International Journal of Botany Studies
www.botanyjournals.com
ISSN: 2455-541X
Received: 28-12-2021, Accepted: 12-01-2022, Published: 28-01-2022
Volume 7, Issue 1, 2022, Page No. 562-566

Effect of pre-sowing seed enhancement techniques in rice (*Oryza sativa* l.) var. ADT 43

Sivalingam T[1*], Balasubramanian A[2], Gobi R[2], Sathiyamurthi S[3]

[1] Research Scholar, Department of Agronomy, Faculty of Agronomy, Annamalai University, Annamalainagar, Tamil Nadu, India

[2] Assistant Professors, Department of Agronomy, Faculty of Agronomy, Annamalai University, Annamalainagar, Tamil Nadu, India

[2] Assistant Professor, Department of Soil Science and Agricultural Chemistry, Faculty of Agronomy, Annamalai University, Annamalainagar, Tamil Nadu, India

Abstract

A laboratory experiment was conducted to study the "Effect of Pre-Sowing Seed Enhancement Techniques in rice ADT 43 (*Oryza sativa* L.)" at Dept. of Agronomy, Annamalai University during 2021. The present investigation was carried out in completely randomized block design which consists of 16 treatments with 3 replications. The treatments contains soaking the seeds in various pre sowing seed priming chemicals *viz.,* water, 1% KCl, 3% $ZnSO_4$, 40ppm GA_3 and 1% Pungam leaf extract, were tested with different soaking duration (24, 30 and 36hr) and control. The results of the findings revealed that, the treatment T_5-1% KCl (24hr) recorded higher germination percentage (95.23 %), speed of germination (29.03), seedling length (29.46 cm), dry matter production (0.43 g seedling^{-10}), vigour index I (3029) and vigour index II (40). Lower seed quality and seedling characters were recorded in control (T_1) treatment.

Keywords: seed priming, KCL, $ZNSO_4$, GA_3, pungam leaf extract, soaking period

Introduction

Rice *(Oryza sativa L.)* is one of the most important extensively cultivated cereals in the world. It is the major source of food for nearly half of the world's population (Kumar *et al.*, 2008), contributing to 43% of total food grain production and 46% of total cereal production in India and obviously, it plays a major role in the national food grain supply. It has been estimated that demand for rice in 2025 will be around 140 million tonnes. Rice contributes about 20% to the agricultural gross domestic product (AGDP) and almost 7% to GDP. It is cultivated in 43.24 % of the total cereal covered area, with average productivity of 3.76 metric tons per hectares (Sabita Ghimire *et al*., 2021) [7]. In India total rice cultivated area is around 99 million hectares and annual production of 110 million tonnes. In India, major rice cultivating states are West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab and Tamilnadu. Tamil Nadu share around 1.72 m.ha with an annual production of 7.12 m.t. Seed plays a major role in agriculture for both production and consumption purpose. Availability of vigorous seed is one of the major problem for achieving higher production. Seed priming is a technique that may boost the germination percentage, speed and uniformity of germination in rice seeds. Seed priming is based on seed imbibition, which can be divided into three phases: the imbibition phase - which allows the seed to imbibe water to activate enzyme activity; the activation phase, during which, food reserve degradation, cell membrane reorganization and starch biosynthesis occur to support root protrusion; the third phase is the growth phase, where radicle protrusion can be seen and then root growth and seedling growth continue (Ruttanaruangboworn *et al*., 2017). The favourable effect of seed hardening with different chemicals and organic products was decisively recommended by several scientists for various crops to improve the seed yield and quality (Satheesh Kumar *et al.,* 2019). Seed hardening for 24hr not only improved the growth of nursery seedlings but also the subsequent growth, yield, and quality of both coarse and fine rice in transplanted culture (Farooq *et al.,* 2007). The chemicals frequently used for osmo- hardening are namely NaCl, $CaCl_2$, KH_2 PO_4, K_3 PO_4, KCl, KNO_3, $MgSO_4$, $Mg(NO_3)_2$ etc. These chemical solutions of low water potential enhance the performance of various crops via inducing different metabolic events or by enhancing the synthesis/activity of α-amylase during germination (Lee and Kim, 2000; Anaytullah and Bose, 2007; Mondal and Bose 2012) [2, 9]. The improvements in seedling length (both root length and shoot length) may due to the enhanced metabolic activity and enzyme activity which hydrolysis the stored reserved food material and make available high energy bio molecules and vital components to growing points and also due to the presence of growth promoting substance GA_3, auxin, IAA which induces elongation of cells thereby increasing root and shoot length (Ganesh *et al*., 2013) [6].

Materials and Methods

A laboratory experiment was conducted during 2021 at Annamalai University, Faculty of Agriculture, Department of Agronomy to study the effect of pre-sowing seed enhancement techniques in rice var. ADT 43. This experiment was laid out in completely randomized block design which consists of 16 treatments with 3 replications of various seed enhancement techniques *viz.*, water, 1% KCl, 3% $ZnSO_4$, 40 ppm GA_3, 1% Pungam leaf extract with different soaking duration (24, 30 and 36hr) and control. After pre-soaking treatment the seeds were shade dried for 12hrs under room temperature and dried back to the original moisture content of the seeds. Germination test and speed of germination was conducted with 25 seeds for each treatment by roll towel method at 25 ± 2ºC with 95 ± 2 % relative humidity. At the end of fourteen days, the number of normal seedlings was counted and germination per cent was calculated as per ISTA (1999). Ten normal seedlings were taken at random from each treatment replication-wise to observe root length, shoot length, total seedling length, fresh weight then the seedlings are dried in a hot air oven at 85ºC for 24hr and cooled in a dessicator for recording dry matter production in g.seedlings^{-10}. The vigour index was computed by adopting the procedure of Abdul Baski and Anderson (1973) and expressed as whole number.

Results and Discussion

Seed Quality

All the pre-sowing seed enhancement techniques exerted significant influence on seed quality characters of rice var. ADT 43 (Table.1).

Among the pre-sowing seed enhancement techniques, the treatment with T_5 - 1% KCl (24hr) recorded higher seed quality parameters *viz.*, germination percentage (95.23 %) and speed of germination (29.03) (Fig.1). This might be due to that Potassium chloride has been introduced as the osmoticum to improve the germination, emergence and growth of poaceae plants. Similar result for germination percentage and speed of germination was reported by Elouaer *et al*., (2012) [4]. Lower germination percentage (84.55 %) and speed of germination (18.35) was recorded in the treatment control - (T_1).

Seedling Characters

All the pre-sowing seed enhancement techniques exerted significant influence on seedling characters of rice var. ADT 43 (Table. 2).

Among the treatments, the pre sowing treatment with T_5 - 1% KCl (24hr) recorded higher seedling physical parameters *viz.*, root length (17.73cm), shoot length (11.73cm) and seedling length (29.46cm) (Fig.2a). This might be due halo-priming of seeds in pre-sowing treatments with osmotic solution allows seeds to absorb water, but restricts radicle occurrence through testa until the primed seeds are sown for germination under salt stress conditions. Similar results on increased root and shoot lengths in seeds due to salt priming as compared to non-primed seeds were reported by Demir and Oztokat, 2003. The lower seedling characters *viz.*, root length (17.73cm), shoot length (11.73cm) and seedling length (29.46 cm) was observed under the treatment control (T_1). The same treatment T_5 - 1% KCl (24hr) recorded higher fresh weight (3.39 g seedling^{-10}) and dry matter production (0.43 g seedling^{-10}) (Fig.2b). This might be due to osmo-priming, halo-priming has positive effect on the seed germination and their consequences. They help to release in enzymes and accelerate seed metabolism and physiological activities. These results are coincide with the findings of Toklu *et al.* (2015). The lower fresh weight (1.48 g seedling^{-10}), dry matter production (0.09 g seedling^{-10}) recorded in control (T_1).

Vigour Indices

All the pre-sowing seed enhancement techniques exerted significant influence on vigour indices (Table.3).

Among the treatments, the treatment with T_5 - 1% KCl (24hr) recorded higher vigour index I (3029) and vigour index II (40). This might be due to that primed seeds showed better germination pattern and higher vigour level than non-primed. The similar results were also observed by Pradhan *et al.* (2017) in balckgram. The lower vigour index - I (1662) and vigour index - II (7) were recorded in the treatment control (T_1). These findings corroborates with the findings of Monalisa *et al*. (2017) [10].

Conclusion

In this presence study the pre sowing seed enhancement technique by using 1% KCl with 24hr soaking period recorded higher seed quality, seedling character, and vigour indices. It has been concluded that this technique may be a viable technique in rice for increasing seed quality and vigour index and may be remunerative for rice growers.

Table 1: Effect of pre-sowing seed enhancement techniques on germination percentage and speed of germination of rice var. ADT 43.

Treatment	Germination percentage (%)	Speed of germination
T_1 – Control	84.55 (66.85)	18.35
T_2 – Water (24hr)	86.54 (68.48)	20.39
T_3 - Water (30hr)	86.49 (68.43)	20.33
T_4 - Water (36hr)	86.23 (68.21)	20.05
T_5 - 1% KCl (24hr)	95.23 (77.39)	29.09

T_6 - 1% KCl (30hr)	93.38 (75.09)	27.03
T_7 - 1% KCl (36hr)	92.86 (74.50)	25.9l
T_8 - 3% $ZnSO_4$ (24hr)	90.41 (71.96)	24.04
T_9 - 3% $ZnSO_4$ (30hr)	88.53 (70.20)	22.22
T_{10} - 3% $ZnSO_4$ (36hr)	88.47 (70.16)	22.15
T_{11} – 40 ppm GA_3 (24hr)	88.51 (70.18)	22.18
T_{12} - 40 ppm GA_3 (30hr)	88.45 (70.13)	22.12
T_{13} - 40 ppm GA_3 (36hr)	88.42 (70.11)	22.09
T_{14} - 1% Pungam leaf extract (24hr)	86.57 (68.50)	20.40
T_{15} – 1% Pungam leaf extract (30hr)	86.53 (68.47)	20.30
T_{16} - 1% Pungam leaf extract (36hr)	86.30 (68.27)	20.32
S.E(d)	0.423 (0.382)	0.706
CD(0.05)	0.863 (0.788)	1.439

Table 2: Effect of pre-sowing seed enhancement techniques on root length, shoot length, seedling length, fresh weight, dry weight of rice var. ADT 43.

Treatment	Root length (cm)	Shoot length (cm)	Seedling length (cm)	Fresh weight (g seedlings^{-10})	Dry matter production (g seedlings^{-10})
T_1 – Control	12.63	7.03	19.66	1.48	0.09
T_2 – Water (24hr)	13.67	8.09	21.76	1.93	0.17
T_3 - Water (30hr)	13.62	8.04	21.63	1.88	0.16
T_4 - Water (36hr)	13.60	8.00	21.61	1.83	0.14
T_5 - 1% KCl (24hr)	19.05	12.76	31.81	3.39	0.43
T_6 - 1% KCl (30hr)	17.73	11.73	29.46	3.09	0.38
T_7 - 1% KCl (36hr)	17.21	11.21	28.42	3.05	0.37
T_8 - 3% $ZnSO_4$ (24hr)	16.03	10.29	26.32	2.74	0.32
T_9 - 3% $ZnSO_4$ (30hr)	14.93	9.35	24.28	2.41	0.27
T_{10} - 3% $ZnSO_4$ (36hr)	14.79	9.07	23.86	2.37	0.25
T_{11} – 40 ppm GA_3 (24hr)	14.81	9.32	24.13	2.39	0.26
T_{12} - 40 ppm GA_3 (30hr)	14.75	9.05	23.80	2.33	0.24
T_{13} - 40 ppm GA_3 (36hr)	14.73	9.03	23.76	2.29	0.23
T_{14} - 1% Pungam leaf extract (24hr)	13.68	8.12	21.80	1.95	0.18
T_{15} – 1% Pungam leaf extract (30hr)	13.64	8.03	21.68	1.90	0.16
T_{16} - 1% Pungam leaf extract (36hr)	13.61	8.01	21.64	1.85	0.15
S.E(d)	0.471	0.288	0.851	0.073	0.025
CD(0.05)	0.961	0.589	1.734	0.149	0.046

Table 3: Effect of pre-sowing seed enhancement techniques on Vigour index I and Vigour index II of rice var. ADT 43.

Treatment	Vigour index I	Vigour index II
T_1 – Control	1662	7
T_2 – Water (24hr)	1883	14
T_3 - Water (30hr)	1870	13
T_4 - Water (36hr)	1863	12
T_5 - 1% KCl (24hr)	3029	40
T_6 - 1% KCl (30hr)	2750	35
T_7 - 1% KCl (36hr)	2639	34
T_8 - 3% $ZnSO_4$ (24hr)	2379	28
T_9 - 3% $ZnSO_4$ (30hr)	2149	23
T_{10} - 3% $ZnSO_4$ (36hr)	2110	22
T_{11} – 40 ppm GA_3 (24hr)	2135	23
T_{12} - 40 ppm GA_3 (30hr)	2105	21
T_{13} - 40 ppm GA_3 (36hr)	2100	20
T_{14} - 1% Pungam leaf extract (24hr)	1887	15
T_{15} – 1% Pungam leaf extract (30hr)	1875	13
T_{16} - 1% Pungam leaf extract (36hr)	1867	12
S.E(d)	69.12	2.11
CD(0.05)	140.81	4.31

Fig.1 EFFECT OF PRE-SOWING SEED ENHANCEMENT TECHNIQUES ON SEED QUALITY OF RICE Var. ADT 43

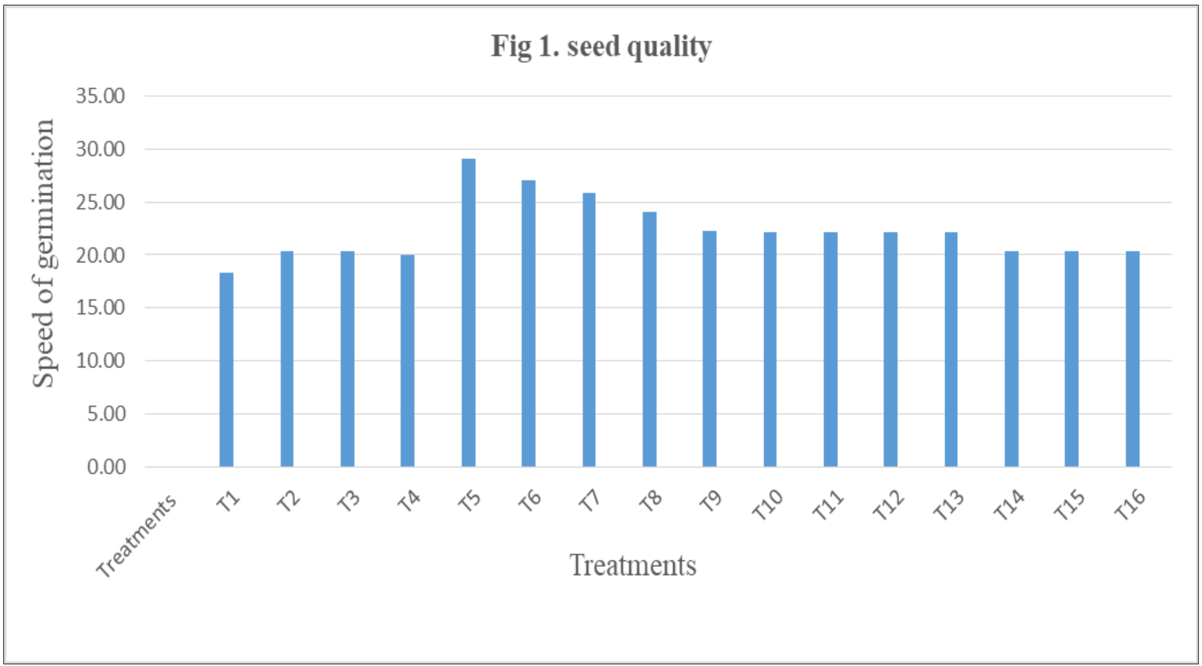

Fig 1: Seed quality

Fig.2 EFFECT OF PRE-SOWING SEED ENHANCEMENT TECHNIQUES ON SEEDLING CHARACTERS OF RICE Var. ADT 43.

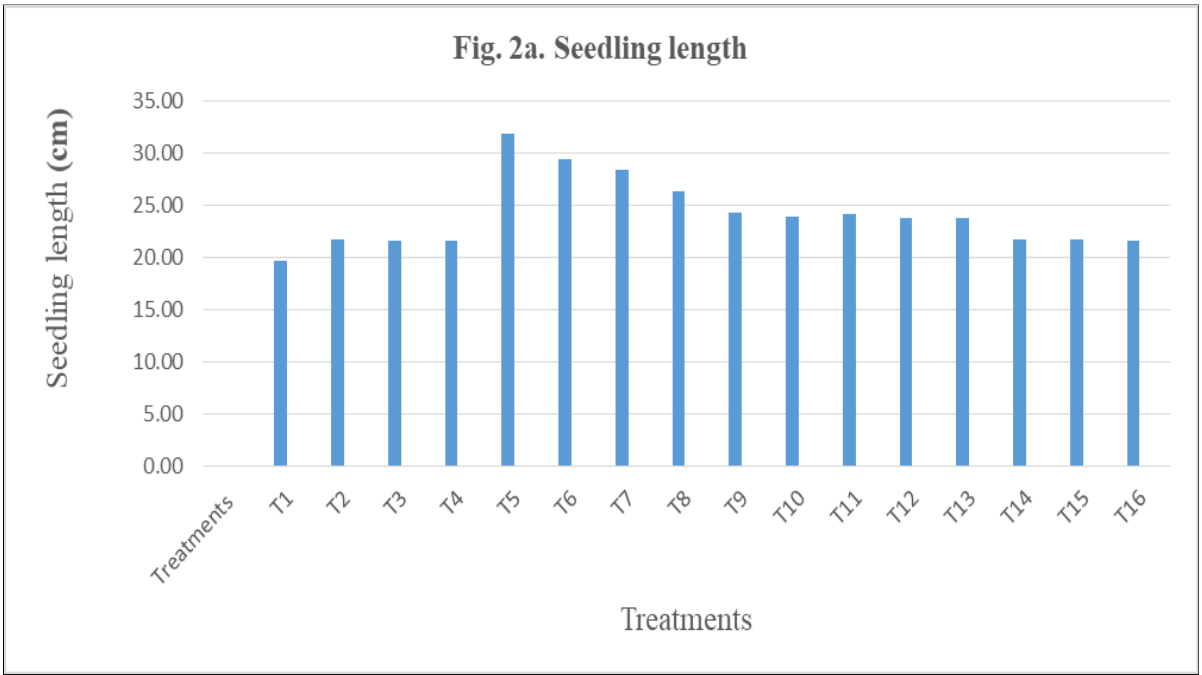

Fig 2a: Seedling length

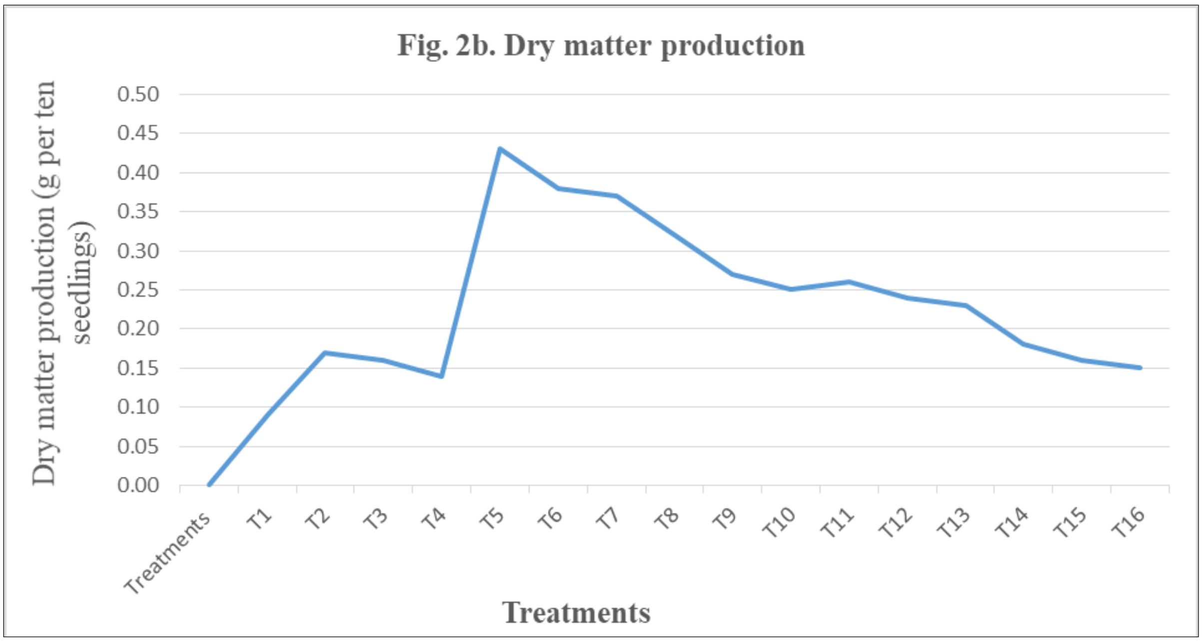

Fig 2b: Dry matter production

References

1. Abdul-Baki AA. Bio-chemical aspects of seed vigour. Hort. Science,1980:(15):765-771.
2. Anaytullah BB, Bose B. Nitrate-hardened seeds increase germination, amylase activity and proline content in wheat seedlings at low temperature. Physiol. Mol. Biol. Plants,2007:13:199-207.
3. Demir I, Oztokat C. Effect of salt priming on germination and seedling growth at Low temperatures in water melon seeds during development. Seed Science Technology,2003:31:765-770.
4. Elouaer MA, Hannachi C. Seed priming to improve germination and seedling growth of safflower (*Carthamus tinctorius)* under stress. Eurasian J. Bio-sci,2012:6(1):76-84.
5. Farooq MSMA, Basra SMA, Ahmad N. Improving the performance of transplanted rice by seed priming. Plant Growth Regulation,2007:51(2):129-137.
6. Ganesh KS, Sundaramoorthy P, Baskaran, Rajesh M, Rajasekaran S. Effect of seed priming using various plant growth hormones on two varieties of green gram germination and seedling establishment. Intl. J. Modern Biol. Med,2013:3(2):78-87.
7. Ghimire S, Yadav H, Acharya P, Kharel R. Rice (*Oryza sativa* L.) Seed Priming: It's Effect on Seed Germination and Seedling Emergence of Spring Varieties in Kapilvastu District, Nepal. Intl. J. Res in Applied Sci., and Biotechnology,2021:8(2):196-201.
8. Lee SS, Kim JH. Total sugars, $\alpha $-amylase activity, and germination after priming of normal and aged rice seeds. Korean J. Crop Sci,2000:45(2):108-111.
9. Mondal S, Bose B. Kinetics studies on α-amylase extracted from germinating wheat endosperm of primed and non-primed seeds. Ind. J. Agricultural Biochemistry,2012:25(2):137-141.
10. Monalisa SP, Beura JK, Tarai RK, Naik M. Seed quality enhancement through biopriming in common bean (*Phaseolus vulgaris*. L). J. Applied and Natural Sci,2017:9(3):1740-1743.
11. Pradhan V, Rai PK, Bara BM, Srivastava DK. Influence of halopriming and organic priming on germination and seed vigour in blackgram (*Vigna mungo* L.) seeds. J. Pharmacogn Phytochem,2017:6(4):537-540.
12. Ruttanaruangboworn A, Chanprasert W, Tobunluepop P, Onwimol D. Effect of seed priming with different concentrations of potassium nitrate on the pattern of seed imbibition and germination of rice (*Oryza sativa* L.). J. Integrative Agriculture,2017:16(3):605-613.
13. Kumar PS, Kamaraj A, Suganthi S, Prabhu T. Effect of presowing seed hardening treatment on seed quality, crop growth and seed yield in rice cv. IR 64, 2019.
14. Toklu F, Baloch FS, Karakoy T, Ozkan H. Effects of different priming applications on seed germination and some agro-morphological characteristics of bread wheat (*Triticum aestivum* L.). Turkish J. Agriculture and Forestry,2015:39:1005-1013.