Selvarani and Umarani (2011) obtain contrasting results that showed hydro priming is batter and gave a positive influential effect on test crop.

Fiber Parameters of Cotton

Data presented in table 15 showed non-significant differences among all the treatments regarding uniformity index (%). Therefore, it is concluded that seed priming of cotton seed with water and salts have no effect on uniformity index (%).

Data presented in table 16 showed non-significant differences among all the treatments regarding UHML Fiber length. Therefore, it is concluded that seed priming of cotton seed with water and salts have no significant effect on UHML Fiber length.

Data presented in table 17 showed non-significant differences among all the treatments regarding micro narie value. Therefore, it is concluded that seed priming of cotton seed with water and salts have no effect on micro narie value.

Data presented in table 18 showed significant differences among all the treatments regarding ginning outturn (%). Therefore, it is concluded that the maximum seed index was (46.033%) in treatments soaking seed in potassium chloride solution whereas minimum seed index was (42.863%) in the control treatment.

Seed priming of cotton with water and salts have no effect on uniformity index (%), UHML fiber length and micro narie value but maximum GOT was (46%) in soaking the seed in potassium chloride solution whereas minimum GOT was (43.23%) in the control treatment.

In addition, all priming techniques gave excellent results but cropping behaviour response is different for different crops. However, some parameter selected under this study is new because these parameters are new and not included by previous investigators.

DISCUSSION

Cotton is grown in about 80 countries but only five countries viz., China, India, USA, Pakistan and Brazil accounted for about 81% of the global area and provided 75% of the world's cotton in 2009-10. In the world, Pakistan is the fifth largest producer, 4th largest consumer of cotton and the 2nd largest exporter of cotton yarn (1.3 million out of 5 million) (Akhtar *et al*., 2005). The seed meal is a protein-rich by-product useful to feed ruminant livestock, but toxic to non-ruminant animals and humans because of the existence of pigment glands of gossypol, a terpenoid aldehyde. The development of insects/pests resistant crop varieties has been one of the most successful applications of agricultural biotechnology research to-date. The induction and promotion of Bt. (*Bacillus thuringiensis)* cotton in Pakistan is one of the most important steps in this direction. Bt cotton was first introduced in 1996 in the

United States and Australia (Traxle, 2006). Bt cotton has been genetically engineered with the insecticidal gene from the soil bacterium *B. Thuringiensis*. It is assumed that the trans-gene produces a protein that paralyzes the larvae of pest insects, including cotton bollworm and borers and is highly specific to the target organisms. The Bt cotton varieties achieve higher yields than the non-Bt cotton varieties and better boll retention on the first fruiting branch is an agronomic advantage.

Similarly Bt Cotton provides an alternative by replacing insecticides with a toxin within the plant. According to (Layton *et al*., 1997) overall performance of Bt. Cotton was better than conventional varieties. Transgenic Bt. cotton can effectively control specific lepidopterous species. For Bt cotton, in a developed country such as the USA, an increase in yield is 10–15% (China, India, USA) . Today, biotech cotton occupies almost 60% of the world's cotton area. In India, around 85% of the cotton area is under Bt hybrids. The agronomic performance of Bt cultivars may vary substantially from their non-Bt counterparts. referred to extensive studies comparing transgenic cotton varieties with their recurrent parents showed that fiber uniformity, length, strength, and elongation showed no significant differences due to transgenic technology. reported that GM crops increase the yield significantly in developing countries, especially in the tropics and subtropics. An increase or decrease in yield depends on the yield loss of the non-transgenic counterparts under the same cropping practice. For Bt cotton, in a developed country such as the USA, an increase in yield is 10–15%.

Table 1. Effect of growth stimulants on cotton seed germination m^{-2-}.

Treatments		Germination
T1	Control	26.667 c
T2	Hydro priming	30.333 ab
T3	Soaking seed in $CaCl_2$ 2% solution.	28.333 b
T4	Soaking seed in KCL 2% solution.	37.00 a

Table 2. Effect of growth stimulants on number of plants m^{-2}.

Treatments		Number of plants m^{-2}
T1	Control	20.667 a
T2	Hydro priming	25.333 ab
T3	Soaking seed in $CaCl_2$ 2% solution.	26.333 b
T4	Soaking seed in KCL 2% solution.	32.667 a

Table 3. Effect of growth stimulants on plant height (cm).

Treatments		Plant height (cm).
T1	Control	148.67 c
T2	Hydro priming	155.67 bc
T3	Soaking seed in $CaCl_2$ 2% solution.	158.33 ab
T4	Soaking seed in KCL 2% solution.	165.67 a

Table 4. Effect of growth stimulants on number of monopodial branches $plant^{-1}$.

Treatments		Number of monopodial branches $plant^{-1}$.
T1	Control	2.00 a
T2	Hydro priming	2.33 a
T3	Soaking seed in $CaCl_2$ 2% solution.	2.66 a
T4	Soaking seed in KCL 2% solution.	2.33 a

Table 5. Effect of growth stimulants on number of sympodial branches $plant^{-1-}$.

Treatments	Number of sympodial branches per plant
T1 (Control)	18.333 d
T2 (Hydro priming)	21.00 c
T3 (Soaking seed in $CaCl_2$ 2% solution)	23.20 b
T4 (Soaking seed in KCL 2% solution)	23.33 a

Table 6. Effect of growth stimulants on number of squares plant^{-1}.

Treatments		Number of squares plant^{-1}
T1	Control	13.03 a
T2	Hydro priming	13.30 a
T3	Soaking seed in $CaCl_2$ 2% solution.	13.63 a
T4	Soaking seed in KCL 2% solution.	14.48 a

Table 7. Effect of growth stimulants on number of flowers.

Treatments		Number of Flowers
T1	Control	2.17 a
T2	Hydro priming	2.93 a
T3	Soaking seed in $CaCl_2$ 2% solution.	2.31 a
T4	Soaking seed in KCL 2% solution.	2.38 a

Table 8. Effect of growth stimulants on number of unopened bolls plant^{-1}.

Treatments		Number of unopened bolls plant^{-1}
T1	Control	3.2333 a
T2	Hydro priming	3.0667 a
T3	Soaking seed in $CaCl_2$ 2% solution.	3.2000 a
T4	Soaking seed in KCL 2% solution.	3.6667 a

Table 9. Effect of growth stimulants on number of opened bolls plant^{-1}.

Treatments		Number of opened bolls plant^{-1}
T1	Control	20.767 a
T2	Hydro priming	21.433 a
T3	Soaking seed in $CaCl_2$ 2% solution.	20.900 a
T4	Soaking seed in KCL 2% solution.	23.633 a

Table 10. Effect of growth stimulants on boll weight (g).

Treatments		Boll weight (gm).
T1	Control	2.9133 a
T2	Hydro priming	2.9367 a
T3	Soaking seed in $CaCl_2$ 2% solution.	3.0467 a
T4	Soaking seed in KCL 2% solution.	3.2200 a

Table 11. Effect of growth stimulants on average yield kg ha^{-1}.

Treatments		Average yield kg ha^{-1}
T1	Control	2338.00 d
T2	Hydro priming	2500.00 c
T3	Soaking seed in $CaCl_2$ 2% solution.	2620.00 b
T4	Soaking seed in KCL 2% solution.	2700.33 a

Table 12. Effect of growth stimulants on seed cotton yield kg ha^{-1}.

Treatments		Seed cotton yield kg ha^{-1}.
T1	Control	773.70 d
T2	Hydro priming	822.74 c
T3	Soaking seed in $CaCl_2$ 2% solution.	878.70 b
T4	Soaking seed in KCL 2% solution.	901.07 a

Table 13. Effect of growth stimulants on lint yield kg ha^{-1}.

Treatments		Lint yield kg ha^{-1}
T1	Control	1545.6 d
T2	Hydro priming	1637.4 c
T3	Soaking seed in $CaCl_2$ 2% solution.	1702.8 b
T4	Soaking seed in KCL 2% solution.	1797.7 a

Table 14. Effect of growth stimulants on seed index (g).

Treatments		Seed index (gm).
T1	Control	7.6133 c
T2	Hydro priming	7.8300 bc
T3	Soaking seed in $CaCl_2$ 2% solution.	7.9933 b
T4	Soaking seed in KCL 2% solution.	9.0167 a

Table 15. Effect of growth stimulants on uniformity index (%).

Treatments		Uniformity index (%).
T1	Control	77.300 b
T2	Hydro priming	77.367 b
T3	Soaking seed in $CaCl_2$ 2% solution.	79.300 a
T4	Soaking seed in KCL 2% solution.	80.233 a

Table 16. Effect of growth stimulants on UHML Fiber lengths.

Treatments		(UHML) Fiber Lengths.
T1	Control	24.573 a
T2	Hydro priming	25.033 a
T3	Soaking seed in $CaCl_2$ 2% solution.	25.060 a
T4	Soaking seed in KCL 2% solution.	24.853 a

Table 17. Effect of growth stimulants on micro narie value.

Treatments		Micro Narie Value
T1	Control	4.5600 a
T2	Hydro priming	4.6233 a
T3	Soaking seed in $CaCl_2$ 2% solution.	4.8000 a
T4	Soaking seed in KCL 2% solution.	4.8000 a

Table 18. Effect of growth stimulants on ginning out turn (%).

Treatments		Ginning out turn (%)
T1	Control	42.863 d
T2	Hydro priming	43.990 c
T3	Soaking seed in $CaCl_2$ 2% solution.	44.937 b
T4	Soaking seed in KCL 2% solution.	46.033 a

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