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Research on Seed Germination Test of *Paeonia ostii* 'Fengdan'

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Abstract: *In order to accelerate the Paeonia ostii 'Fengdan' seeds rooting rate and increase the rate of emergence. Adopt method of GA3 and substrate layer treatment in this experiment. The results showed, the best condition for the seeds hypocotyls dormancy breaking of Paeonia ostii 'Fengdan' was that, the seeds were soaked in 500mg/L GA3 solution for 48h, and then germinated in wet sand layer by 25 ℃ temperature; the best condition for the seeds epicotyls dormancy breaking was as below: root length greater than 3cm rooting seeds were soaked in 300mg/L GA3 for 2h, and then germinated in wet sand by 25 ℃ temperature. So the seed germination treatment of Paeonia ostii 'Fengdan' can accelerate the seed rooting rate and increase the rate of emergence. The time of sowing to germination was only about 112d, which shortened the emergence time obviously.*

Key words: *Paeonia ostii 'Fengdan'; seed; dormancy breaking; GA3*

1. Introduction

Paeonia ostii "Fengdan" is mainly distributed in Tongling and Nanling, Anhui Province. It belongs to the species of Jiangnan Peony. The flower is single-lobe type, with normal stamens and strong adaptability [1]. Fengdan peony varieties with root thick, fleshy, flour foot and other characteristics, abounds in Dan, is China's medicinal peony in the valuable species. With the exploration and discovery of people, Fengdan peony varieties can produce high-quality peony oil, unsaturated fatty acid content of more than 90%, is now one of the main oil with peony varieties used in production of goods. Therefore, the number of fengdan peony seedlings in the market of China is limited, which has become the bottleneck of the peony industry. Raising seed multiplication technology is the key to solving this problem. However, due to the double dormancy characteristics of Fengdan peony seeds, direct sowing, seed germination rate is low, and the production is greatly restricted. Therefore, this project aims at the characteristics of the peony seed of Feng Dan, and explores the most appropriate way to break the seed dormancy, forming a complete set of germination technology to provide technical support for large-scale production of peony.

2. Materials and Methods

2.1. Materials

This project is to collect the Fengdan peony seeds from phoenix mountain in tongling city, anhui province. After the seeds being collected, the seeds with the full grain size and the uniform size were put in the refrigerator at 4 ℃ for 20 days and then stored for further use.

2.2. Treatment of seeds

Fengdan seed is a typical double dormancy seed, that is, the germination of the seeds needs to go through the seed, the endoderm growth and germ growth can germinate, and the seeds of any one cannot germinate. For the characteristics of fengdan seed, the experiment was conducted to induce root and germination of seeds by hormone and different substrate layer to break the dormancy.

2.1.1. Dissolving method of the embryo root dormancy

With the concentration of 0.3% KMnO4, the seeds of fengdan were sterilized for 30min, and the water was rinsed with distilled water. The distilled water was immersed in the control (CK), 100mg/L, 300mg/L, 500mg/L, 700mg/L gibberellin (GA3) after soaking 48h respectively. After the separation

of sand, carbon and coconut bran, the matrix was treated with high temperature sterilization. Three repeats for each 100 seeds. Zheng Xiang Mu thinks that the optimum temperature of ripening roots of Feng Dan seed is about 25 ℃, so the treated seed placed in 25 ℃ constant temperature conditions, and pay attention to moisture. Observed on a daily basis, recording the rooting rate of the hair, the rooting period, the root length, etc., the seed hair root to the radicle seed coat 0.5cm prevail.

Hair root start days: stratification from the matrix to the first seed hair root number of days required.

Date of origin: from the root of the first seed to the last 1 seed in the statistical period, the beginning of the peak of the root of the root is 15d no longer the occurrence of root seeds.

2.1.2. The method for the dormancy of the embryo bud

The germination of rooting seeds was carried out. The rooting seeds were divided into root length 0.5 ~ 3cm and ≥3cm according to the root length. The rooting seeds were treated with 100 mg / L, 200 mg / L, 300 mg / L and 400 mg / L gibberellin After soaking for 2h, the seeds were treated with wet sand, coco peat and peat stratified separately. The seeds were soaked in clear water for CK, with 30 seeds per treatment and 3 replicates. Germination treatment at 25 ℃ constant temperature conditions, and pay attention to moisture. Periodic observation and record of the treatment of the starting days of germination, germination rate and germination period, the same statistical methods and dredging treatment. Seed germination germ excavated 0.5cm prevails.

Data processing and chart making were carried out by EXCEL software, and variance analysis was carried out using SPSS13.0 software (P= 0.05 level).

3. Results and Analysis

3.1. Effects of Different Treatments on Rooting of Fengdan Seeds

As shown in Table 1, at the same GA3 concentration, the initiation time of the root of the stalks was the earliest of the cocoanut straws, the second was the wet sand, and the last was the peat. The rooting period was the shortest of the coconut bran, followed by the wet sand , While the peat was the longest. The rooting rate, the longest root length and the average root length of the seeds were the best in wet sand sedimentation, which was significantly higher than that in coco peat and peat.

With the increase of GA3 concentration, the root initiation time and root length of the seedlings of P. phoenixensis shrank continuously with the increase of GA3 concentration, especially the rooting time of soaked seeds of 500 mg / L and 700 mg / L GA3 solution, Hair root duration was significantly lower than other treatments; While the seed rooting rate, the longest root length and average root length index increased first and then decreased with the increase of GA3 concentration, the maximum value of every index by 500mg/LGA3 seed treatment, and was significantly higher than other treatments 500mg/L GA3 soaking seeds in wet sand, rooting rate, root length and average root length were significantly higher than the coir and peat layer. Thus 500mg/L GA3 + treatment soaking wet sand can effectively promote seed radicle growth.

Table1. *Influence of different treatment on rooting of Fengdan seeds*

Different treatment（48h）		Hair root start days（d）	Hair root process（d）	Hair root rate（%）	The longest root length（cm）	Average root length（cm）
matrix	Gibberellin （GA_3） concentration /(mg/L)					
Wet sand plot	CK	47a	53a	32.3d	3.20d	2.05c
	100	38b	42b	56.0c	5.50c	2.11c
	300	34b	32c	68.3b	9.20b	3.43b
	500	27c	22d	83.0a	12.00a	6.64a
	700	25c	19d	60.0c	8.00b	2.27c
Peat stratification	CK	47a	54a	25.6d	2.40b	1.45d
	100	37b	47b	48.8c	3.70b	2.32c
	300	37b	36c	54.0c	3.80b	3.76b
	500	31c	28d	72.8a	7.10a	4.97a
	700	27c	22e	66.3b	6.20a	2.43c
Coconut bran layer	CK	39a	48a	26.3e	2.20b	1.70d
	100	34b	31b	40.0d	3.10b	2.85d

product	300	31c	25c	62.5b	5.20a	3.80b
	500	24d	19d	74.7a	6.20a	5.36a
	700	23e	17d	54.0c	5.80a	2.03c

Note: *The results for the three replicate average, with different letters marked numbers at the P = 0.05 significant difference in level, with a, b, c ... ... said the difference between the different concentrations of gibberellic acid, the same below.*

3.2. Different Treatments on the Seedling of Feng Dan Affect

As shown in Table 2, the seed germination rate of P. phoenixensis with 0.5-3 cm root length was very low. The germination rate of the wet sand layer with 300 mg / L GA3 treatment was the highest (38.5%), significantly lower than that of the roots with the length of ≥3 cm Germination rate (85.4%). It can be seen that the length of the endoderm is the key factor affecting the germination of Fengdan seeds.

At the same concentration of GA3, the initiation time and the germination period of the seeds were different due to the influence of different stromal stratification, the coconut bran was the shortest, followed by the peat and the wet sand was the longest. However, the seed germination rate was significantly higher than that of coconut bran and carbon.

Under the same substrate stratification, with the increase of GA3 concentration, the rooting time and the duration of rooting of the *Paeonia ostii* 'Fengdan' seeds were shortened, significantly lower than CK. The germination rate of seed germination was significantly higher than that in control, especially in 300 mg/L GA3. The germination rate of seeds was significantly higher than that of other treatments, indicating that GA3 could effectively shorten the germination period of Fengdan seeds and raise germination rate. The results showed that the germination rate of the seed germination of 300 mg/L GA3+ wet sand layer was the highest, at 85.4%, and the seed germination was the best.

Table2. *Effects of different treatments on rooting of Paeonia ostii 'Fengdan' seeds*

Root length（cm）	**Different processing**		**Germination number of days（d）**	**Sprouting history（d）**	**Germination rate（%）**
	The substrate	**gibberellin（GA_3）concentration /(mg/L)**			
0.5cm≤Root length＜3cm 2h	Wet sand plot	CK	0	0	0
		100	47	8	7.7
		200	47	10	15.4
		300	47	7	38.5
		400	35	5	23.1
	Peat stratification	CK	0	0	0
		100	0	0	0
		200	0	0	0
		300	47	5	8.2
		400	0	0	0
	Coconut bran layer product	CK	0	0	0
		100	0	0	0
		200	0	0	0
		300	0	0	0
		400	17	4	7.5
Root length≥3cm 2h	Wet sand plot	CK	47a	45a	23.4e
		100	32b	43b	50.0d
		200	25c	43b	61.8c
		300	25c	38c	85.4a
		400	17d	26d	73.0b
	Peat stratification	CK	45a	42a	10.0e
		100	38b	35b	33.0d
		200	21c	32b	43.3c
		300	13d	25c	70.6a
		400	10e	21c	53.0b
	Coconut bran layer product	CK	40a	45a	30.0e
		100	32b	37b	47.5d
		200	21c	27c	53.0c
		300	10d	23d	72.7a
		400	6d	16e	66.3b

4. Discussion

Fengdan seeds have a long dormant period under natural conditions, and the germination of the seeds can take up to six months, and the germination rate is low. Feng Dan seeds by GA3 solution + matrix laminated processing, advance your time of seed to take root, and rooting rate increased significantly, especially in the 500 mg/L GA3 solution immerse 48 h after wet sand bed and only 27 d product to take root, 22 d after rooting rate can reach 83.0%, significantly higher than the control. The main reason for the dormancy of Fengdan seeds is the physiological and the presence of the substances that inhibit the germination of the seeds. GA3 solution can promote physiological seed ripening [6] and change the content of endogenous hormones to promote seed dormancy [7-8]. The results also showed that GA3 solution had a positive effect on breaking dormancy of the hypocotyls of *Paeonia ostii* 'Fengdan' seeds, and GA3 solution + matrix stratification synthesis method effectively shortened the rooting process and improved the rooting rate of the seeds; however, the concentration of GA3 solution Compared with the previous studies, 500mg / L GA3 solution (immersion 48h) with wet sand stratification for the best treatment of the rooting of the seed of the Fengdan.

The best solution to the hypocotyls dormancy release was found in this study. The optimal seed germination time was 300mg / LGA3 (soaked 2h) Up to 85.4%, significantly higher than the control.

In production, it is recommended that the phoenix Dan seed should be first to 500 mg/L GA3 solution (soaking 48 h) + wet sand bed charge of root, and root length reaches more than 3 cm, and then to 300 mg/LGA3 immerse (2 h) + wet sand ground treatment, can make the seed germination rate is far higher than that of sowing the seeds of natural conditions, germination time reduced to around 112 d. But Ma Xincai have proved, after 24h treatment with 100~200mg/LGA3 solution, the effect of *Paeonia suffruticosa* seeds germination was the best [9]; Liu Xiuxian, proved *Paeonia delavayi* seeds in the constant temperature of 15 DEG C under the condition of 400mg/L GA3 solution 24h rooting effect best, root length more than 3cm of Fengdan at 20 DEG C under the condition of constant temperature, with 200mg/L GA3 the solution after 2H treatment were the most effective; Ni Shengwu that purple peony seeds soaked in 500mg / L of GA3 solution for 48h after soaking peat layer base, root length greater than 3cm seeds treated with 200mg / L GA3 solution for 2h at room temperature after the best germination effect [3]. There are some differences with the conclusion of this experiment, which may be influenced by the differences of peony varieties, and have some relations with the characteristics of the seed coat of different peony varieties and the differences of the substances contained in embryos. It needs further study.

5. Conclusion

The results showed that 500mg / L GA3 solution (immersion 48h) after wetting stratification for the root, the best and the highest rooting rate. When the root length reached more than 3cm, wet sand layer treatment was conducted after 300mg / L GA3 (soaking for 2h), which could shorten the seed germination time and increase the germination rate. It can be seen that the germination technology has achieved the purpose of further shortening the germination time of the seeds and improving the germination rate, and providing technical support for the large-scale production of the fenugreek seeds.

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References

[1] Li Jiayu, He Lixia, Chen Dezhong. Chinese peony varieties map northwest. Southwest. Jiangnan volumes [M] Beijing: China Forestry Publishing House, 2005.

[2] Song Xingrong. Flower Plant Handbook [M]. Sichuan Science and Technology Press, 2005.

[3] NI Sheng-wu, WANG Lian-ying .Studies on Seed Characteristics and Germination of Pistacia chinensis. *Annual Meeting of China Horticultural Society Ornamental Horticulture Committee*, 2008,189-192.

[4] Zheng Xiangmu, Zhou Ruanbao, Gu Liping. Study on the dormancy and germination characteristics of the seeds of Fengdan. *Plant Physiology*, 1995, 31 (4): 260-262.

[5] Liu Xiu-Xian, Zhang Yan-Li, Ma Hong, et al.Study on the effect of dormancy release in the seed of Peony

.*Seeds*, 2013, 32 (2): 9-12.

[6] GUO Li-Ping, ZHANG Yan-Long, NIU Li-Xin, et al.Study on dormancy characteristics of Fengdan seeds. *Journal of Northwest Forestry University*, 2016, 31 (4): 165-169.

[7] Xu Kai, Sun Qixiang.Studies on dormancy and germination of chestnut seeds. *Chinese Agricultural Science Bulletin*, 1998,14 (1): 24-25,

[8] Ma Xincai, Ren Youhua, Lei Shijun, et al.Effect of gibberellic acid, naphthalene acetic acid and ethephon on the germination of dried peony seeds. *Weifang Higher Vocational Education*, 2005, 1 (1): 58-60 Liu Yongqing, Luo Zemin. Physiological Regulation of GA3 and ABA on Germination of Tomato 7-271. Seeds .*Chinese Journal of Horticulture*, 1995, 22 (3): 26

[9] Liu Yongqing, Luo Zemin. Physiological Regulation of GA3 and ABA on Germination of Tomato 7-271. Seeds .*Chinese Journal of Horticulture*, 1995, 22 (3): 26

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