e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:05/Issue:10/October-2023 Impact Factor- 7.868 www.irjmets.com

INFLUENCE OF SEED STORAGE PERIOD AND PRE-GERMINATION TREATMENTS ON VIABILITY AND VIGOUR OF PASSION FRUIT (*PASSIFLORA EDULIS* VAR *FLAVICARPA*) SEEDS

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DOI : https://www.doi.org/10.56726/IRJMETS45211

ABSTRACT

The period of seed viability for the majority of passiflora species is unknown and the prolonged period of natural or induced dormancy make seed germination slow and unevenness. Hence, an experiment was conducted to study the influence of seed storage period and pre-germination treatments on viability and vigour of passion fruit seeds . The study revealed that seeds sown after 15 days of storage significantly recorded higher seed quality parameters like shoot length (11.58 cm), root length (4.92 cm), fresh weight of the seedling (78.79 mg), dry weight of the seedling (8.27 mg), seedling vigour index-I (901) and seedling vigour index-II (458.96) which reduced with different storage period. Irrespective of seed storage period, seeds treated with thiourea 1 per cent for 10 minutes resulted in more germination percentage and seedling quality parameters followed by seeds treated with GA_3 250 ppm for 10 minutes.

Keywords: Passion Fruit, Pre-Germination Treatments. Viability, Germination, Vigour, Storage. Dormancy, Recalcitrant.

I. INTRODUCTION

Passion fruit is botanically called as *Passiflora edulis* belongs to the family passifloraceae and found in tropical America (Brazil). It is known for its wonderful aroma, flavor and medicinal as well as nutritional importance. Fruits are rich in copious amount of Vitamin A, Vitamin C and mineral salts. It is commercially cultivated in countries like Kenya, Australia, New Zealand, Hawaii, South Africa and Srilanka (Sema and Maiti, 2009).

The genus passiflora comprising about 500 species, out of which 50 species bears edible fruits. But only two species are commercially cultivated *i.e, Passiflora edulis var edulis* (Purple passion fruit) and *Passiflora edulis var flavicarpa* (Yellow passion fruit). Some of the other important species are *P. quadrangularis*, *P. incarnata*, *P. ligularis*, *P. laurifolia* are cultivated in limited scale for local consumption (Ramaiya *et al*., 2018). The most common diseases are anthracnose, dieback, and root rot. Dieback is caused by a variety of organisms and can result in the death of branches. The management of dieback was all stages of observation was to be done. Similarly the per cent disease index recorded in other crops on die back of chilli revealed that significantly least per cent disease index (Kareem *et al*,2016 a) for die back and chlorothalonil spray for fruit rot (Kareem *et al,* 2016 b). Since the crop is a traditional one, many possibilities of exploring this like the characterization of the plants at different geographical location by chemical markers can be a tool (Masuthi *et al,* 2015a),physical characterization (Shridhar *et al,* 2019), genetic diversity (Sulochana *et al*, 2018), different priming treatments for better germination ((Masuthi *et al,* 2015b), storage studies to retain and make available the viable seed (Bhavya *et al,* 2017), Influence of pre-germination treatments on germination, growth and vigour (Pallavi *et al,* 2022) , and Influence of pelleting with micronutrients and botanical on growth, seed yield and quality of vegetable cowpea (Masuthi *et al,* 2009), can be the other potential works on this crop that can be explored.

Thirty to forty per cent juice content extracted from passion fruit can be consumed fresh, used as concentrate or as flavour in some foods (Alegbejo, 2004). The fruit is eaten alone or in fruit salads, *sherbet*, ice cream, jams,

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cool drinks. The yellow variety is used for juice processing whereas, the purple type has been sold in fresh fruit markets. The fruit has been used by the Brazilian tribes as a heart tonic as their favourite drink called maracuja grande that is commonly used to treat asthama, bronchitis, whooping cough and other tough coughs. The fruit still occupies a prominent place in South American and Peruvian traditional medicine.

The rind is used in cattle and pig feed, the glycoside passiflorine which is extracted from dried flowers used as a sedative or tranquilizer. The fruit juice acts as a digestive stimulant, treatment for gastric ulcer, urinary infections and as mild diuretic. Besides, the oil extracted from the passion fruit seeds has properties which is similar to sunflower and soybean oil, is edible and has industrial importance (Baiyeri *et al*., 2011).

In India however, the cultivation of passion fruit is confined to limited area due to lack of awareness about crop and also lack of planting materials. To increase the productivity, there should be availability of good quality planting material along with proper management practices. The vine can be propagated sexually through seeds and asexually through cuttings, layering, grafting and tissue culture, however in most cases through seeds. It ensures plant health as crop diseases are not transmitted by seeds. Seed propagation is also recommended for rootstock production and plant breeding program focused on disease-resistant and drought-tolerant hybrids with medicinal and ornamental use.

The germination of passion fruit seeds is less and uneven which may be due to physical (integument impermeability to water and gas), chemical (presence of inhibitory substances), physiological immaturity (mechanisms of germination inhibition), embryo immaturity (Favaris *et al*., 2020). Pre-germination treatments may enhance the germination potential of passion fruit seeds.

Passion fruit seeds can present different forms and levels of dormancy and cases in which more than one type occurs are known as complex dormancy (Delanoya *et al*., 2006) and the period of seed viability for the majority of passiflora species is unknown and the prolonged period of natural or induced dormancy make seed germination slow and unevenness. Hence, the investigation was carried out at Department of Fruit Science, Kittur Rani Channamma College of Horticulture, Arabhavi to study the influence of seed storage period and pre-germination treatments on viability and vigour of passion fruit seeds.

II. MATERIAL AND METHODS

2.1 Details of the experimental site

The experiment was conducted at the K.R.C. college of Horticulture, Arabhavi, of the University of Horticultural sciences, Bagalkot, in Karnataka, India. Arabhavi is situated in Northern dry Zone of Karnataka state (Zone NO.3, Region-2) at 16°15' N latitude and 74°45' E longitude, 612 m above mean sea level. The experimental sites receive, on an average, about 550 mm rain annually.

2.2 Experimental details

The present investigation was carried out during the year 2020- 2021 at K.R.C. College of Horticulture, Arabhavi in Belgaum district of Karnataka. The experiment was laid in factorial completely randomized design with two factors (Seed storage period and pre-germination treatments. Required amount of seeds were collected, dried and packed in polythene bag and stored in deep freezer condition.

2.3 Treatment details:

Factor A: Seed storage period

S_1: Seeds sown after 15 days of storage

S_2: Seeds sown after 30 days of storage

S_3: Seeds sown after 45 days of storage

S_4: Seeds sown after 60 days of storage

Factor B: Pre-germination treatments

T_1: Thiourea (1 %) for 10 minutes

T_2: GA_3 (250 ppm) for 10 minutes

T_3: Seeds immersed in hot water at 50°C for 10 minutes

T_4: Soaking of seeds in sulphuric acid (98 %) for 4 minutes.

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T_5: Soaking of seeds in lemon juice for 15 hrs.

T_6: Soaking of seeds in sucrose solution (10 %) for 7 days

T_7: Control

After the application of different treatments, seeds were sown in paper towel method. In this method, the seeds were placed in between the paper which was pre-moistened with distilled water and rolled. These rolled papers were kept at seed germinator which was maintained at temperature of 25 ± 2ºC with 80-85 per cent relative humidity. The germination percentage was worked out after complete germination, i.e., after stoppage of germination. It was calculated by dividing total number of seeds sown with the number of seeds germinated and was multiplied by 100. Shoot length, root length, Fresh weight and dry weights of seedlings were also recorded. Seedling vigour was calculated based on the following formula (Bewley and Black, 1982).

Vigour index I = Per cent germination × Length of seedling

Vigour index II = Per cent germination × Total dry weight of seedling

III. RESULT AND DISCUSSION

Shoot length

The investigation revealed that seeds sown after 15 days of storage resulted in highest shoot length (11.58 cm) which decreases with storage days and recorded 10.68 cm, 10.00 cm and 8.75 cm at 30, 45 and 60 days of storage respectively. Among different pre-germination treatments, seeds treated with thiourea 1 per cent for 10 minutes resulted in higher shoot length (12.14 cm) followed by GA_3 250 ppm for 10 minutes (11.24 cm).

Increased shoot length may be attributed to the reason that thiourea stimulates the photosynthetic activities that resulted in vigorous growth and enhancement in shoot length resulting in and better plant growth as reported by (Asthir *et al*., 2013). Similar results were reported by Guarav (2004) in Rangpur lime, Tripathi *et al*. (2006) in walnut.

Root length

The study revealed that seeds sown after 15 days of storage resulted in highest root length (4.92 cm) which decreases with storage days and recorded 4.64 cm, 3.98 cm and 3.48 cm at 30, 45 and 60 days of storage respectively. Among different pre-germination treatments, seeds treated with thiourea 1 per cent for 10 minutes resulted in higher root length (4.64 cm) which was supported by the findings of Guarav (2004) in Rangpur lime and Gurung *et al*. (2014) in passion fruit.

Seedling quality parameters:

The investigation revealed that seeds sown after 15 days of storage resulted in highest fresh weight of the seedling (78.79 mg) which decreases with storage days and recorded 65.65 mg, 60.10 mg and 51.39 mg at 30, 45 and 60 days of storage respectively. Among different pre-germination treatments, seeds treated with thiourea 1 per cent for 10 minutes recorded higher fresh weight of the seedling (75.39 mg).

The study revealed that seeds sown after 15 days of storage resulted in highest dry weight of the seedling (8.27 mg) which decreases with storage days and recorded 6.89 mg, 6.32 mg and 5.40 mg at 30, 45 and 60 days of storage respectively. Among different pre-germination treatments, seeds treated with thiourea 1 per cent for 10 minutes recorded higher dry weight of the seedling (7.91 mg).

The increased fresh and dry weight of seedling may be due to the enhanced root and shoot length. Thus the increase in root and shoot length leads to overall assimilation and redistribution of photosynthates with in the plant and resulted in higher fresh and dry weight of seedling and increased dry matter assimilation (Choudhari and Chakrawar, 1982).

The seedling vigour index-I of the passion fruit seedlings as influenced by different storage days and pre-germination treatments were significantly different and seeds treated with thiourea 1 per cent for 10 minutes which was sown after 15 days after storage resulted in maximum seedling vigour index-I (1407). From this investigation, it can be concluded that seedling vigour index-I value is significant up to 45 days of storage and then drastically reduced, this might be due to sudden decrease in germination percentage. Seedling vigour index-I which was a product of per cent germination and seedling height was found to be highest in thiourea treatment. This might be due to increased germination percentage and seedling height which have contributed

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to higher seedling vigour index-I. The seedling vigour index-II of the passion fruit seedlings as influenced by different storage days and pre-germination treatments were significantly different and seeds treated with thiourea 1 per cent for 10 minutes which was sown after 15 days after storage resulted in maximum seedling vigour index-II (82.38). In this study, it can be concluded that seedling vigour index-II value is significant up to 45 days of storage and then drastically decreased, this might be due to sudden fall in germination percentage. Seedling vigour index-II which was a product of per cent germination and dry weight of the seedling was found to be maximum in thiourea, the reason might be due to the increased dry matter production in the concerned treatments (Rajamanickam *et al*., 2002).

Table 1: Effect of different storage days and pre-germination treatments on shoot length (cm) and root length (cm) of passion fruit seedling

Shoot length (cm)						Root length (cm)				
Treatments	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
T_1	13.64	12.24	11.44	11.26	12.14	5.21	5.04	4.21	4.08	4.64
T_2	12.35	11.60	11.56	9.47	11.24	5.03	4.77	4.31	3.84	4.49
T_3	10.92	10.24	10.17	8.56	9.97	5.01	5.01	3.97	2.94	4.23
T_4	9.54	9.52	8.59	7.33	8.80	4.46	3.88	3.00	2.90	3.56
T_5	11.88	11.61	10.30	8.95	10.69	5.17	4.85	4.36	3.67	4.51
T_6	12.57	9.80	8.36	8.14	9.72	4.90	4.70	4.27	3.60	4.37
T_7	10.19	9.75	9.59	7.55	9.22	4.63	4.26	3.77	3.36	4.01
Mean	11.58	10.68	10.00	8.75	-	4.92	4.64	3.98	3.48	-
For comparing means			S.Em±	CD @ 1 %			For comparing means	S.Em±	CD @ 1 %	
Treatments (T)			0.19	0.73			Treatments (T)	0.13	0.50	
Storage days (S)			0.25	0.97			Storage days (S)	0.17	0.66	
Interaction (T×S)			0.50	NS			Interaction (T×S)	0.34	NS	

Table 2: Effect of different storage days and pre-germination treatments on fresh wight (mg) and dry weight (mg) of passion fruit seedling

fresh wight (mg)						**Dry weight (mg)**				
Treatments	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
T_1	97.46	76.50	68.54	59.07	75.39	10.25	8.01	7.19	6.20	7.91
T_2	79.03	76.42	66.57	57.53	69.88	8.29	8.03	7.04	6.04	7.35
T_3	76.15	58.13	54.55	52.66	60.37	7.99	6.11	5.73	5.53	6.34
T_4	55.16	54.05	43.66	29.53	45.60	5.69	5.67	4.59	3.10	4.76
T_5	86.27	70.92	68.40	55.27	70.21	9.08	7.44	7.18	5.80	7.37
T_6	83.01	66.61	65.13	54.05	67.20	8.71	6.99	6.83	5.68	7.05
T_7	74.43	56.93	53.88	51.61	59.21	7.84	5.97	5.66	5.42	6.22
Mean	78.79	65.65	60.10	51.39	-	8.27	6.89	6.32	5.40	-
For comparing means			S.Em±	CD @ 1 %			For comparing means	S.Em±	CD @ 1 %	
Treatments (T)			1.80	7.05			Treatments (T)	0.20	0.77	
Storage days (S)			2.38	9.32			Storage days (S)	0.26	1.02	
Interaction (T×S)			4.76	NS			Interaction (T×S)	0.52	NS	

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Volume:05/Issue:10/October-2023 Impact Factor- 7.868 www.irjmets.com

Table 3: Effect of different storage days and pre-germination treatments on seedling vigour index-I and seedling vigour index-II of passion fruit seedling

	fresh wight (mg)					Dry weight (mg)				
Treatments	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
T_1	97.46	76.50	68.54	59.07	75.39	10.25	8.01	7.19	6.20	7.91
T_2	79.03	76.42	66.57	57.53	69.88	8.29	8.03	7.04	6.04	7.35
T_3	76.15	58.13	54.55	52.66	60.37	7.99	6.11	5.73	5.53	6.34
T_4	55.16	54.05	43.66	29.53	45.60	5.69	5.67	4.59	3.10	4.76
T_5	86.27	70.92	68.40	55.27	70.21	9.08	7.44	7.18	5.80	7.37
T_6	83.01	66.61	65.13	54.05	67.20	8.71	6.99	6.83	5.68	7.05
T_7	74.43	56.93	53.88	51.61	59.21	7.84	5.97	5.66	5.42	6.22
Mean	78.79	65.65	60.10	51.39	-	8.27	6.89	6.32	5.40	-
For comparing means			S.Em±	CD @ 1 %			For comparing means	S.Em±	CD @ 1 %	
Treatments (T)			1.80	7.05			Treatments (T)	0.20	0.77	
Storage days (S)			2.38	9.32			Storage days (S)	0.26	1.02	
Interaction (T×S)			4.76	NS			Interaction (T×S)	0.52	NS	

IV. CONCLUSION

Seed viability can be maintained maximum up to 45 days of storage when seeds of passion fruit are stored in refrigerated condition and germination percentage can be enhanced by treating seeds with thiourea at 1 per cent for 10 minutes.

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