



**EFFECT OF PLANT GROWTH REGUALTORS
ON THE GROWTH OF *VIGNA RADIATA L.***

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ABSTRACT

By the application of various concentrations of selected growth regulators viz. NAA, IAA and Kinetin in *Vigna radiata L.*, the experimentation was undertaken with an intention to find out how the seed germination and seedling rise can be influenced. The seed material was collected from the Durgapura Agricultural Research Institute, Jaipur, Rajasthan (India). The seeds were soaked in different concentrations (10, 50, and 100 ppm) of NAA, IAA and Kinetin for 24 hours. Five replicates of each treatment with 10 seeds per replicate were set for accurate analysis. Noteworthy variations were found between all treatments in all germination aspects.

KEYWORDS: Plant growth regulators, *Vigna radiata L.*, Plumule, radicle and seed germination.



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INTRODUCTION

Vigna species accounts for 31% of pulse cultivation in India and are the principal sources of dietary protein. Plant hormones are produced within the plant and are indicator molecule occur in tremendously stumpy concentrations. Besides being prosperous sources of protein, they preserve soil fruitfulness through mechanism of biological nitrogen fixation. Hormones standardize and regulate all major type of cellular processes in targeted cells locally and, when signaled to other locations in plant. Hormones are vital to plant growth and development and in their absence plants would be a cluster of undifferentiated cells. The growth and development of flowers, stems, leaves, the shedding of leaves, and the maturity and ripening of fruit also find out and standardize by hormones.

The foliar relevance of plant growth regulators like IAA, NAA and Kinetin helped the plant to refurbish retardation in water content in Mung bean plants subjected to water stress⁴. GA3 used to overcome the unpleasant possessions in Mung bean plants². The evidence for hormone involvement comes from correlation of hormone application with specific maturity stages, effects of applied hormones and the relationship of hormones to metabolic activities. The general improvement of plant is brought by the effect of hormones, various ecological factors and nutrient uptake. They may vary in their essential germination requirements. This study with growth hormones will help in determining that which concentration of hormonal application is most suitable for seed germination and seedling growth. This study is significant as since the favorable effect of presoaking treatment of seeds with various growth regulator and other substances have been reported in the literature repeatedly.

MATERIALS AND METHODS

As influenced by various concentrations of plant growth regulators in different varieties of *Vigna radiata* L., the current research was carry out

with an objective to determine the rate of seedling growth and seed germination. For this study, On the basis of literature cited, three different growth hormones viz. IAA, NAA and Kinetin were selected and four different varieties like RMG-62, RMG-344, RMG-268 and SML-668 were selected. The seeds were obtained from Durgapura Agricultural Research Institute, Durgapura, Jaipur (Rajasthan). The seeds were treated under different concentrations of 10, 50 and 100 ppm of IAA, Kinetin and NAA with a separate control set, namely T1, T2 and T3 respectively. These were soaked for 24 hours in the above concentrations and only double distilled water for the control set was used. Five replicates of each treatment with 10 seeds to each replicate were placed in specially designed petri-dish sets. Diverse aspects like germination count (recorded for 9 days), measurement of radicle and plumule length were carefully measured (recorded for 15 days). Seed germination was properly recorded and maintained by omitting every two days and radicle and plumule length was measured every alternate day till the final day of experimentation. The calculated mean of various growth parameters like germination percent, plumule and radical length was used for evaluating effects of various treatments quantitatively by comparing observation values of various treatments with the control.

RESULTS

Highest germination percentage was experiential in control treatment of all four crops. The seeds treated with IAA showed considerable similarity to control. The highest germination percentage was found in the treatment of IAA in T1 of RMG-62, followed by T2 and then T3. In RMG-268 it followed the same pattern like RMG-62 and RMG-344 also followed the same mode whereas in SML-668 it was higher for T1 treatment then followed by T3 and then T2. Germination percentage under the treatment of NAA was recorded in all four crops. Highest germination

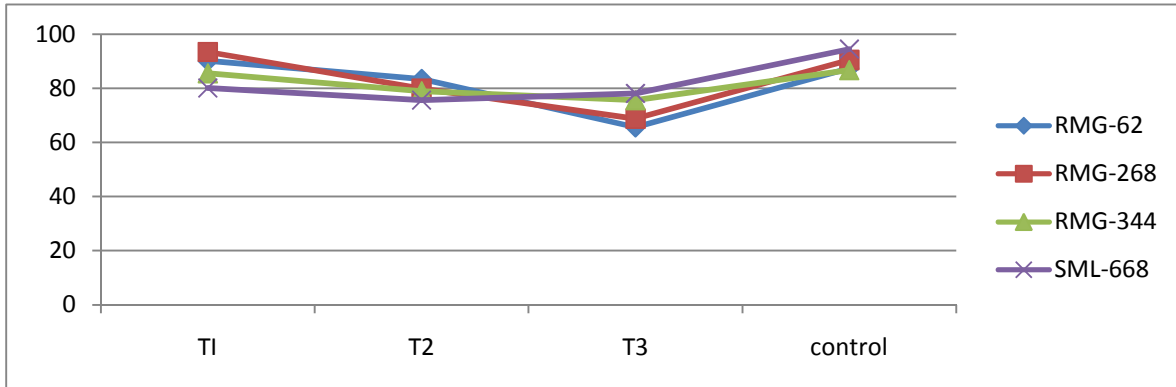
percent were shown by T1 treatment of RMG-62 then followed by T2 and then T3 and in RMG-268 it showed the same pattern. SML-668 also gave the same results but in RMG-344 the highest value was for treatment T1 which was followed by T3 and then T2. In these, 50 ppm was found most suitable for all four crops because it showed highest germination percent in comparison to 10 and 100ppm. Both 50 and 100 ppm concentration IAA did not show any major difference in respect of germination which meant the higher concentration was not as good as the lower concentration rather it decreased the germination percent. A significant difference was observed between 10 ppm and the other two treatments. The highest concentration of IAA (100 ppm) showed the least germination percentage (Graph-1). Hence from above it is observed that in all cases whether it is Kinetin, NAA or IAA, the germination percentage decreases when the concentration increased, which shows that higher concentration inhibit germination. Next pair observations revealed IAA and NAA, both the growth hormones respond uniformly to radicle elongation. The highest germination percent was found in IAA, control treatment of RMG-268 and SML-668. The radicle length for the given treatment of Kinetin was 10ppm for RMG-62 recorded was 6cm, for 50ppm - 5.88cm. For 100ppm - 4.97cm and for control was 6.45cm. For plumule length for various treatments of 10ppm, 50ppm, 100ppm and control it was found 6.32cm, 5.92cm, 4.22cm and 7.66cm respectively (Graph-2). For RMG-344, radicle and plumule length for 10ppm was 4.56cm and 5.00cm, for 50ppm it was 4.33cm and 4.99cm, for 100ppm it was 4.00cm and 4.80cm and for control it was 6.05cm and 6.00cm. For RMG-268 radical and plumule length for 10ppm is 5.90cm and 5.86cm, for 50ppm 5.68cm and 5.00cm, For 100ppm - 5.35cm and 4.80cm and for control it was found to be 7.00cm and 6.86cm. For SML-668 the

radicle and plumule length for 10ppm was 5.68cm and 6.09cm, for 50ppm - 5.01cm and 5.99cm, for 100ppm - 5.46cm and 5.60cm and for control -7.00cm and 6.89cm. Furthermore similar results were obtained from other treatments (Graph-3). The highest radical length was obtained from control treatments of RMG-268 and same observation was recorded in RMG-62. A uniform plumule elongation was observed in the treatments of kinetin to all the crop species indicating growth hormone kinetin had good response on plumule growth. But IAA and NAA treatments in both the crop species showed great variation among the treatments and moderate difference to kinetin treatments. When we compared the control treatment to the other treatments particularly to the maximum length, observation showed that there is a significant difference which meant there was great effect by the treatment of growth hormones.

Substantial deviation on germination and other features were found between all four crop varieties. All the treatment results were recorded and were found more effective in *Vigna* variety RMG-268. In the IAA treatments, plumule elongation was found in decreasing trend with the increase of hormonal concentration. In treatment IAA of RMG-62 the highest mean were shown by T2 treatment which was a 50ppm concentration which were similar to the results obtained by RMG-268. Where as in variety RMG-344 and SML-668, the highest mean was shown by T2 and T3 treatments respectively. In treatment NAA of RMG-62, RMG-344, SML-668 and RMG-268 the highest mean value was shown by T1 treatment in all crop variety. In treatment Kinetin of RMG-62 and RMG-268 the highest mean were shown by T1 treatment in both crop species and in RMG-344 and SML-668 the highest mean were also shown by T1 and T2 treatment respectively.

Graph 1

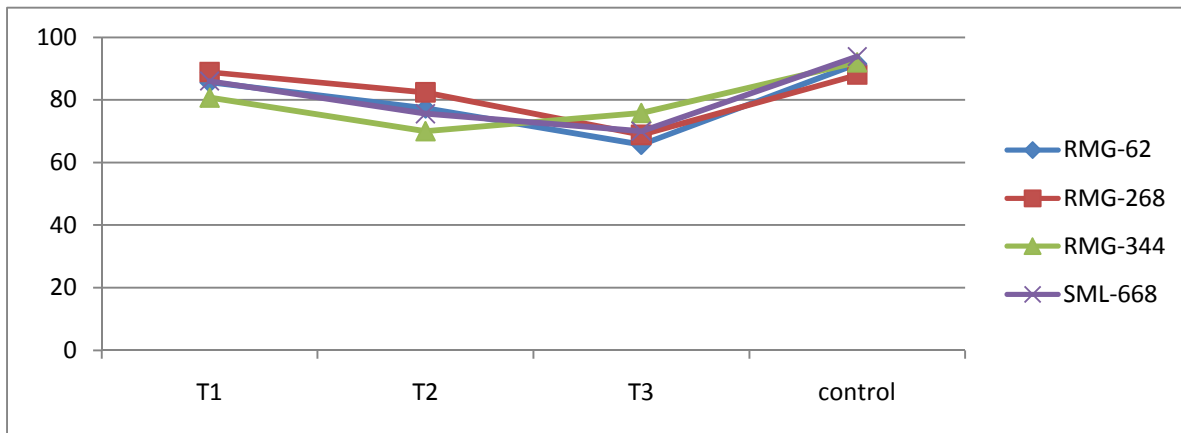
Application of IAA on all four varieties of *Vigna radiata* L. to study seed germination.



In the above graph treatments are T1-10ppm, T2-50ppm and T3-100 ppm

Graph 2

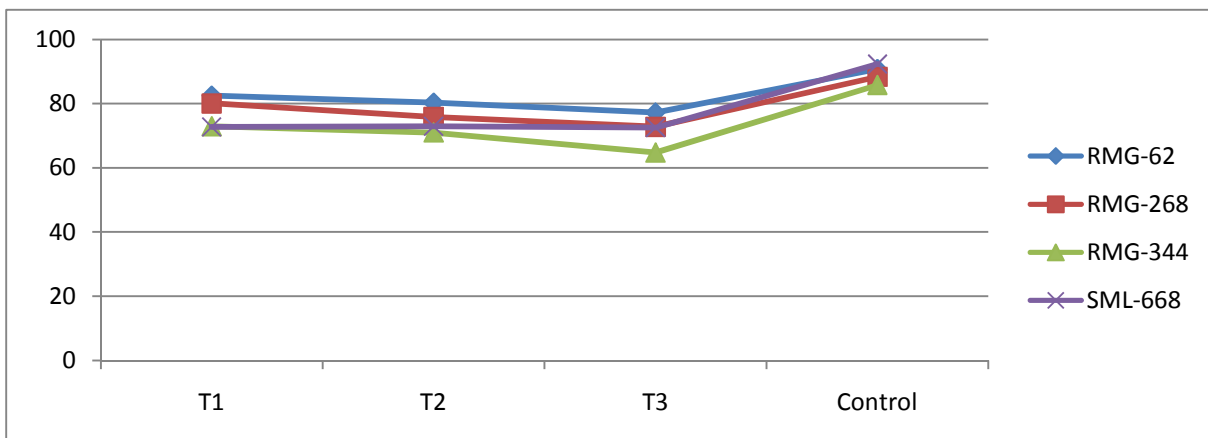
Application of NAA on all four varieties of *Vigna radiata* L. to study seed germination



In the above graph treatments are T1-10ppm, T2-50ppm, T3-100ppm

Graph 3

Application of Kinetin on all four varieties of *Vigna radiata* L. to study seed germination



In the above graph treatments are T1-10ppm, T2-50ppm and T3-100ppm

DISCUSSION AND CONCLUSION

In the present study, when the three respective hormones on *Vigna radiata L.* were evaluated, Kinetin was found to be most effective and responsive to the seed germination and plumule elongation³. The seed germination and additional physiological action could be improved by the appliance of another plant growth regulator, by the cause of forbearance to the venomous particles^{6, 8}. The result was considered in parallel to the findings of many other researchers⁴. The undesired effects on plant growth can be overcome by the use of hormones, may be due to the change in the endogenous growth regulators¹⁰. Due to variations found in seed germination and root, shoot elongation by different hormone treatments, it is evident that soaked seed could improve overall germination and seedling establishment^{1, 7}. The sopping period of 24 hours augmented the total uptake of water which helps to achieve the maximum imbibition rate. This in turn serves to the quick biochemical alterations and time period was found suitable for seed germination. This was also found that application of IAA and NAA results in multiple radicle formation and appliance of kinetin results in multiple plumule growth. So one can say that IAA and NAA has immense enhancing effect for root germination and kinetin is very effective for shoot germination.

From the above discussion it can be consummate that divergence in some results was found between the RMG-62, RMG-268, RMG-344 and SML-668. The higher application of IAA showed very least elongation of plumule as this higher concentration constantly restrained the plumule formation and elongation. IAA at 10 ppm application in all four varieties used in the present study showed highest germination percentage as well as the higher radicle and plumule length in contrast to other hormone treatments. But in case of radicle and plumule elongation, these hormones did not show any noteworthy effect in all four varieties. This indicates that the improved enzymatic actions which lead to the favorable environment for the

germination as well as the escalation of the radicle and plumule favored by the lower concentration of growth regulators. Similarly, significantly higher seed germination was verified in seeds treated with IBA 200 mg/l followed by NAA (200 mg/l) and GA₃ (100 and 200 mg/l) in *Rheum austral L.*⁵. The experiment with an objective to determine how the rate of seed germination and seedling growth can be influenced by various concentrations of growth regulators i.e. GA₃ and IAA in Black gram and Horse gram¹¹ showed the similar results. Significant variation was found between the Black gram and Horse gram in all aspects. T2 (GA₃ 10ppm) showed highest germination percentage as well as the higher radicle and plumule length in contrast to other treatments. But when considered particularly on the radicle and plumule elongation, these did not show any significant effect on both the crop species. A similar study was carried out on *Simaruba glauca L.* which showed improvement of vigor by IAA at 200ppm and was found four fold higher than the control. The root length and root biomass were increased significantly by GA₃ treatment¹³. The effects of seed soaking with plant growth regulators (IAA, GA₃, kinetin) on wheat (*Triticum aestivum* cv. Auqab-2000) emergence and seedling growth under normal (4 dS/cm) and saline (15 dS/cm) conditions were studied to determine their usefulness in increasing relative salt-tolerance⁹. The effects of growth regulators on ex-Vitro rooting of *Adhatoda* and *Barleria prionitis L.* were also studied¹².

So from above discussion we concluded that the effects of growth hormones on seed germination varied according to their concentration used on the seeds and showed significant difference to control. The concentration at 10 ppm was found most suitable for all four varieties because it showed highest germination percent in comparison to 50 and 100ppm. Both 50 and 100 ppm concentration did not show any major difference in respect of germination which meant the higher

concentration was not as good as the lower concentration rather it decreased the germination percent. A uniform plumule elongation was observed in the treatments of kinetin to all the varieties indicating good influence on plumule growth. IAA and NAA treatments had good effects on radicle

elongation. When we compared the control treatment to the other treatments particularly to the maximum length of plumule and radicle, observation showed that there is a significant difference which meant that they greatly influence various growth parameters of *Vigna radiata* L.

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