



# Effect of Kinetin Concentration on Physiological Growth Parameters of *Triticum Aestivum*



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## ABSTRACT

India has different biotic and abiotic stresses which initiate the decrease in the wheat production every year and due to this reason it is not accessible to majority of the population. *Triticum aestivum* (wheat) is known for its nutrient value and is grown on large scale in our country. It is declared as the healthiest diet compared to any other source. To improve the crop production of the wheat, Kinetin has been used by many researchers. Kinetin is a plant growth hormone isolated earlier by the scientists to promote the cell division and to encourage comparable growth. So, a low cost experiment was done in the plant tissue culture lab to cultivate the seeds *in-vitro*. These seeds were then treated with the various concentration of kinetin (0mg/l, 50mg/l, 100mg/l, and 150mg/l) and kept in the plant growth chamber to evaluate the expansion of seeds. These seeds were kept under observation for 7 days and then sub-cultured with MS-media representing that kinetin improves crop salt tolerance; improvise heavy metal stress, and a plant phytohormone that further activates antioxidant defense system. Present study supports *in-vitro* growth of *Triticum aestivum* with additional improved physical conditions. Cost effective and top quality seeds can be obtained in minimum time through this technique.

## 1. INTRODUCTION

Wheat is the largest produced crop than any other crop due to its high nutrient value. In recent years, wheat production was about a million tons, which made it the second most widely produced crop subsequent to maize. Wheat consumption is increasing day by day due to its unique properties and its nutrient content, which facilitates the assembly of processed foods. Its utilization is increasing due to wide-reaching industrial activities and therefore the demand of the diet, which declared it as the healthiest food. Wheat is a crucial resource of carbohydrates and proteins.

It is considered as the leading source of nutrients to the human food, having a comparatively high nutritional value than any other cultivated crop. It is also considered low in providing other few nutrients and few minerals. When eaten as a meal, wheat may be a vital source of nutrient and minerals which significantly increase the protein content to human body. Gluten which is considered as the significant part of wheat protein – can activate some cardiovascular diseases and some other harmful diseases to a small part of our population.

Kinetin may be a sort of cytokinin, a category of phytohormone or plant growth regulator (PGR) that promotes cellular division and cell growth. For an extended time, it has been believed that in DNA deoxyadenosine residues produces an enzyme known as kinetin which gets accumulated when heated during the isolation method or when left for a long period of time. Since, time ago it was proved that Kinetin occurs naturally i.e. present in the DNA of every organism or also in the cells of plants, which failed the assumption that Kinetin doesn't occur naturally.

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Kinetin also improves seed viability and seedling vigor. Many different types of the models which doesn't have any shape or size such as microbial growth or other types are also applied to the experiment. There were many different types of kinetic models which are based on the Monod equation (which is a mathematics model for the expansion of micro-organisms) and therefore after some time followed other different equations such as the logistic equation and the Luedeking–Piret equation (A classic study by Luedeking and Piret (1959) considered the connection of cell growth to product formation) for product formation (Akerberg *et al.*, 1998).

Abiotic and Biotic environmental stresses adversely affects crop yield. (Yuan *et al.*, 2016). Kinetin is produced in the DNA via the method of assembly of Furfural or its quenching. Kinetin is employed in plant part culture for inducing pattern of callus formation and to redevelop short tissues from callus. It is widely used to improve various important physiological processes which are affected due to the abiotic stresses in several crops. Stresses like salinity and oxygen deficiency have various properties which effect the crop growth so, to improve these properties kinetin and its applications are widely used. Sodium, calcium and chlorine accumulation which are likely to occur under salinity and waterlogging stresses are reduced with the help of Kinetin to improve the potassium ion uptake. Shoot growth and grain yield are enhanced with the increase in the potassium/Nitrogen ratio which reduce toxicity to a high extent. (Mostafaet *al.*, 2011) During an oxidative damage (imbalance between free radicals and antioxidants within the body) plants can protect themselves with the presence of antioxidants systems in them. POD (Peroxidase) is the basic enzyme participating in biosynthesis process to form the lignin radicals before the polymerization takes place (Leaver and George, 1998). Plant has an initial event throughout the lifetime i.e. seed germination which basically initiated with the help of various reactions (which boost the speed of chemical reactions). Germination basically depends on the above processes and if any of the process is lagging then the germination is also affected. When the storage compounds breakdown, seed germination is considered to be amongst the most critical events. (Alscher and Erturk, 2002).

The main purpose of this study is to determine the various types of different biochemical changes during the germination of seeds when it is subjected to Kinetin treatment. Higher concentrations can severely distress the expansion of plant and biomass yield (Hussain *et al.* 2015). This study clearly depicts various collisions that take place during the germination period, when kinetin is taken by the seedlings. Also, it analyzes the various morphological and biochemical effects that take place during the sowing period of wheat i.e. 6 days (Lalarukh *et al.*, 2004). Basically the kinetin regulates

the growth of wheat and to check whether this plant hormone (kinetin) is used as a regulator to enhance the wheat growth or not. Datta *et al.*, (2009) studied the effect of salt stress under five different varieties of wheat, which considerably influenced the expansion results by reducing the shoot length.

## 2. MATERIALS AND METHODS

### 2.1. Growth Chamber Conditions

The experiments were carried out in the plant tissue culture lab and an optimum temperature was maintained at 20-24°C in plant growth chamber.

### 2.2. Collection of Explants

Seeds of strain B-22 of *Triticum aestivum* were used for germination and were collected from the fields. Seeds were collected from the wheat plants on the basis of their maturity and growth potential.

### 2.3. Surface Sterilization of Explants

The seeds are surface sterilized using 0.5% mercuric chloride.

### 2.4. Initiation

Murasige and Skoog (MS) media was prepared with the help of vitamins, sucrose, agar,  $\text{CaCl}_2$  and different concentrations of kinetin (50mg/l, 100mg/l, 150mg/l ) to carry out the intimation accordingly and pH was maintained at 5.7 prior to autoclaving.

### 2.5. Seed Germination

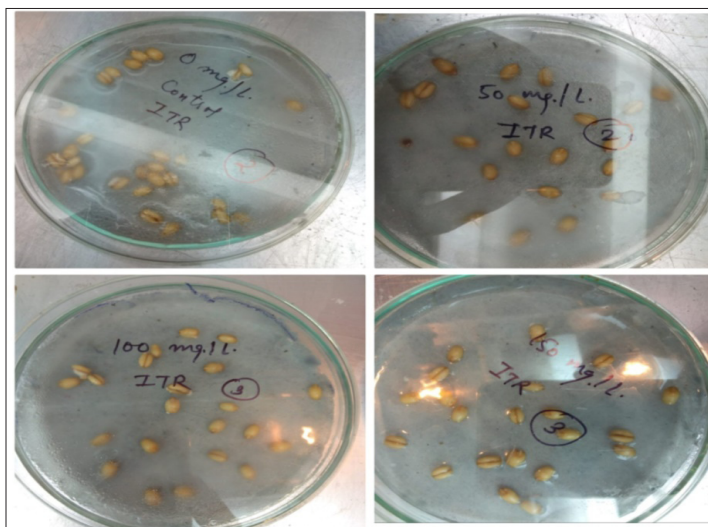
The germination of seeds was counted after every 24 hours and 48 hrs. of sowing. Random sampling was done on the 7<sup>th</sup> day for various morphological and physiological measurements. Estimation of root/shoot length and fresh/dry biomass weight was done. Root and shoot length were measured and then its fresh biomass was recorded. Dry biomass was estimated at 68°C after drying the seedlings for 72 hours.

## 3. RESULTS AND DISCUSSION

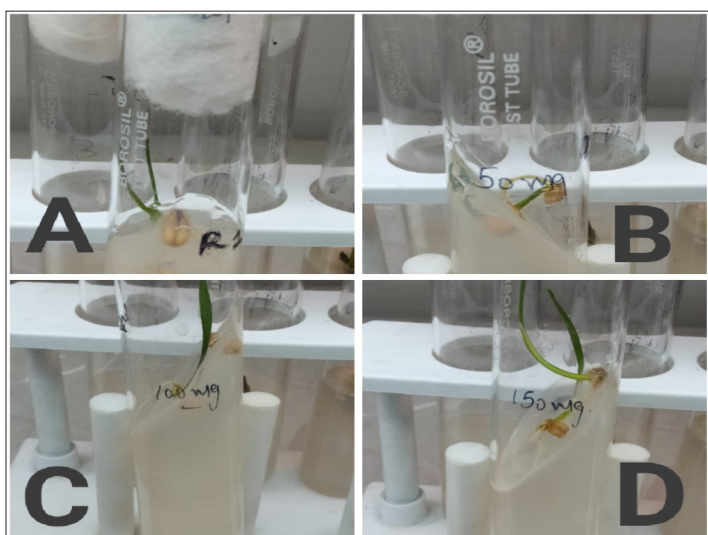
The Germination was examined after every 24 hours till the 7<sup>th</sup> day as shown in (Figure 1).

Plant growth regulators has been applied to improve the seed growth and to reduce the effects of stresses such as salinity on the plant growth as well as on the germination (Debez, Chaibi and Bouzid, 2001). Although the kinetin failed to show the various harmful effects on germination and the seed growth, it was much effective in determining the shoot length and dry weight of the seedlings followed by its germination and the seedlings growth. Therefore, the applications of kinetin help to determine the consequences of media on the wheat growth. Due to reduced capacity to include amino acids into proteins there has been a significant decline in the level of proteins

in the active leaves and the activity of RNase. It is due to the mixture of abscisic acid which leads to inhibiting the process of protein synthesis as reported by (Singh et al., 1985).



**Figure 1.** Depicts the examination of seeds on the 7th day.



**Figure 2.** Seed development on MS medium at different kinetin concentrations.

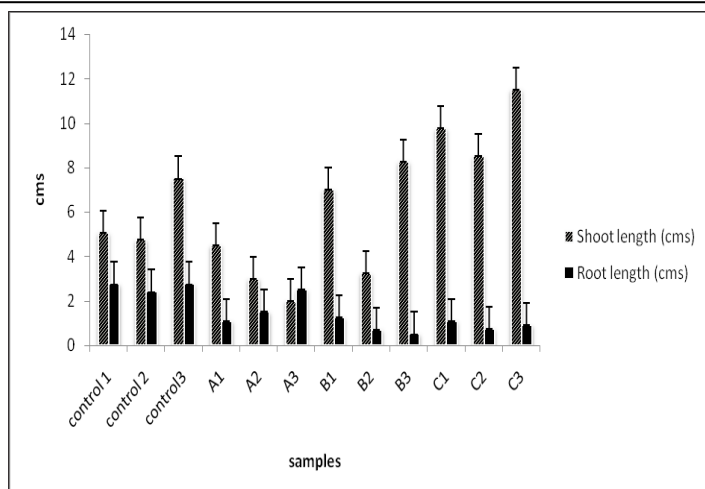
(A) Seed development on MS medium with no kinetin concentration.

(B) Seed development on MS medium with 50 mg/l kinetin.

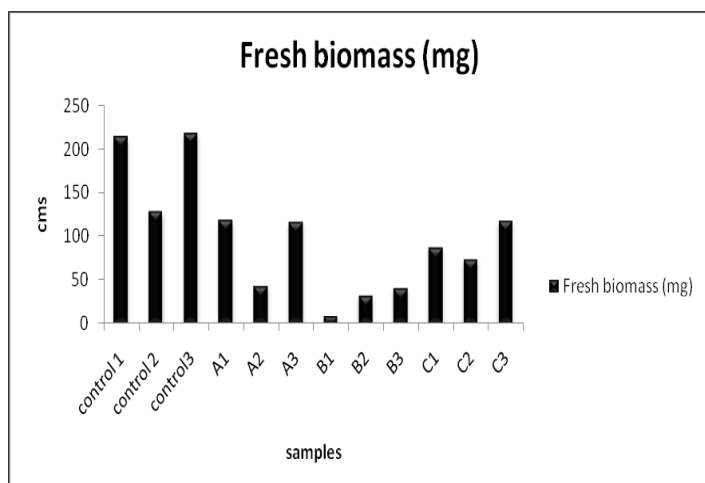
(C) Seed development on MS medium with 100 mg/l kinetin.

(D) Seed development on MS medium with 150 mg/l kinetin.

These seeds were then taken out carefully and their root and shoot part was separated to determine their root/shoot length. During the drought stress conditions, kinetin was reported to uptake source strength that leads to the decline in the drought induced yield losses (Peleg et al., 2011). Rajpal et al., 2018 developed a steady and well-organized regeneration system during which inter nodal branch cuttings when treated with kinetin are ready to develop shoots under greenhouse conditions.



**Figure 3.** Depicts the growth of the seeds when treated with kinetin and determines its Root/shoot length



**Figure 4.** Depicts the Fresh Biomass weight of the seeds.

Present study concludes that, increase in the kinetin concentration from 0 to 150 mg/l has significantly increased the shoot length throughout the experiment. However, concentration (50 mg/l) shows the maximum decrease in the shoot length along with the increase in the Root length. Also, in the higher concentrations i.e. (100 mg/l and 150 mg/l) root length decreases only. Root length is almost constant when the kinetin concentration was zero. On the other hand when it comes to the biomass weight, it is observed that the kinetin concentration had an adverse effect on the fresh biomass weight. The seeds that have no kinetin concentration have good biomass weight. Also, at 100 mg/l kinetin concentration biomass weight is very less. From the current experimentation it was found that root length is a highly sensitive parameter for all the concentration of kinetin. Also, the kinetin shows a more significant effect on root length compared to the shoot length. Variations in the Root and shoot length of the seeds may occur due to the unbalanced uptake of nutrients by the seedlings or due to the harmful or toxic effects of the Kinetin.

#### 4. ACKNOWLEDGEMENT

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#### Conflict of Interest

The authors declared no conflict of interest

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