Environment and Ecology 40 (4B) : 2369—2373, October–December 2022
ISSN 0970-0420

Evaluation of Seed Dormancy Duration in Selected Land Races of Rice (*Oryza sativa* L.)

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Received 25 July 2022, Accepted 26 September 2022, Published 10 November 2022

ABSTRACT

The clean seeds of 31 paddy landraces produced during *kharif* 2021, depicted difference in dormancy duration ranging from 0-83 days. The 31 paddy landraces were divided into five groups duration of their dormancy: Very weak (14 days), weak (14–21 days), moderate (21–27 days), strong (28–35 days), and very strong (>35 days). The landraces (Jasmine, Ratnachudi, Najarbad, Rajabhoga, Gandhasale, Bangarasanna, Champakali, Dappavalya, Madrassanna, Karigajavale, Karijiddu, Neregulibhatta, Jeerigesanna, Gilisale, Mysurumallige, Rajamudi, Barmablack, Doddabairunellu, Kempusale, Kempujiddu and Anekombinabhatta) had seed dormancy duration of > 35 days followed by Gowrisanna, Kiruvani, Ratnasagara, Ambemohari and MTU-1001 with a dormancy of 28-35 days while, Puttabhatta had dormancy more than 21 days. Remaining landraces viz., Raichursanna exhibited weak dormancy and Navara, Jyothi and Misebhatta possess very weak dormancy. In order to use them as donors in the upcoming rice development program, the study concentrates on the fact that landraces exhibit a wide range of dormancy.

Keywords Landraces, Seed dormancy, Duration, Rice.

INTRODUCTION

Paddy is the second most widely consumed cereal in the world next to wheat. It is the staple food for two thirds of the world's population (Kumari *et al*. 2014). Paddy occupies a pivotal role in Indian agriculture. It is the staple food for more than 70% Indians and a source of livelihood for 120-150 million rural households. It supplies more than half of the required daily caloric intake and is regarded as the most affordable source of protein, energy, and nourishment in developing nations. Given that it is grown in nearly all of its states, India ranks second in the world for paddy production. Major Rice producing states in India are West Bengal, Uttar Pradesh, Punjab, Andhra Pradesh, Odissa, Tamil Nadu and Madhya Pradesh. In world rice is grown in an area of 167.1 million hectares with the production and productivity levels of 782 million tonnes and 4678 kg per hectare, respectively. In India, rice is grown in an area of 44.15 million hectares

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with the production and productivity levels of 116.47 million tonnes and 2638 kg per hectare, respectively. In Karnataka rice is grown in an area of 1.13 million hectares with the production and productivity levels of 3.43 million tonnes and 3012 kg per hectare, respectively (Anon 2020). Dormancy is problematic in agriculture as it affects plant establishment but it is the ability of the seeds to delay their germination until the time and place are right reflecting an important survival mechanism in plants. Dormancy is one mechanism by which seeds maintain their viability in unfavorable conditions. In spite of this advantage dormancy creates problems for seed analysts and seed producers, especially when the germination percentage of seed lot must be determined in a few weeks after harvesting. Sometimes even if the seeds germinate readily at harvest, due to unfavourable environmental conditions during storage or germination, secondary dormancy may develop. Variation in seed dormancy has been reported in different varieties of paddy (Padma and Reddy 2000). Dormancy had emerged as a significant factor in modern rice, as larger area is under monsoonic conditions. Therefore, development of varieties possessing dormancy is envisaged as a major research strategy. Despite several attempts made in the past to identify strong dormant lines among developing germplasm to suit to the demands of the coastal belts and cyclone affected regions especially during grain ripening in wet season, majority seemed to be either weakly or moderately dormant. It has become necessary to study the duration of dormancy period for the farmer who takes up seed production or crop production. Keeping above facts in mind the present study was undertaken to study the mechanism and duration of dormancy in paddy landraces (Vasudevan *et al.* 2014).

MATERIALS AND METHODS

The laboratory and field experiments of the present investigation were conducted at Department of Seed Science and Technology, GKVK, Bangalore and OFRC, KSNUAHS, Navile, Shivamogga during the *kharif*, 2021-22. The freshly harvested 31 paddy landraces (Jasmine,Ratnachudi,Najarbad, Rajabhoga, Gandhasale, Bangarasanna,Champakali, Dappavalya, Raichursanna, Madras sanna , Karigajavale, Karijiddu, Neregulibhatta, Puttabhatta, Jeerigesanna, Gilisale, Mysurumallige, Rajamudi, Gowrisanna, Barmablack, Doddabairunellu, Kempusale, Navara, Kempujiddu, Anekombina bhatta, Kiruvani, Rathnasagara, Misebhatta, Ambemohari, Jyothi and MTU-1001) were used in present investigation. The landraces were tested in CRD design (Sundaraju *et al.*1972) during *kharif* 2021. Between paper methods of germination test as prescribed by the International Seed Testing Association (ISTA 2013) was followed. Four replication of 100 seeds were randomly counted and placed on the germination paper at uniform spacing of 25 mm between seeds in row. The rolled paper towels with seeds were secured at both the ends with rubber bands and placed vertically in cabinet of seed germinator by maintaining a constant temperature of 25±1 °C and relative humidity of 90%. The germination was recorded on 14th day and based on normal seedlings produced (Vasudevan *et al.* 2014).

Duration of dormancy

Germination being noted systematically at weekly interval from harvest up to the stage where the germination reached to minimum seed certification Standard (80%). The dormancy duration was computed as the period from harvest till the germination reached to 80 % in each entry. Based on dormancy duration, the 31 paddy landraces were classified into five categories viz., very weak (<14 days), weak (14-20 days), moderate (21-27days), strong (28-35 days) and very strong (>35 days).

RESULTS AND DISCUSSION

The duration of dormancy in 31 paddy landraces including 2 checks ranged from 0 to 83 days with an initial germination percentage of 10 to 96, when they were tested immediately after harvest (Tables1-2). Based on, this dormancy was classified as very weak dormancy, weak dormancy, moderate dormancy, strong dormancy and very strong dormancy. Among the 31 paddy landraces including 29 checks, 2 landraces and 1 check (Navara, Misebhatta and Jyothi) as very weak dormancy, one landrace (Raichursanna) as weak dormancy (3 weeks) (Fig.1), 1 landrace (Puttabhatta) as medium dormancy (4 weeks), 4 landraces and 1 check variety (Gowrisanna, Kiruvani, Ratnasagara, Ambemohari and MTU-1001) as strong

Table 1. Classification of landraces of rice dormancy duration.

Sl. No.	Class of dormancy	No. of land races	Land races
1	Very week (< 14 days)	3	Navara, Jyothi and Misebhatta
2	Weak (14-20 days)	1	Raichur sanna
3	Medium (21-27days)	1	Puttabhatta
4	Strong (28-35 days)	5	Gowrisanna, kiruvani, ratnasagara, ambemohari and MTU-1001
5	Very strong > 35 days	21	Jasmine,Ratnachudi,Najarbad,Rajabhoga,Gandhasale,Bangarasanna, Champakali, Dappavalya,Madrassanna, Karigajavale, Karijiddu, Neregulibhatta, Jeerigesanna, Gilisale, Mysurumallige, Rajamudi, Barmablack, Doddabairunellu, Kempusale, Kempujiddu and Anekombinabhatta

dormancy (5 weeks) and remaining landraces (Jasmine, Ratnachudi, Najarbad, Rajabhoga, Gandhasale, Bangarasanna, Champakali, Dappavalya, Madrassanna, Karigajavale, Karijiddu, Neregulibhatta, Jeerigesanna, Gilisale, Mysuru mallige, Rajamudi, Barmablack, Doddabairunellu, Kempusale, Kempujiddu and Anekombina bhatta) as very strong dormancy (Fig.2). The findings were supported by (Kanyeka 2006 and Ilyas Dan and Diani 2007 in rice). The highest dormancy duration of 83 days was observed in two landraces viz., Madrassanna and Doddabirunellu and no observed dormancy was absent in landraces. Similar work was agrees largely with previous reports that rice in general have dormancy from weak to strong (Padma and Reddy 2000).

Fig. 1. Non-dormant seeds.

Table 2. Dormancy duration in landraces of rice (days).

Sl. No.	Landraces of rice	No. of days taken for breaking the dormancy (days)
1	Jasmine	55.00
2	Ratnachudi	47.89
3	Najarbad	75.94
4	Rajabhoga	68.00
5	Gandhasale	75.17
6	Bangarasanna	47.83
7	Champakali	68.11
8	Dappavalya	48.00
9	Raichura sanna	20.00
10	Madrassanna	83.06
11	Karigajavale	48.00
12	Karijiddu	54.00
13	Neregulibhatta	46.83
14	Putta bhatta	27.00
15	Jeerigesanna	69.00
16	Gilisale	67.89
17	Mysurumallige	76.00
18	Rajamudi	55.83
19	Gowrisanna	34.00
20	Barmablack	48.83
21	Doddabairunellu	83.00
22	Kempusale	41.89
23	Navara	14.00
24	Kempujiddu	41.06
25	Anekombinabhatta	47.89
26	Kiruvani	27.83
27	Rathnasagara	28.00
28	Misebhatta	13.94
29	Ambemohari	34.00
30	Jyothi	13.94
31	MTU-1001	34.94
	SEm±	1.09
	CD @ 5%	3.09
	CV (%)	3.92
	F-test	Significant

Fig. 2. Dormant seeds.

The allelic character of the seeds may be the reason of the variation in dormancy in paddy landrace (Shabaq 2013 in loquat), variations in dormancy, how the environment affects how genetic competency are exhibited, how water cannot penetrate the seed coat, and how germination promoters and inhibitors are controlled in the seed (Hanzi *et al.* 2014 in Arabidopsis) and Hard seededness, silica content, the presence of growth inhibitors like ABA, chlorogenic acid, and paraascorbic acid, as well as mechanical prudence by the seed parts are structural characteristics that strongly impact the antagonistic activity and progression of the biological processes involved in germination and seedling development (Arya and Ragini 2017 in *Psoralea corylifolia* L, Aida Yuningsih and Wahyuni 2015 in rice).

CONCLUSION

A significant variation was found among all the landraces evaluated for dormancy duration. Based on results obtained on dormancy three (Navara, Jyothi and Misebhatta) landraces were classified as very weak, one landrace (Raichursanna) as weak, one landrace (Puttabhatta) as Medium, five landraces (Gowrisanna, Kiruvani, Ratnasagara, Ambemohari and MTU-1001) as strong and twenty one landraces (Jasmine, Ratnachudi, Najarbad, Rajabhoga, Gandhasale, Bangarasanna, Champakali, Dappavalya, Madrassanna, Karigajavale, Karijiddu, Neregulibhatta, Jeerigesanna, Gilisale, Mysurumallige, Rajamudi, Barmablack, Doddabirunellu, Kempusale, Kempujiddu and Anekombinabhatta) had very strong dormancy.

The present study would be of immense help to the seed producer in planning seed production program for these landraces in various paddy areas in particular and for crop breeders in general in order to exploit these landraces in crop improvement program to incorporate this trait into the well-known landraces which do not possess dormancy to overcome the problem of precocious germination (Vivipary) or complications with growing that occurred before and after harvest. To serve as potential donors in the rice intensification program in the future, this would aid in improving this valuable character trait in the promising cultivars. Since both dormant and non-dormant seeds are useful in seed production program, it is obvious that a better understanding of the genetic controls of dormancy is desired.

ACKNOWLEDGEMENT

We thank Co-ordinator, Organic Farming Research Center and Special officer (Seed), Seed Unit, ZAHRS, KSNUAHS, Navile, Shivamogga for providing necessary facilities and other co-workers for their hard work and commitment while providing technical assistance in the research.

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