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EFFECT OF GIBBERELLIC ACID PRE-TREATMENTS ON GROWTH PARAMETERS OF WALNUT (*Juglans regia* L.)

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Abstract

Present investigation was carried out during the winter season at Horticulture Research block, Department of Horticulture, Shri Guru Ram Rai University, Dehradun, Uttarakhand. To investigate the effect of GA_3 treatment on growth attributes and days taken for germination initiation of walnut. The experiment was laid out in randomized block design with three replications and twelve treatments. The treatments comprised following levels of GA_3 concentrations viz. 500ppm, 1000ppm, 15000ppm and control in three different replications of Horticultural Research Block. Various observations regarding growth parameters such as leaf length, leaf width, shoot length, shoot width and numbers of days taken for germination initiation of walnut were recorded. The result revealed that treatment of GA_3 1500ppm of nursery polybag application found to be beneficial for vegetative characters viz, found to be the most effective treatment for increasing leaf length, shoot length and shoot diameter. In another point of view, 1500ppm GA_3 treatment in polyhouse was found to be profitable as compared to rest of treatments in terms of number of days taken for germination. Apart from this leaf width of 1000ppm in nursery polybag was found best.

Keywords: Germination, Shoot length, Leaf width, Nursery polybag, Polyhouse

Introduction

Walnut (*Juglans regia* L.) is an important temperate fruit nut crop which belongs to family of Juglandaceae and is considered native to Persia and North Western Himalayas. The major walnut producing countries are USA, China, France, Turkey and Italy. In India it is cultivated at an altitude of 1200-2200 metres above the mean sea level. The Western Himalayas region of India

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comprising of the states of Jammu & Kashmir, Himachal Pradesh and Uttarakhand are the country's major walnut-producing region.The Juglans genus has 21 species of which *Juglans regia* is the most important. Apart from this, the seedling trees attain giant size and bear a nut of variable sizes and shapes after 10-15 years where as vegetatively propagated plants are true-to-type and produce almost uniform sized nuts after 4-5 years. Seed Dormancy has always been a major problem in germination of seeds. Studies related to the mechanism of seed dormancy have a little different approach. Some seeds are dormant because of the impermeability of the testa to oxygen and water. Stokes (1964) reported that many seeds of temperate fruit crops show dormancy which is overcome by chilling treatment such as in case of apple, pear, peach, plum, apricot etc. However in case of walnut the seed dormancy has been correlated with physiological dormancy that is controlled by seed coat and embryo dormancy. Seed germination is a complex process that started with the absorption of water and after a short pause; the enzyme is activated (Matilla and Matilla-Vazquez, 2008). There are many ways to be followed to break the dormancy in walnut seeds to improve the seed germination i.e., by scarification, stratification and gibberellic acid treatment. Therefore the investigation was carried to test different pre-sowing treatments in an attempt to improve overall growth attributes of walnut seeds in three different replications i.e., in Polyhouse, Nursery polybag and Nursery bed conditions.

Materials and Methods

The present experiment was carried out during winter season of 2018-19 at the Horticulture Research Block of Department of Horticulture, Shri Guru Ram Rai University, Dehradun, Uttarakhand, India. The fully matured seeds of walnut cultivar (V) 'Chandler' were brought from Jammu and Kashmir. There were twelve different treatments including four gibberellic acid concentrations (500 ppm, 1000 ppm, 1500 ppm and control) with a combination of three replications of sowing location i.e. Polyhouse (P1), Nursery polybags (P2)and Nursery beds (P3). The selected seeds were participated with the different pre-sowing treatments of stratification for 30 days at 5 ◦C, scarification with combination of hot water (60◦C) for 6 hours and cold water for 6 hours and finally gibberellic acid treatment for 24 hours with the three different concentrations (500 ppm, 1000 ppm, 1500 ppm) and then these treated seeds were sown in a Randomized Block Design with three replications at a spacing of (30×15) cm^2 in Polyhouse bed, Nursery polybag and Nursery bed conditions. The experimental observations of different growth and germination attributes were starts recorded from first week of February, 2019 onwards at fixed interval. All the intercultural operations were followed timely in the different experimental conditions as per the requirement of the crop. From each three experimental conditions randomly selected five plants were used for recording observations for different growth and germination attributes.

Results and Discussion

The findings of the present investigation were recorded and are thoroughly discussed below:

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Leaf Length and Leaf Breadth (cm)

The highest calculation in leaf length (13cm) was reported in 1500ppm conc. of GA_3 with nursery polybag followed by (9.33cm) in 500ppm conc. of GA_3 with nursery polybag, (8cm) of control in nursery bed and (7.78cm) in 1500ppm conc. of GA_3 with polyhouse as presented in Table 2 and Figure 1. The least count of leaf length is reported only in 500ppm conc. of GA_3 with polyhouse beds having (3.64cm) followed up by (3.31cm) in control of polyhouse beds. The leaf breadth was found excellent (13cm) in 1000ppm conc. of GA_3 with nursery polybags followed by the 1500ppm conc. of GA_3 with nursery polybags having the breadth of (12cm) of the leaves. The least count of the leaf breadth was found in 500ppm conc. of GA_3 with polyhouse beds having a width of (3cm). As the further results of the experiments reveals that due the rapid process of cell elongation and cell division the leaf expansion take place which causes leaves broader and elongated length. Sinha et al. (1977); Sharma and Singh (1980) and Martin et al. (2012) also mentioned similar observations as a leaf size in effect of stratification and plant growth regulating substance on seed germination and seedling growth in apples.

Shoot Length (cm) and Shoot Width (mm)

Data revealed in Table 2 and Figure 2 indicates that the best shoot length was recorded in three different concentration of 1500ppm of GA_3 with nursery polybag having (1.24cm), 500ppm of GA_3 with nursery polybag having (1.16cm) and 1000ppm of GA_3 with nursery polybag having (1.01cm). Shoot length of (0.36cm) in 1500ppm conc. of GA_3 with nursery was founded least measured. Shoot width was best in 1500ppm of GA_3 with nursery polybag measured (1.09mm) followed by 1500ppm of GA_3 with polyhouse beds which have (0.94mm) shoot width while 1000ppm of GA_3 with nursery polybags recorded (0.91mm) shoot width. Thus, (0.31mm) shoot width was measured in 500ppm of GA_3 with polyhouse beds and control of nursery polybags was measured (0.32mm) least. The similar observations for both shoot length and breadth was also recorded by Mathur (1964) and Nabil (2007) in peach and apricot seedlings and the increase in seedling height with GA might be related to the fact that GA promote stem and shoot elongation through the increase of both cell division and from internodes elongation in higher plant (Hopkins and Huner, 2004; Kumar et al., 2014).

Number of days taken for initiation of Germination

The rapidity in number of days taken for germination was found under the 1500ppm conc. of GA_3 with polyhouse beds was the best having (14 days) after sowing followed by (15 days) in 1000 ppm conc. of GA_3 with polyhouse beds and (16 days) in 500ppm conc. of GA_3 with polyhouse beds. The highest number of days taken for germination was recorded in Control of Nursery having (57days) of germination after sowing followed up by 500ppm conc. of GA_3 with Nursery having (52 days) of germination after sowing. Research done by Negi et al., (2016) while working on the effect of GA_3 on germination percentage of walnuts in Uttarakhand condition also observed that there was an early germination within (12.67 days) and best germination (75.88%) with a combination of cracking with 750 ppm GA_3 and

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stratification for 30 days. As the GA_3 plays an important role by exerting its effects on a variety of different processes rapidly as in case of walnuts it helps the necessary enzymes to convert storage polymers into sucrose or amino acids rapidly by digestion processes of is α-amylase which is stimulated by Gibberellic acid synthesized in the scutellum (cotyledon) or other parts of the embryo. So, there will be an increase in the number of days taken for initiation of germination. Bal et al; Bhan and Sharma; and Heidari et al. were reported similar results in different temperate crops.

Conclusion

The conclusion obtained from the results recorded in the present studies showed that the among the following different pre-sowing treatments, the best results in terms of Leaf Length, Leaf Breadth Shoot Length Shoot Width and Number of days taken for initiation of Germination were obtained with scarification + stratification for 30 days + gibberellic acid @ 500 ppm, 1000ppm, 1500 ppm and control amongst three different location (Table:1).The maximum Number of days taken for initial Germination was recorded with control in nursery bed sown walnuts while, the maximum leaf length was recorded in scarification + stratification for 30 days + GA_3 @ 1500ppm concentration of nursery polybags was found to be very effective. Among the growth attributes, like leaf width was recorded highest with scarification + stratification for 30 days + GA_3 @ 1000ppm of nursery polybags. However, shoot width and shoot length results was recorded maximum with scarification + stratification for 30 days + GA_3 @ 1500ppm of Nursery polybags which was measured with overall growth of walnut seedlings.

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Table 1: **Details of treatments used in present experiment**

S.No.	Symbol	Treatments
1.	VP1T1	GA_3@500ppm +Scarification+ Stratification+ Polyhouse bed
2.	VP1T2	GA_3@1000ppm +Scarification+ Stratification+ Polyhouse bed
3.	VP1T3	GA_3@1500ppm +Scarification+ Stratification+ Polyhouse bed
4.	VP1T4	Control + Polyhouse
5.	VP2T5	GA_3@500ppm +Scarification+ Stratification+ Nursery Polybag
6.	VP2T6	GA_3@1000ppm +Scarification+ Stratification+ Nursery Polybag
7.	VP2T7	GA_3@1500ppm +Scarification+ Stratification+ Nursery Polybag
8.	VP2T8	Control + Nursery Polybag
9.	VP3T9	GA_3@500ppm +Scarification+ Stratification+ Nursery bed
10.	VP3T10	GA_3@1000ppm +Scarification+ Stratification+ Nursery bed

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11.	VP3T11	GA_3@1500ppm +Scarification+ Stratification+ Nursery bed
12.	VP3T12	Control + Nursery bed

Table2: Effect of GA_3 with pre-sowing treatment on growth and germination attributes of Walnut seed

Treatments	Leaf Length	Leaf Width	Shoot Length	Shoot Width	Number of days taken for germination
VP1T1	3.64	3	0.43	0.31	16
VP1T2	5.49	6	0.70	0.66	15
VP1T3	7.78	7	0.91	0.94	14
VP1T4	3.31	4	0.36	0.39	41
VP2T5	9.33	8	1.16	0.76	40
VP2T6	6.99	13	1.01	0.91	39
VP2T7	13.0	12	1.24	1.09	31
VP2T8	6.35	5	0.46	0.32	47
VP3T9	5.59	7	0.68	0.53	52
VP3T10	5.68	6	0.55	0.48	43
VP3T11	5.81	8	0.36	0.47	37
VP3T12	8	5	0.41	0.81	57
±SE m	1.867	2.021	0.210	0.180	4.255
$CD_{0.05}$	N/A	N/A	N/A	N/A	15.009

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Figure 1: Representation of effect of GA_3 on leaf length of walnut

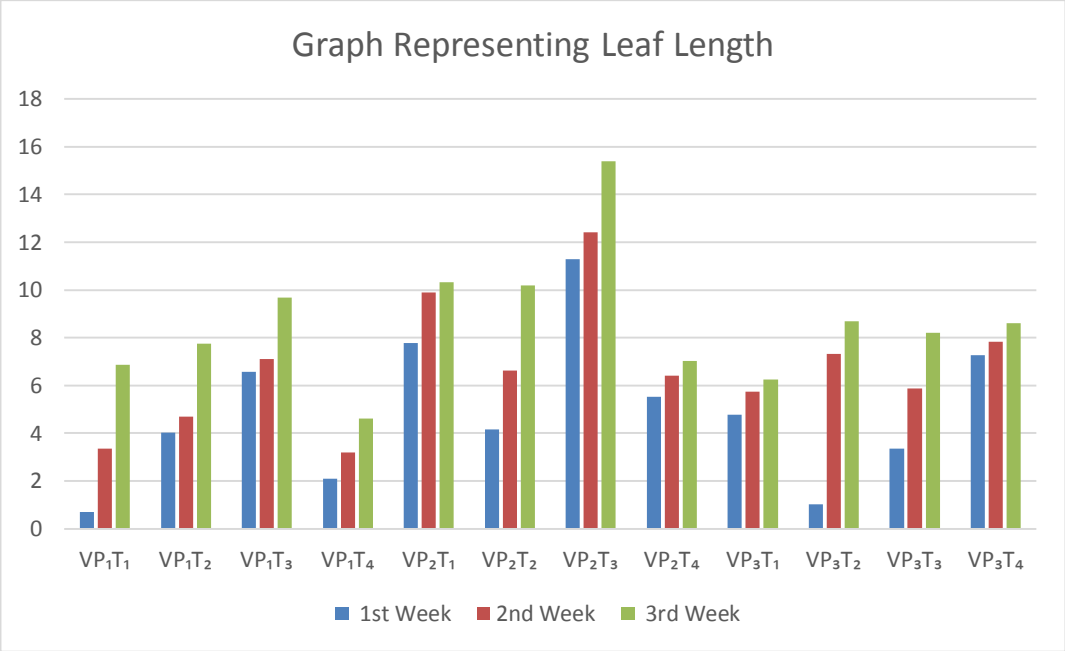

Figure 2: Representation of effect of GA_3 on shoot length of walnut

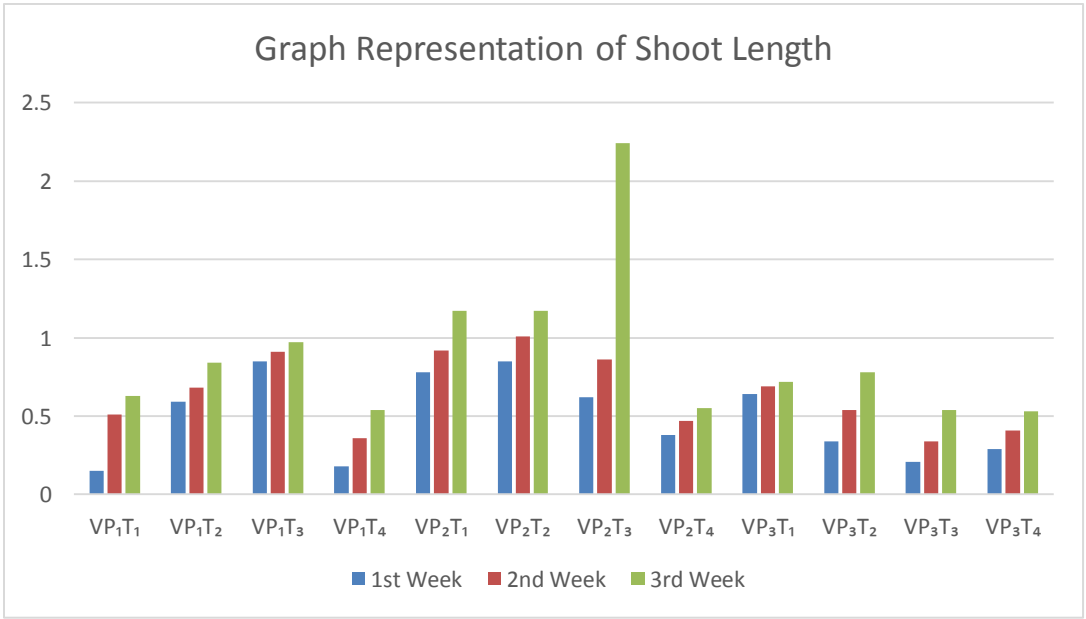

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Figure 3: Representation of effect of GA_3 on number of days taken for germination