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Effect of growth regulator, scarification and thiourea on seed germination in peach (*Prunus persica* L. Batsch) rootstock 'Flordaguard'

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A B S T R A C T

The present investigations entitled "effect of growth regulator, scarification and thiourea on seed germination in peach (*Prunus persica* L. Batsch) rootstock "Flordaguard" were carried out at the New Orchard of the Department of Fruit Science Punjab Agricultural University, Ludhiana during 2010-2011 to find out the affect of different treatments on seed germination and to find out an ideal treatment for good seed germination. Seeds collected from mature, healthy and disease free fruits were subjected to stratification in small gunny bags and kept in cold storage at 0 ± 3^0 and 85-90% RH for a period of 90 days and then seeds were sown on three dates at 10 days interval (15th December, 25th December and 5th January) after stratification (which was considered as control), scarification (mechanical rupturing of the seed coat) and after soaking in GA_3 (100 & 200 ppm), thiourea (1% & 2 %) and Kinetin (100 & 200 mg/lt) for 24 hours before sowing. Among the treatments seeds sown after mechanical rupturing of the seed coat had exhibited significantly higher percent seed germination (57.26), and minimum duration of seed germination (16.33), mortality rate (1.9) was recorded in the same treatment. Irrespective of the treatments the maximum percent seed germination (22.57), and minimum duration of seed germination (23.62) was also recorded on same date (25th December). The seedling percent seed germination under GA_3, Thiourea and Kinetin was found to be lower during the present studies.

Introduction

Prunus belongs to sub- family *Prunoidae* of family *Rosaceae*, which includes several species producing edible drupes of economic importance. A high germination percentage coupled with a desirable growth habit is the basic requirement of a good seedling rootstock. Dormancy is a condition in which seeds do not germinate even when the environmental conditions (water, temperature and aeration) are permissive for germination (Nikolaeva, 1977; Bewley & Black, 1994; Hartmann *et al*, 1997). Several mechanical and chemical methods have been used in attempts to crack, remove, or soften the endocarp, including freezing, mechanical scarification, boiling water, sulphuric acid, citric acid, lye, or hydrogen peroxide. Scarification is a method used to break physical dormancy and it includes removing the seed coat or wounding the seed coat. Stratification plays an important role as a stimulator that helps to break dormancy (Bewley, Black, 1994; Agrawal & Dadlani 1995; Hartmann *et al*, 1997). Thiourea overcomes certain types of dormancy, such as the seed-coat inhibiting effect of deep embryo-dormant *Prunus* seeds (Hartmann *et al*, 1997).

In Punjab, seedlings have been used as rootstock and little attention is paid to their characteristics other than compatibility with scion. Seeds of 'Sharbati' generally used for raising the rootstock due to its easy availability and compatibility with commercial peach cultivars. But, this rootstock is highly susceptible to root knot nematodes. Recently, PAU has released a new rootstock 'Flordaguard' for peach. This rootstock is resistant to root knot nematodes and is also compatible with all the peach cultivars (Singh, 2010). But, there is a big problem of seed germination in this rootstock. Therefore, in the present studies an attempt has been made to improve the seed germination in 'Flordaguard' rootstock with the following objectives.

i) To ascertain the effect of treatments on seed germination.

ii) To find out an ideal treatment for good seed germination.

Material and Methods

The present studies on seed germination of peach rootstock 'Flordaguard' were carried out in the Department of Fruit Science, Punjab Agricultural University, Ludhiana during the year 2010-11.

Details of experiment

This experiment was conducted with a view to find out if some growth regulator treatments can substitute cold stratification, completely or partially, for better seed germination. The experiment was laid out on seeds stratified for 90 days at $\pm$ 3^0C. The stratified seeds were soaked in different concentration of the growth regulators for 24 hours before sowing. 50 seeds were sown in each treatment and there were 4 replications per treatment.

The details of the treatments used were as under:

T_1 After stratification (Control)
T_2 Scarification (Mechanical rupturing of seed coat)
T_3 Soaking in GA_3 @ 100 ppm for 24 hours
T_4 Soaking in GA_3 @ 200 ppm for 24 hours
T_5 Soaking in Thiourea @ 0.5% for 24 hours
T_6 Soaking in Thiourea @ 1% for 24 hours
T_7 Soaking in Kinetin @ 100 mg/lt for 24 hours
T_8 Soaking in Kinetin @ 200 mg/lt for 24 hours

Number of treatments		= 8
Number of replication		= 4
Treatment unit		=50 seeds
Number of dates		= 3
Date of sowing	(i)	15th Dec 2010
	(ii)	25th Dec 2010
	(iii)	5th Jan 2011

Total Number of seeds used = 4800

Steps in sowing of seeds as follows

a) Extraction of the seeds
b) Selection of Seeds
c) Seed Stratification
d) Treatment with Growth Regulators
e) Sowing of seeds: The seeds were sown in well prepared nursery beds in rows 10 cm apart at 3 cm depth.

Observations Recorded

1 Start of seed germination: It was recorded when 10% of the seedlings emerged in different treatments.

2 End of germination: It was recorded when germination was completed and no more sprouting took place.

3 Per cent seed germination:

$$\frac{\text{Number of seedlings germinated}}{\text{Total number of seeds sown}} \times 100$$

4. Mortality of the seedlings:

$$\frac{\text{Number of seedlings died}}{\text{Total number of seedlings emerged}} \times 100$$

Statistical analysis

The data recorded during the course of this study was analysed statistically as Randomized Block Design (Factorial) as per the procedure laid out by Gomez and Gomez (1986) and results are summarized in tables with average of 4 replications.

Results and Discussion

The results obtained from the present investigation “seed germination in peach rootstock Flordaguard” are presented and discussed under the following heads.

1 Start and end of seed germination (duration of seed germination) and percent seed germination

The data on the effect of different treatments on the start of seed germination in peach rootstock ‘Flordaguard’ is presented in Table 1. The data reveals that different treatments had a significant effect on the start of seed germination in the present studies. Seeds sown on 15th December under all the treatments started sprouting early as compared to those sown on 25th December and 5th January. The seeds sown on 5th January started sprouting in the end. Irrespective of the dates, sprouting started early in T_2, where seeds were sown after mechanically rupturing the seed coat and in the last in T_1 (control). On the 1st sowing date (15th December) earliest germination was recorded in T_2, (IV week of January) and it was followed by T_3, (I week of February). In all the other treatments, germination started in the II and III week of February. On the 2nd sowing date (25th December) earliest germination was again observed in T_2 , (II week of February) and in the last in T_1, (I week of March). Similar trend was observed on the 3rd sowing date (5th January) where earliest germination was noted in T_2. The GA, kinetin and thiourea treatments started sprouting late on all the sowing dates as compared to those seeds sown by mechanically rupturing.

The data on the effect of different treatments on the end of seed germination is presented in Table 2.

The data shows that germination of seed was completed in different treatments in March and it continued till mid April. Irrespective of the dates, germination was completed earlier in T_2, as compared to other treatments.

Earliest germination was completed in T_2 sown on 15th December (III week of February) and it was followed by same treatments sown on 25th December (IV week of February). Germination in all the other treatments was completed by end of March which were sown on 15th December and 25th December. However, germination was completed in mid April in kinetin and thiourea treatments sown on 5th January.

The persual of data presented in Table 3 shows that duration of seed germination irrespective of the treatments was maximum when the seeds were sown on 15th December and minimum when they were sown on 25th December. Among the treatments, duration of seed germination was minimum in T_2 and maximum in kinetin treatments on all the sowing dates. Minimum duration of 14 days was observed in T_2, sown on 25th December and 5th January. Maximum duration of 25 days was observed in all the treatments (except T_2 and T_5) sown on 15th December. The examination of data reveals that germination was started and completed earlier in T_2 and the duration of seed germination was also less in this treatment. This may be due to the fact that seeds under this treatment were sown after mechanically rupturing of the seed which favoured early sprouting. In all other treatments, the presence of hard seed coat provided resistance to the embryo which delayed the germination. Du Toit *et al* (1979) observed that endocarp affected peach seed germination by delaying water uptake. Mehanna and Martin (1985) also concluded that the seed coat provides mechanical resistance for germination in peach. This studies showed that if the seed's endocarp was removed it had an overall higher percentage of germination than those seeds whose endocarp was left intact. This shows that stratification alone and in combination of thiourea, GA and kinetin is not effective for seed germination in peach rootstock 'Flordaguard'.

The commencement of seed germination under longer periods of stratification may be attributed partly to the softening of endocarp and overcoming of the mechanical resistance of seed coat for embryo growth under stratification (Foggle and McCrary, 1960; Mehanna and Martin, 1985) and partly to the high level of promoters and low level of inhibitors associated with stratification (Villiers and Wareing, 1965; Martin and Corgan, 1969; Kilany, 1986). The failure of unstratified seeds to germinate may be attributed to the high level of inhibitors present in these seeds, which causes them to remain dormant (Bonamy and Dennis, 1977).

Per cent seed germination

The data on the effect of different treatments on per cent seed germination in peach rootstock 'Flordaguard' is presented in Table 4. The data shows that mean seed germination was found to be maximum (22.57%) when the seeds were sown on 15th December and it was significantly higher than the seeds sown on 25th December (20.20%). The per cent seed germination was found to be minimum (14.80%) on the 3rd sowing date (5th January). Among the treatments, maximum mean seed germination (57.26%) was recorded in T_2, where the seeds were sown after rupturing the seed coat and it was significantly higher than all other treatments. The mean seed germination in T_1 (control), T_3 and T_4 (GA_3 treatments) were found to be statistically at par. Minimum mean seed germination was recorded in Thiourea and Kinetin treatments. The data further shows that maximum seed germination (67.2%) was recorded in T_2, sown on 25th December and it was significantly higher than all other treatments. It was followed by the same treatment sown on 5th January (54.0%) and 15th December (50.6%), respectively. The seed germination under control (T_1) and GA_3 treatments (T_3 and T_4) sown on 15th December was found to be better than sown on other dates.

In Thiourea and Kinetin treatments, seed germination was found to be poor at all the sowing dates. In general, seed germination in all the treatments was less when sown on 15th December as compared to other sowing dates. Higher seed germination in T_2 treatment was due to the absence of barrier provided by the seed coat for germination. Zigas and Coomb (1977) reported that removal of seed coat of peach seeds eliminates the physical dormancy and stratification eliminates internal dormancy. Eliminating physical dormancy by removing the endocarp provides better chances for germination of peach seeds.

Gianfagna and Rachmial (1986) found that the effects of Gibberellins on the seeds were found to be negligible if the endocarp was left intact. During the present studies also, the growth regulators did not improve seed germination in peach rootstock 'Flordaguard' although these treatments have been found to break dormancy and improve seed germination in stone fruits (Dweikat & Lyrene, 1988; Karam & Al-Salem, 2001and Mehanna *et al*, 1985).

Mortality of the seedlings

The data on the effect of different treatment on the mortality rate (%) of the 'Flordaguard' seedlings recorded during June and December months are presented in Table 5 and 6. The data in Table 5shows that maximum mean mortality of the seedlings (26.81%) was recorded in the treatment sown on 5th January and it was significantly higher than mortality rate of the seedlings observed 1st (15th December) and 2nd (25th December) sowing dates. Among the treatments, minimum mean mortality (16.83%) was recorded in T_2, where seeds were sown after rupturing the seed coat and it was significantly lower than all other that removal of seed coat of peach seeds

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Table.1 Effect of different treatments on the start of seed germination in peach rootstock 'Flordaguard

TREATMENTS	DATE OF SOWING		
	15 DEC 2010	**25 DEC 2010**	**5 JAN 2011**
T1 ---- Stratification (control)	II Week FEB	I Week MARCH	II Week MARCH
T2 ---- Scarification	IV Week JAN	I Week FEB	III Week FEB
T3 ---- GA_3 100 ppm	I Week FEB	III Week FEB	IV Week FEB
T4 ---- GA_3 200 ppm	II Week FEB	III Week FEB	IV Week FEB
T5 ---- Thiourea 0.5 %	II Week FEB	IV Week FEB	II Week MARCH
T6 ---- Thiourea 1.0 %	II Week FEB	IV Week FEB	III Week MARCH
T7 ---- Kinetin 100 mg	III Week FEB	IV Week FEB	II Week MARCH
T8 ---- Kinetin 200 mg	III Week FEB	IV Week FEB	II Week MARCH

Table.2 Effect of different treatments on the end of seed germination in peach rootstock 'Flordaguard

TREATMENTS	DATE OF SOWING		
	15 DEC 2010	**25 DEC 2010**	**5 JAN 2011**
T1---- Stratification (control)	III Week MARCH	IV Week MARCH	I Week APRIL
T2---- Scarification	III Week FEB	IV Week FEB	I Week MARCH
T3---- GA_3 100 ppm	II Week MARCH	III Week MARCH	IV Week MARCH
T4---- GA_3 200 ppm	III Week MARCH	III Week MARCH	IV Week MARCH
T5---- Thiourea 0.5 %	II Week MARCH	III Week MARCH	II Week APRIL
T6---- Thiourea 1.0 %	III Week MARCH	III Week MARCH	II Week APRIL
T7---- Kinetin 100 mg	IV Week MARCH	IV Week MARCH	II Week APRIL
T8---- Kinetin 200 mg	IV Week MARCH	IV Week MARCH	II Week APRIL

Table.3 Effect of different treatments on the duration of the seed germination (days) in peach rootstock ‘Flordaguard’

TREATMENTS	**DATE OF SOWING**		
	15 DEC 2010	**25 DEC 2010**	**5 JAN 2011**
T1---- Stratification (control)	35	21	21
T2---- Scarification	21	14	14
T3---- GA_3 100 ppm	35	28	28
T4 ---- GA_3 200 ppm	35	28	28
T5---- Thiourea 0.5 %	28	21	28
T6---- Thiourea 1.0 %	35	21	21
T7---- Kinetin 100 mg	35	28	28
T8---- Kinetin 200 mg	35	28	28

Table.4 Effect of different treatments on duration and percent seed germination in peach rootstock “ Flordaguard”

TREATMENTS	Duration of the seed germination (days)				Percent seed germination			
	Dates				Dates			
	15 DEC 2010	25 DEC 2010	5 JAN 2011	MEAN	15 DEC 2010	25 DEC 2010	5 JAN 2011	MEAN
T1--Stratification (control)	35	21	21	25.66	29.2	13.6	13.2	18.66
T2--Scarification	21	14	14	16.33	50.6	67.2	54.0	57.26
T3--GA_3 100 ppm	35	28	28	30.33	22.0	18.0	11.6	17.20
T4--GA_3 200 ppm	35	28	28	30.33	24.4	21.2	12.0	19.20
T5--Thiourea 0.5 %	28	21	28	25.66	12.8	6.0	5.6	8.13
T6--Thiourea 1.0 %	35	21	21	25.66	16.8	8.4	6.8	10.66
T7--Kinetin 100mg	35	28	28	30.33	12.0	10.4	7.2	9.86
T8--Kinetin 200mg	35	28	28	30.33	12.8	10.8	8.0	10.53
MEAN	32.37	23.62	24.50		22.57	19.45	14.8	

CD (p=0.05) D=0.73 T= 1.19 D X T=2.07

Table.5 Effect of different treatments on the Mortality of the seedlings in peach rootstock 'Flordaguard' during June

TREATMENTS	DATE OF SOWING			MEAN
	15 DEC 2010	25 DEC 2010	5 JAN 2011	
T1---- Stratification (control)	20.4	21.0	23.5	21.63
T2---- Scarification	16.0	16.0	18.5	16.83
T3---- GA_3 100 ppm	24.4	25.0	25.8	25.06
T4---- GA_3 200 ppm	22.0	22.6	23.5	22.70
T5---- Thiourea 0.5 %	30.4	31.5	32.2	31.36
T6---- Thiourea 1.0 %	28.5	29.0	29.6	29.03
T7---- Kinetin 100 mg	29.4	30.0	31.4	30.26
T8---- Kinetin 200 mg	28.5	29.4	30.0	29.30
MEAN	24.95	25.56	26.81	

CD (p=0.05) Date= 1.17 TREATMENT= 1.91 D X T= NS

Table.6 Effect of different treatments on the Mortality of the seedlings in peach rootstock 'Flordaguard' during December

TREATMENTS	DATE OF SOWING			MEAN
	15 DEC 2010	25 DEC 2010	5 JAN 2011	
T1---- Stratification (control)	4.2	4.0	3.5	3.9
T2 ---- Scarification	2.2	1.5	2.0	1.9
T3---- GA_3 100 ppm	4.0	3.8	4.5	4.1
T4---- GA_3 200 ppm	3.1	3.5	3.0	3.2
T5---- Thiourea 0.5 %	4.8	5.2	4.5	4.8
T6---- Thiourea 1.0 %	2.8	3.0	3.2	3.0
T7---- Kinetin 100 mg	4.5	3.8	3.9	4.06
T8---- Kinetin 200 mg	3.0	2.9	2.6	3.83
MEAN	3.57	3.46	3.40	

CD (p=0.05) DATE= NS TREATMENT= 0.59 D X T = NS

The mortality rate of the seedlings in T_1 (control) was also comparatively less than the GA_3, Thiourea and Kinetin treatment. On the 2nd sowing date (25th December), minimum mortality rate was again recorded in T_2 followed by T_1 and maximum in T_5. On the 3rd date (5th January), similar trend was observed where the mortality rate of the seedlings continued to remain highest in Thiourea and Kinetin treatment. The data in Table 6 shows that mortality rate of the seedlings reduced drastically when the data was recorded in December as compared to June month in all the treatments. The date of sowing had no significant effect in mortality of the seedlings under different treatments. Among the treatments, minimum mean mortality (1.9%) was recorded in T_2 and it was significantly lower than all other treatments. The mean mortality of the 'Flordaguard' seedlings in other treatments was found to be statistically at par.

The examination of the data reveals that mortality rate of the seedlings were significantly less in T_2 as compared to other treatments. This was due to the reason that early germination results into longest radicle which helped in early establishment of new seedling to produce maximum food material with the help of photosynthesis that resulted into the maximum survival of seedlings.

Conclusion

Seeds sown on 15th December started early as compared to those sown on 25th December and 5th January in all the treatments. Among the treatments, earliest sprouting was recorded in T_2, where seed was sown after rupturing the seed coat. Seed germination was started late in the Kinetin and Thiourea treatment.

Seed germination was completed in March and it continued up to mid April in different treatments. Germination was completed earliest in T_2 as compared to other treatments. Seed germination in Kinetin and Thiourea treatments was completed in the end.

Duration of seed germination was maximum when the seeds were sown on 15th December and minimum when they were sown on 25th December. Among the treatments, duration of seed germination was minimum in T_2 and maximum in kinetin treatments on all the sowing dates. Minimum duration of 14 days was observed in T_2, sown on 25th December and 5th January. Maximum duration of 35 days was observed in all the treatments (except T_2 and T_5) sown on 15th December.

Maximum mean per cent seed germination was recorded in T_2, when seeds were sown after rupturing the seed coat and it was significantly higher then all other treatments. The mean per cent seed germination in control and GA_3 treatment were at par. The minimum per cent seed germination was noted in Kinetin and Thiourea.

The highest mortality rate was recorded in the treatment sown on 5th January and it was significantly higher than those observed on other sowing dates. Among the treatments, lowest mortality was recorded in T_2, where seeds were sown after mechanical rupturing of the seed coat and it was significantly lower than than all other treatments. The mortality rate of the seedlings was found to be highest in Thiourea and Kinetin treatment.

References

Agrawal P K and Dadlani M (1995) Techniques in Seed Science and Technology. *Second Edition South Asian Publishers New Delhi International Book Company Absecon Highlands* 109: 113.

Bewley J D and Black M (1994) Physiology and development of seed germination. *Second Edition New York Plenum Press.*

Bomany P A and Dennis F G (1977 b) Abscissic acid levels in seeds of peach I changes during maturation and storage. *J Am Soc Hort Sci* 102 (1):23-26.

Du Toit H J, Jacobs G and Strydom D K (1979) Role of the various seed parts in peach seed dormancy and initial seedling growth. *J Am Soc Hort Sci* 104 (4): 490-492.

Dweikat I M and Lyrene P M (1988) Response of high bush blueberry seed germination to GA_3 and *6N*-benzyladenine. *Canadian J Bot* 67: 3391–3393.

Foggle H W and McCrary C S (1960) Effects of cracking after ripening and gibberellins on germination of Lambert cherry seeds. *Proc Am Soc Hort Sci* 76: 134-38.

Hartmann H T, Kester D E and Davies F T (1997) Plant Propagation, Principles and Practices. *Prentice Hall Internacional Inc Upper Saddle River N J.*

Mehanna H T, Martin G C and Chic Nishijima (1985) Effects of temperature chemical treatments and endogenous hormone content on peach seed germination and subsequent seedling growth. *Scientia Hort* 27:63-73.

Nikolaeva M G (1977) Factors controlling the seed dormancy pattern In Khan A A (ed) Physiology and Biochemistry of Seed Dormancy and Germination. *Amsterdam North Holland Publishing Co Academic Press*: 51–74.

Singh H, Kaushal V,Thakur A, Jawandha S K and Sharma S K (2010) Effect of rootstocks on vegetative and fruit characters of peach. *J Res PAU* 47 (1& 2): 34-38.

Villiers T A and Wareing P P (1960) Interaction of growth inhibitor and a natural germination stimulator in the dormancy of *Fraxinus excelsior*. *Nature* 185:112-114.