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Studies on Effect of Kinetin, GA_3, Scarification and Thiourea on Vegetative Parameters and Seed Germination in Peach (*Prunus persica* L. Batsch) Rootstock 'Flordaguard'

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Abstract—*Peach seeds were sown on three dates at 10 days interval (15th December 2010, 25th December 2010 and 5th January 2011) 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 the vegetative parameters in terms of height (130.56), girth (0.57) and number of leaves (170.25). The seedling percent seed germination under GA_3, Thiourea and Kinetin was found to be lower during the present studies.*

Keywords*: Peach, Flordaguard, GA_3, thiourea, Kinetin*

1. INTRODUCTION

Peach belongs to the genus *Prunus* which includes the cherry and plum, in the family Rosaceae. The genus *Prunus* has 5 well- marked sub- genera including plums and apricots (*Prunophora*), almonds and peaches (*Amygdalus*), umbellate cherries (*Cerasus*), deciduous racemose cherries (*Padus*) and the evergreen racemose orlaurel cherries (*Laurocerasus*) (Grisez *et al*, 2000). Among the sub- genera, species *persica* (Peach and nectarine) ranked third as most agronomically important plant in temperate regions after apple and pear. Peach seeds, like the seeds of other deciduous fruit species, require a certain period of after ripening for proper germination. The poor and delayed germination in peach seeds has been attributed to several factors like hard seed coat (Flemion, 1936; Mehanna & Martin, 1985; Chopra *et al*, 1987) developmental status of the embryos (Tukey & Lee, 1937; Hesse & Kester, 1955; Amen, 1963) and the presence of endogenous germination inhibitors (Diaz & Martin, 1972; Sharma & Singh, 1978 a) etc. Several workers have conducted studies to secure higher germination percentage in peach (Chao & Walker, 1966; Sharma & Singh, 1978 a) and it has been reported that the germination potential of peach seed can be improved considerably by employing pre sowing treatments (Chopra *et al*, 1988). Seed dormancy defined as the failure of viable mature seeds to germinate under favorable conditions is assumed to be an important adaptive trait in nature, enabling seeds to remain quiescent until the conditions for germination and seedlings establishment become favorable (Finch- Savage and Leubner-Metzger, 2006). Two main mechanisms of dormancy have been described in *Prunus* species an external mechanism controlled by the endocarp and the testa (maternal tissue) and an internal mechanism controlled by the embryo which affects later growth of seedlings (Martinez-Gomez & Dicenta, 2001; Garcia- Gusano *et al*, 2004; 2009). Under natural conditions release of *Prunus* species dormancy generally occurs during stratification (imbibitions at low temperature) being regulated by a combination of environmental and endogenous signals with both synergistic and competing effects.

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. No work has been done to improve seed germination in newly released 'Flordaguard' rootstock. Therefore, in the present studies an attempt was 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

2. 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. The trial was laid out in a factorial experiment in Randomized Block Design with 8 treatments viz stratification (T_1), scarification (T_2), GA_3 @ 100 ppm (T_3), GA_3 @ 200 ppm (T_4),Thiourea @ 0.5% (T_5), Thiourea @ 1.0% (T_6), Kinetin @ 100 mg (T_7) and Kinetin @ 200 mg (T_8) sown on three different dates (15th December, 25th December and 5th January). The treatments were replicated thrice and 50 seeds were sown under each replication.

Observations Recorded

1. Per cent seed germination:

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

2. Height of the seedlings

3 Girth of the seedlings

4. Number of leaves

3. RESULTS AND DISCUSSION

3.1 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 1. 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).

3.2. Height (cm) of the seedlings

The data on the effect of different treatments on the height of the seedlings of peach rootstock 'Flordaguard' recorded during December presented in Table 2. The data shows that treatments had a significant effect on the height of the seedlings during the present studies. The data given in Table 2 also shows that the mean seedling height during December was found to be maximum (84.96 cm) when the seeds were sown on 2nd date (25th December) and it was significantly higher than those sown on 15th December (80.86 cm) and 5th January (76.18 cm). Among the treatments, T_2 recorded maximum mean seedling height (130.56 cm) and it was significantly higher than all other treatments. The minimum seedling height was recorded in Kinetin treatments (T_7 and T_8). Maximum seedling height during December was recorded in T_2 (135.7 cm) sown on 25th December followed by this treatment sown on 15th December and 5th January.

The critical evaluation of data reveals that seedling height was found to be maximum where the seeds were sown on 25th December closely followed by those sown on 15th December. Among the treatments, the maximum seedling height was recorded in T_2, where the seeds were sown after rupturing the seed coat and it was significantly higher than all other treatments. This was due to the reason that seed germination was also found to be early in this treatment and this provided better chances for growth and height of the seedlings. The seedling height under GA_3, Thiourea and Kinetin treatments was found to be lower during the present studies. In contrast to these findings, Abo- Hassan (1986) reported that stratification followed by GA_3 treatment improved seed germination and increased plant height in apricot.

Table 1: Effect of different treatments on the seed germination (per cent) in peach rootstock 'Flordaguard'

TREATMENTS	DATE OF SOWING			MEAN
	15 DEC 2010	25 DEC 2010	5 JAN 2011	
T1---- Stratification (control)	29.2	13.6	13.2	18.66
T2---- Scarification	50.6	67.2	54.0	57.26
T3---- GA_3 100 ppm	22.0	18.0	11.6	17.20
T4---- GA_3 200 ppm	24.4	21.2	12.0	19.20
T5---- Thiourea 0.5 %	12.8	6.0	5.6	8.13
T6---- Thiourea 1.0 %	16.8	8.4	6.8	10.66
T7---- Kinetin 100 mg	12.0	10.4	7.2	9.86
T8---- Kinetin 200 mg	12.8	10.8	8.0	10.53
MEAN	22.57	19.45	14.8	

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

Table 2: Effect of different treatments on the height (cm) of the seedlings of peach rootstock 'Flordaguard' during December

TREATMENTS	DATE OF SOWING			MEAN
	15 DEC 2010	25 DEC 2010	5 JAN 2011	
T1---- Stratification (control)	91.4	95.2	71.8	86.13
T2---- Scarification	130.2	135.7	125.8	130.56
T3---- GA_3 100 ppm	76.5	79.4	71.2	75.70
T4---- GA_3 200 ppm	74.2	80.6	73.3	76.03
T5---- Thiourea 0.5 %	70.4	73.2	69.0	70.86
T6---- Thiourea 1.0 %	70.6	74.8	68.3	71.23
T7---- Kinetin 100 mg	66.6	70.0	64.8	67.13
T8---- Kinetin 200 mg	67.0	70.8	65.3	67.70
MEAN	80.86	84.96	76.18	

CD (p=0.05) DATE= 1.92 TREATMENT= 3.14 D X T= 5.44

3.3. Girth (cm) of the seedlings

The data on the effect of different treatments on the girth of the seedlings of peach rootstock 'Flordaguard' recorded during December presented in Table 3. The data shows that treatments had a significant effect on the girth of the seedlings during the present studies. The data given in Table 3 shows that the mean seedling girth during December was found to be maximum (0.42 cm) when the seeds were sown on 2^{nd} date (25^{th} December) and it was statistically at par with those sown on 15^{th} December and 5^{th} January. Among the treatments, T_2 recorded maximum mean seedling girth (0.57 cm) and it was significantly higher than all other treatments. The minimum seedling girth was recorded in Kinetin treatments (T_7 and T_8). Maximum seedling girth during December was recorded in T_2 (0.57 cm) sown on 25^{th} December followed by this treatment sown on 15^{th} December and 5^{th} January. The next best treatment was found to be T_1 (control), on all the sowing dates. The data on seedling girth reveals that sowing dates had no significant effect but the treatment had a significant effect on the girth of 'Flordaguard' seedlings during the present studies.

The maximum seedling girth was recorded in T_2, where the seeds were sown after rupturing the seed coat and it was significantly higher than all other treatments. It was followed by T_1 (control) and T_4 (seeds sown after treating with GA_3 @ 200 ppm). Higher seedling girth under T_2 was due to the reason that removal of endocarp facilitates early germination which resulted in better girth of 'Flordaguard' seedling under the present studies. Abo- Hassan *et al* (1979) also found better seedling growth in apricot when the seeds were sown after scarification.

3.4. Number of leaves

The data on the effect of different treatments on the number of leaves in peach rootstock 'Flordaguard' recorded during December are presented in Tables 4. The data shows that treatments had a significant effect on the number of leaves during the present studies. The data given in Table 4 shows that the mean number of leaves during December was found to be maximum (129.84) when the seeds were sown on 2^{nd} date (25^{th} December) and it was significantly higher than those sown on 5^{th} January (127.87) and 15^{th} December(127.14). Among the treatments, T_2 recorded maximum mean leaf number (170.25) and it was significantly higher than all other treatments. The minimum number of leaves was recorded in Kinetin treatments (T_7 and T_8). Maximum number of leaves during December was recorded in T_2 (172.2) sown on 25^{th} December followed by this treatment sown on 5^{th} January (170.2) and 15^{th} December (168.3). The minimum number of leaves was resulted in Kinetin treatment on all the sowing dates and it was significantly less than all other treatments.

Table 3: Effect of different treatments on the girth (cm) of seedlings of peach rootstock 'Flordaguard' during December

TREATMENTS	DATE OF SOWING			MEAN
	15 DEC 2010	25 DEC 2010	5 JAN 2011	
T1---- Stratification (control)	0.47	0.48	0.47	0.47
T2---- Scarification	0.57	0.57	0.57	0.57
T3---- GA_3 100 ppm	0.40	0.41	0.40	0.40
T4---- GA_3 200 ppm	0.40	0.41	0.41	0.41
T5---- Thiourea 0.5 %	0.37	0.38	0.38	0.37

T6---- Thiourea 1.0 %	0.38	0.38	0.39	0.38
T7---- Kinetin 100 mg	0.35	0.36	0.35	0.35
T8---- Kinetin 200 mg	0.36	0.36	0.36	0.36
MEAN	0.41	0.42	0.41	

CD (p=0.05) DATE=NS TREATMENT=0.0 DXT=NS

The critical evaluation of data reveals that maximum number of leaves during December was recorded in T_2, where the seeds were sown after rupturing the seed coat and it was significantly higher than all other treatments. It was followed by T_1 (Control) and T_4 (seeds sown after treating with GA_3 @ 200 ppm). The number of leaves under other treatments was found to be lower during the present studies. The more number of leaves in T_2 was probably due to better vegetative growth in terms of height and girth under this treatment recorded in the present studies. Singh *et al* (1968) found that peach seedlings grown from seeds treated with GA_3 attained greater height and more number of leaves than the seedlings grown from untreated seeds.

Table 4: Effect of different treatments on number of leaves on peach rootstock 'Flordaguard' during December

TREATMENTS	DATE OF SOWING			MEAN
	15 DEC 2010	25 DEC 2010	5 JAN 2011	
T1---- Stratification (control)	143.2	145.8	141.2	143.41
T2---- Scarification	168.3	172.2	170.2	170.25
T3---- GA_3 100 ppm	122.9	125.4	125.0	124.48
T4---- GA_3 200 ppm	123.3	127.2	125.4	125.32
T5---- Thiourea 0.5 %	117.6	121.0	119.8	119.48
T6---- Thiourea 1.0 %	119.5	121.3	120.8	120.48
T7---- Kinetin 100 mg	109.8	112.7	109.9	110.85
T8 ---- Kinetin 200 mg	112.3	112.9	110.5	111.92
MEAN	127.14	129.84	127.87	

CD (p=0.05) DATE= 0.81 TREATMENT= 1.32 D X T= NS

4. CONCLUSION

It is concluded from the present studies that the seeds sown after mechanical rupturing of the seed coat shows improved seed germination in peach rootstock Flordaguard. The vegetative growth in terms of stem girth, number of leaves, and height are found to be better in T_2 treatment (scarification), where seeds were sown after mechanically rupturing the seed coat.

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