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EFFECT OF DIFFERENT PRE-SOWING TREATMENTS ON SEED GERMINATION OF WALNUT (*JUGLANS REGIA* L.)

Priya Negi[1*], B. P. Nautiyal[2], Nidhika Thakur[3], Manju Negi[4] and Vinita Kumari Meena[5]
[1]Department of Fruit Science, VCSG, UUHF, Bharsar, Pauri Garhwal, U.K.
[2]Department of MAP, VCSG, UUHF, Bharsar, Pauri Garhwal, U.K.
[3]Department of Fruit Science, VCSG, UUHF, Bharsar, Pauri Garhwal, U.K.
[4]Department of Fruit Science, VCSG, UUHF, Bharsar, Pauri Garhwal, U.K.
[5]Department of Horticulture, R.C.A., MPUA&T, Udaipur, Rajasthan
[*]Corresponding author email: 2091priya@gmail.com

ABSTRACT
A systematic study was undertaken to determine the best pre-sowing treatments for seed germination and seedling growth of walnut. The germination and seedling growth of walnut improved with combine application of all pre sowing treatments. Cracking + gibberellic acid @ 500 ppm + stratification for 30 days showed highest germination percentage and early germination was obtained under the treatment combination of cracking, gibberellic acid @ 750 ppm with stratification for 30 days and maximum survival percentage was found under the treatment combination of hot water with gibberellic acid @ 500 ppm for 30 days stratification Thus, the results of present investigation reveal that the combination of different pre-sowing treatments was found effective in improving the germination and survival percentage as compared to the control treatment.

KEYWORDS: walnut, gibberellic acid, stratification, cracking, hotwater.

INTRODUCTION
Walnut (*Juglans regia* L.) is an important temperate nut crop with delicious kernel. It belongs to the family Juglandaceae and genus *Juglans*. The genus *Juglans* has 21 species of which *Juglans regia* is the most important. Seed dormancy is a barrier to walnut seed germination and it has been attributed to one or more factors (Stockes, 1965) i.e. hard and impermeable seed coat, immaturity of embryo, after ripening in dry storage, inhibitors and germination stimulators and light sensitivity of seeds. In case of walnut the seed dormancy has been correlated with physiological dormancy that is controlled by seed coat and embryo dormancy (Tripathi *et al*., 2012). 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). Many practices are most commonly followed to break the dormancy in walnut seeds, in order to improve or stimulate germination i.e. scarification, stratification and gibberellic acid. The aim of this study was to test different pre sowing treatments in an attempt to improve overall germination percentage and early germination of walnut seed.

MATERIALS & METHODS
Fully mature seeds were collected from the nearby places of College of Horticulture, VCSG, UUHF, Bharsar during 2015-16. Seeds were selected, washed, float-checked, and air dried. Selected seeds were subjected to different pre sowing treatments such as cracking, hot water, gibberellic acid at three different concentration (500 ppm, 750 ppm and 1000 ppm), stratification for 30 days and their combinations such as three different concentration (500 ppm, 750 ppm and 1000 ppm) of gibberellic acid with cracking and hot water, combination of cracking and hot water with stratification for 30 days and combination of cracking and hot water with three different concentration (500 ppm, 750 ppm and 1000 ppm) of gibberellic acid under stratification period of 30 days and sowed in Randomized Complete Block Design with three replications at the spacing (30 X 10) cm^2 in poly house.

RESULTS & DISCUSSION
Days taken for germination
The combine application of different pre-sowing treatments resulted in minimum days taken for germination. Seeds of walnut showed early germination (12.67 days) when combination of cracking with GA_3 @ 750 ppm stratification for 30 days than control and single treatments. Early germination might be due to the fact that, GA_3 plays an important role in two stages of germination one at initial enzyme induction and other in activation of reserve food mobilizing system which help in enhancement of germination (Jha et al., 1997). The above results are in conformity with Barche *et al*. (2010), Anburani and Shakila (2010) in papaya. The maximum days taken for germination (76.67 days) were recorded with control treatment.

Germination percentage
The maximum germination might be due to the fact that GA_3 involved in the activation of cytological enzymes which stimulates α – amylase enzyme that converts insoluble starch into soluble sugars (Babu *et al*., 2010) and

early germination might be due to the fact that, GA_3 plays an important role in two stages of germination one at initial enzyme induction and other in activation of reserve food mobilizing system which help in enhancement of germination (Jha *et al*., 1997). In the present studies, it has been observed that gibberellic acid was required in relatively lower concentration with stratification and scarification for the maximum germination. The inability of walnut seeds to germinate may be due to the hard seed coat. As the scarification treatment given to the seed helped in uptake of water, growth hormones and air which was required for seed germination (Çetinbaş M, Conner, 2008 and Al-Absi, 2010). Prechilling stratification had a significant effect on seed dormancy. It can be attributed that at low temperature more oxygen dissolves in water and therefore more oxygen is available for embryo (Young and Young, 1992).

Survival percentage

The maximum survival percentage (93.24%) was recorded with combination application of hot water + gibberellic acid @ 500 ppm + stratification for 30 days. It might be because stratification increased the early germination which resulted into longest radicle, which helps in early establishment of new seedling to produce maximum food material with the helped in photosynthesis that resulted into the maximum survival of seedlings. The results are in conformity with the findings of Wani (2014) who observed increase in the survival percentage with the application of gibberellic acid @ 500 ppm for 40 hours. It might be as GA_3 favors the increased enzymatic activity that leads to the favorable environment for the seed germination as well as the growth of the radicle and plumule leading to better growth and survival of seedlings.

TABLE 1. Effect of different pre sowing treatments on seed germination of walnut

Treatments	Days taken for initial germination	Germination percentage	Survival percentage
T_1 (Cracking)	59.33± 0.67	49.89 (7.13±0.05)	69.87 (8.42 ± 0.04)
T_2 (Hot water)	56.33± 0.88	47 (6.93 ± 0.13)	72.56 (8.58 ± 0.08)
T_3(Cracking+GA_3@500ppm)	25.67± 1.20	53.54(8.07 ± 0.06)	86.91 (9.38 ± 0.01)
T_4(Cracking+GA_3@750ppm)	25.33± 1.33	64.07(7.87 ± 0.05)	78.62 (8.92 ± 0.12)
T_5(Cracking+GA_3@1000ppm)	26.00± 1.15	60.99(7.38 ± 0.11)	73.85 (8.65 ± 0.05)
T_6(HotWater+GA_3@500ppm)	19.67± 0.67	60.71(7.85± 0.07)	87.42 (9.40 ± 0.11)
T_7(HotWater+GA_3@750ppm)	19.00 ±1.15	55.63(7.52 ± 0.16)	85.26 (9.29 ± 0.04)
T_8(HotWater+GA_3@1000ppm)	19.33± 0.33	53.72(7.39 ± 0.29)	83.18 (9.17 ± 0.10)
T_9(Cracking + stratification for 30 days)	19.00± 0.58	52.05(7.28 ± 0.09)	82.78 (9.15 ± 0.08)
T_{10} (Hot Water + stratification for 30 days)	18.00± 1.53	50.15(7.15 ± 0.04)	85.62 (9.31 ± 0.04)
T_{11}(Cracking+GA_3@500ppm+ Stratification for 30 days)	14.33± 0.33	75.88(8.77 ± 0.11)	91.60 (9.62 ± 0.14)
T_{12}(Cracking+GA_3@750ppm+ Stratification for 30 days)	12.67± 0.33	73.05(8.60 ± 0.04)	90.33 (9.55 ± 0.13)
T_{13}(Cracking+GA_3@1000ppm+Stratification for 30 days)	14.33± 0.33	71.63(8.52 ± 0.04)	87.30 (9.40 ± 0.10)
T_{14} (HotWater+GA_3@500ppm+ Stratification for 30 days)	13.33 ± 0.33	74.46(8.67 ± 0.07)	93.24 (9.71 ± 0.05)
T_{15} (HotWater+GA_3@750ppm+ Stratification for 30 days)	14.00 ± 0.58	72.34(8.56 ± 0.07)	91.19 (9.60 ± 0.09)
T_{16}(HotWater+GA_3@1000ppm+Stratification for 30 days)	14.67 ± 0.33	71.63(8.52 ± 0.04)	88.11 (9.43 ± 0.09)
T_{17} (Control)	76.67± 9.26	45.66(6.90 ± 0.29)	67.33 (8.26 ± 0.23)
± SE (m)	3.38	1.89 (0.18)	2.43 (0.13)
$CD_{0.05}$	6.88	3.79 (0.37)	4.96 (0.28)

CONCLUSION

The results obtained in the present studies showed that among different pre sowing treatments, the best results in terms of days taken for germination, germination percentage and survival percentage. The maximum germination percentage was recorded with cracking + gibberellic acid @ 500 ppm + stratification for 30 days while the minimum days taken for germination were recorded with cracking + gibberellic acid @ 750 ppm + stratification for 30 days and maximum survival percentage was observed with hot water + 500 ppm + stratification for 30 days. Hence, it is concluded that the combination of different pre sowing treatments was found effective in early germination, improving the germination percentage and survival percentage as compare to single treatment or control treatment.

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