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RESEARCH ARTICLE

Ragi Seed Quality Enhancement Techniques under Rainfed Conditions of Tribal Habitations of Hosur Forest Division

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Abstract

The present study under the Forest Development Agency sponsored research programme mainly focused to obviate the maladies existing in the tribal society in the way of knowledge gain and adoption of newer techniques. The existing crop components comprise of only ragi and mochai of traditional varieties. The traditional varieties are not only poor in their yield, but are also marginally managed. The scientific evaluation and demonstration of diverse crop components in terms of crop species as well as genotypes will go a long way to enlighten this poor knowledge farming society to widen their activities in order to have a significant gain in their health and income. The studies on ragi obviously showed that, irrespective of varieties, the seed hardening and pelleting treatments performed better. The seed hardening with 0.1 ppm brassinolide and pelleting with DAP at 30 g kg^{-1} + micro nutrient at 20 g kg^{-1} + arrapu leaf powder at 300 g kg^{-1} had positive influence on drought resistance which was evident from its increased physiological and biochemical aspects of seed both under laboratory and field conditions recording maximum field emergence, productive tiller, fingers/ear head, and higher seed yield.

Keywords: Tribal society, ragi, mochai, pelleting, brassinolide, productive tiller, drought resistance.

Introduction

In India, out of the total population, 8% accounting nearly 168 million people are tribal farmers. Out of these, a reasonable population lives in the hilly areas of north-western regions of Tamil Nadu comprising Krishnagiri as one of the district (Anonymous, 2002). The tribal farmers in those areas practice traditional crop cultivation methods and realize very little output. Hence, the life style of those farmers contributed by their crop components in their farming and per capita income has not met with any improvement over the past several decades. Although several agro techniques possibly capable of improving their net income as well as their standard of living are available, the ignorance of the farmers due to their remoteness has been a major negative factor.

Ragi being a poor man's crop is rich in carbohydrate value (72%), which is in the form of non–starch polysaccharides and dietary fibre which helps in lowering cholesterol and slow release of glucose to the blood stream during digestion. Ragi grown under 1.24 lakhs ha which accounts for 2.35 million tonnes. The main goal of the study is rehabilitation and improving the productivity of land owned by tribal population and other forest dependents of Hosur forest division into a productive agro system by improving their economic profitability. In these areas, crop production is ventured, which is subjected to high degree of uncertainty in terms of productivity.

It is imperative to evolve a suitable strategy for augmenting the productivity of such soils. The rainfed agriculture in the plains has benefited tremendously through the evaluation and adoption of many seed and crop management techniques. Among these, seed hardening and pelleting is one of the most important low cost technique which can impart drought tolerance besides achieving enhanced seedling vigour.

Taking into consideration of the present status of farming in the study area, where the farmers cultivate monotonous monocrops over the past several years without adoption of any improved agro techniques under rainfed conditions, this study was programmed with the objective to evaluate the sustainability of improved varieties of ragi under rainfed condition.

Materials and methods

Genetically pure seed materials of different varieties were obtained and served as the base materials for the laboratory and field experiment (Table 1). To realize the objective of the study, the seeds were treated and evaluated in laboratory and the field experiments were conducted at Kottayam village, Denganikottai range of Hosur Forest Division, Krishnagiri, Tamil Nadu during 2002-2004.Throughout the crop growth period of field experiment, the crops showered through normal receipt of rainfall combined with optimal climatic condition.

Table 1. Source of genetically pure seed materials of different varieties.

Crop	Cultivar	Source
Ragi (*Elusine coracana*)	CO 13	Millet Breeding station, TNAU, Coimbatore.
	Paiyur 1	Regional Research Station, Paiyur.
	Trichy 1	Anbil Dharmalingam Agricultural College & Research Institute, Trichy.
	Local variety	Tribal farmer, Kottayam, Denganikotai range of Hosur Forest Division, Krishnagiri.

Influence of seed hardening and pelleting in Ragi: The seeds were thoroughly cleaned and processed using 12 x 12 BSS (British Standard Sieve). The processed seeds were soaked in different chemicals and botanicals in 1: 0.6 ratios of seed and solution for 6 h. After soaking, the hardened seeds were shade-dried to bring back its original moisture content of 10%. The laboratory evaluation was conducted for the treated seeds during 2003 at Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore by adopting Factorial Completely Block Design with the following treatments and varieties having five replications.

Treatments

T_1 -Control (untreated seeds)
T_2 -Seed hardening with Brassinolide @ 0.1 ppm
T_3 -Seed hardening with pungam leaf extract @ 2%
T_4 -Seed hardening with prosopis leaf extract @ 2%
T_5 -T_1+ seed pelleting with DAP @ 30 g kg^{-1} + micro nutrient @ 20 g kg^{-1} + arappu leaf powder @ 300 g kg^{-1}.

Varieties

V_1 - Paiyur 1
V_2 -Trichy 1
V_3 -CO 13
V_4 -Local variety

Laboratory evaluation: The following observations were recorded from the hardened and pelleted seeds. Germination was calculated according to ISTA (1999) and vigour index was calculated according to Abdul-Baki and Anderson (1973).

Field experiment: A field trial was conducted during 2003-2004 with the treatments T_1 to T_5 and varieties V_1 to V_4 as detailed above, in tribal area of kottayam village, Denganikottai range of Hosur Forest Division by adopting Factorial Randomised Block Design with five replications. The crop was raised with recommended package of practices in a plot size of 8 x 5 m^2 under rainfed conditions and the following parameters were recorded.

Field emergence at 4 DAS: The number of seedlings emerged from the soil at 4 DAS was counted and expressed in percentage.
Number of productive tillers plant^{-1}: Productive tillers plant^{-1} at physiological maturity were counted and recorded as whole number.
Number of fingers ear head $^{-1}$: The number of fingers ear head^{-1} was counted and the mean values were expressed as whole number.
Seed yield plant^{-1}: The ear heads harvested in each treatment were hand threshed separately and the produce was cleaned dried and then weighed. The mean seed yield was expressed in g plant^{-1}.

Results

Field emergence at 8 DAS: The field emergence percentage of seeds was highest in T_5 (75%) followed by T_2 (70%), while the lowest field emergence was recorded by T_1 (56%) (Table 2). Among the varieties, the influence of seed treatments on field emergence was highly significant. The emergence percentage was higher in V_1 (78%) when compared to V_4 (46%). The interaction between treatments and varieties were significant. Highest emergence was recorded in V_1T_5 (85%), while V_4T_1 recorded the minimum (36%).

Table 2. Effect of seed hardening and pelleting on field emergence (%) and number of productive tillers plant^{-1} of selected cultivars of ragi under field experiment.

Varieties (V)	Field emergence – Treatments (T)					Mean	Number of productive tillers plant^{-1} – Treatments (T)					Mean
	T_1	T_2	T_3	T_4	T_5		T_1	T_2	T_3	T_4	T_5	
V_1	70 (56.79)	81 (64.16)	74 (59.35)	78 (62.03)	85 (67.22)	78 (61.91)	5.3	7.1	5.7	6.3	7.6	6.4
V_2	61 (51.36)	77 (61.35)	65 (53.73)	72 (58.06)	83 (65.66)	72 (58.03)	4.4	6.3	4.8	5.7	6.5	5.5
V_3	58 (49.61)	72 (58.06)	63 (52.54)	68 (56.17)	76 (60.67)	68 (55.41)	4.2	5.3	4.5	4.6	6.1	4.9
V_4	36 (36.87)	51 (45.57)	46 (42.71)	41 (39.82)	56 (48.45)	46 (42.68)	3.4	5.1	3.9	4.8	5.6	4.6
Mean	56 (48.65)	70 (57.29)	52 (52.08)	65 (54.02)	75 (60.50)		4.4	5.9	4.7	5.3	6.4	
CD (P=0.05)	V 0.29	T 0.32	VxT 0.54				V 0.05	T 0.06	VxT 0.11			

Figures in parentheses indicate arc sine values.

Table 3. Effect of seed hardening and pelleting on ear head weight (g) and Seed yield (g plant^{-1}) of selected cultivars of ragi under field experiment.

Varieties (V)	Number of fingers					Mean	Seed yield (g plant^{-1})					Mean
	Treatments (T)						Treatments (T)					
	T_1	T_2	T_3	T_4	T_5		T_1	T_2	T_3	T_4	T_5	
V_1	5.1	7.1	6.2	6.9	7.8	6.6	5.23	6.95	5.62	5.12	5.95	6.17
V_2	4.8	7.	6.5	5.7	7.6	6.4	4.72	6.43	5.82	5.48	6.77	5.84
V_3	6.1	8.2	7.6	7.1	8.7	7.5	4.32	6.43	5.83	5.37	5.73	5.74
V_4	3.5	5.9	4.7	5.2	6.3	5.1	2.85	4.58	3.74	3.31	4.96	3.89
Mean	4.9	7.1	6.2	5.2	7.6		4.28	6.10	5.25	5.07	6.35	
CD	V	T	VxT				V	T	VxT			
(P=0.05)	0.03	0.03	0.06				0.01	0.01	0.02			

Number of productive tillers plant^{-1}: The number of productive tillers per plant varied significantly due to treatments. Among the treatments, the maximum number of productive tillers was recorded by T_5 (6.4) followed by T_2 (5.9) (Table 2). Among the varieties, V_1 recorded more number of productive tillers (6.4) when compared to V_4 (4.6). The interaction between treatments and varieties were significant. Highest number of productive tillers was recorded in V_1T_5 (7.6), while the lowest number recorded in V_4T_1 (3.4).

Number of fingers ear head^{-1}: Treatment effect on number of finger ear head^{-1} varied significantly and the treatment T_5 recorded maximum number of finger (7.6) followed by T_2 (7.1). Among all varieties, V_3 recorded maximum number of finger (7.5) compared to V_1 (6.6). The interaction between treatments and varieties were significant. Maximum number of fingers were recorded in V_3T_5 (8.7) followed by V_1T_5 (7.8), while the minimum number was recorded in V_4T_1 (3.5) (Table 3).

Seed yield (g plant^{-1}): The single plant yield was significantly different due to seed hardening and pelleting treatments. Among the different treatments, T_5 gave the maximum seed yield (6.35 g) followed by T_2 (6.10 g) (Table 3). Whereas, the minimum seed yield of 4.28 g was recorded by T_1. Among all varieties, V_1 recorded higher seed yield of 6.17 g when compared to V_4 which recorded lowest yield of 3.89 g. The interaction between treatments and varieties were significant. Higher seed yield was recorded in V_2T_5 (6.77 g) followed by V_1T_5 (5.95 g), while the minimum yield was recorded in V_4T_1 (2.85 g).

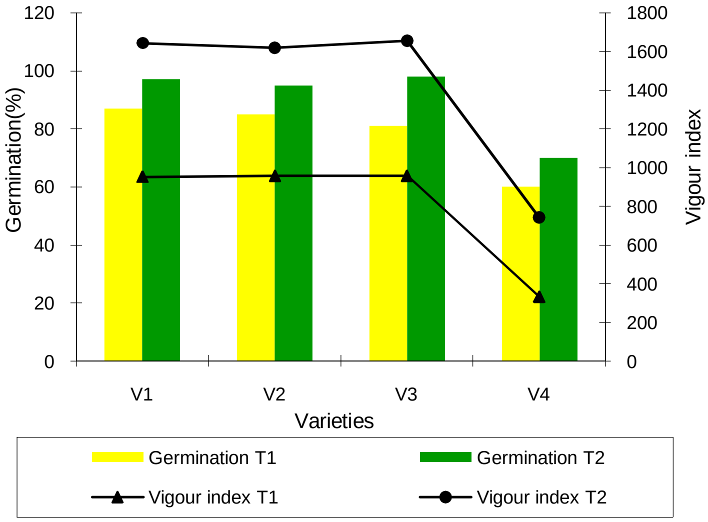
Discussion

The farming activities and livelihood status of tribal farmers who are all living in scattered remote areas of various parts of our country including the study area at Hosur forest division of Tamil Nadu remains marginal for long periods. The tribal farmers in these areas adopt traditional way of crop cultivation practices although several improved varieties and farm techniques are available. This information has not reached those farmers and hence they are still realizing very low yield under rainfed condition. Hence, in order to create awareness among the tribal farmers about the improved varieties and techniques and to exploit the production potentiality of their tribal land productivity, which will enable to rehabilitate and improve their economic profitability and health status the study was carried out and the results obtained are discussed here under. The conjoint treatment of seed hardening and pelleting ensures precision planting and establishment of each seed planted. Seed pelleting offers scope for incorporating either organic or chemical substances into the seed for improving germination, vigour and controlling the microenvironment in which the seed germinates.

With this background, the present investigation was carried out using botanicals like pungam leaf extract, prosopis leaf extract and growth regulator namely brassinolide as hardening materials and nutrients namely DAP, micronutrient and arappu leaf powder as pelleting materials with different set of treatments. The use of chemicals and botanicals as hardening substances to enhance the growth and yield of crop varieties has been employed by several workers (Vanangamudi and Kulandaivelu, 1989; Paul and Choudhury, 1993; Rangasamy *et al.,* 1993; Maitra *et al.,* 1997; Punithavathi, 1997; Kalarani *et al.,* 2001; Vigneswari, 2002; and Menaka, 2003).

In the present investigation, all hardening and pelleting treatments showed significant improvement in seed germination and vigour over control (Fig. 1). Among which, seeds hardened with 0.1 ppm brassinolide and pelleted with several macro and micro nutrients (DAP, micronutrient mixture and arappu leaf powder) recorded maximum germination both under laboratory and field conditions which was 12 and 34% , respectively higher over control (untreated seeds) supported by Fujii and Saka (2001) in their study in rice. Seed treatment with brassinolide might have stimulated the production of auxin and ethylene, which have positive influence on seed germination as reported by Clouse and Sasse (1998).

Fig. 1. Effect of seed hardening and pelleting on germination (%) and vigour index of ragi.



T_1 – Control ; T_2 - Seed hardened with Brassinolide 0.1 ppm and pelleted with DAP @ 30 g kg^{-1} + Micronutrient mixture @ 20 g kg^{-1} + Arappu leaf powder @ 300 g kg^{-1} ; V_1 - Paiyur 1 ; V_2 - Trichy 1 ; V_3 - CO 13 ; V_4 – Local.

Brassinolide also improved the seedling growth irrespective of varieties except untreated seeds and local variety. Similar types of results were obtained by Hayat *et al*. (2001) in wheat. The probable reason for elite seedling growth might be due to cell elongation and cell division and enhancement in enzyme activities induced by brassinolide, which results in a series of other peculiarities, viz., greater xeromorphic structure, lower water deficit and more efficient root system.Besides the laboratory, the efficacy of treatments was further observed in the field conditions by raising the crop with hardened and pelleted seeds at tribal farmers' field under rainfed condition. In the present study, the field emergence percentage was higher in seeds hardened with brassinolide (0.1 ppm) followed by pelleting with DAP 30g kg^{-1} and micronutrient mixture @ 20 g kg^{-1} and arappu leaf powder @ 300 g kg^{-1} (T_5). The next best treatment was seed hardening with brassinolide (T_2) which registered maximum emergence irrespective of varieties due to seed hardening treatments which indicates the possible increase in seedling vigour.

The results of the present study also showed that maximum number of fingers $plant^{-1}$ and seed yield $plant^{-1}$ was also maximum in crops raised with seeds hardened with brassinolide followed by pelleting. Seed soaking treatments caused higher mitochondrial activity (Henckel, 1964), rapid embryo development (Hegarty, 1970) and improved the growth and yield components, as well as productivity of various crops (Shinde and Bhalerao, 1991). The increased yield might be due to the presence of more number of fingers and seeds per ear and higher seed weight.

The increased carbohydrate content at flowering stage due to brassinolide application was related to higher rate of photosynthesis per unit leaf area and regulation of source sink relation for assimilate transport which results in enhancement of yield attributing parameters (Wang and Steffens, 1985). This might be the one of the reason for increased yield due to brassinolide treatments in the present investigation. This is in accordance with the findings of Vigneswari (2002) in her study on ragi hardened with brassinolide (0.1ppm).

Conclusion

The study on seed hardening and pelleting in ragi varieties revealed that the seeds hardened with brassinolide @ 0.1 ppm and pelleted with DAP @ 30 g kg^{-1} and micro nutrient mixture @ 20 g kg^{-1} and arappu leaf powder @ 300 g kg $^{-1}$ was found to be better compared to other treatments under laboratory and field conditions as well.

References

1. Abdul-Baki, A.A. and Anderson, J.P. 1973. Vigour deterioration of soybean seeds by multiple criteria. *Crop Sci*. 13: 630-633.
2. Anonymous, 2002. All India Co-ordinated research project for dryland agriculture. Kovilpatti Centre (2002-03). p34.
3. Clouse, S.D. and Sasse, J.M. 1998. Brassinosteroids. Essential regulators of plant growth and development. *Ann. Rev. Plant Physiol. Plant Mol. Bio.* 49: 427-451.
4. Fujii, S. and Saka, H. 2001. The promotive effect of brassinolide on lamina joint cell elongation, germination and seedling growth under low temperature stress in rice. *Plant Prod. Sci.* 4: 210-214.
5. Hayat, S., Ahmad, A., Hussian, A. and Mobin, M. 2001. Growth of wheat seedlings raised from grains treated with 28 homobrassinolide. *Acta physiologie plantarum*. 23: 27-30.
6. Hegarty, T.W. 1970. The possibilities of increasing field establishment by seed hardening. *Hort. Res.* 10: 59-64.
7. Henckel, P.A. 1964. Physiology of plants under drought. *Ann. Rev. Pl. Physiol.* 15: 363-386.
8. ISTA. 1999. International rules for seed testing. *Seed Sci. Technol.* 27: 25-30.
9. Kalarani, M.K., Sivakumar, R., Mallika Vanangamudi and Sujatha, K.B. 2001. Effect of seed soaking treatments in late sown finger millet under rainfed condition. *Madras Agric. J.* 88(7-9): 509-511.
10. Maitra, S., Sounda, G., Ghosh, D.C. and Jana, P.K. 1997. Effect of seed treatment on finger millet (*Eleusine coracana*) varieties in rainfed upland. *Ind. J. Agric. Sci.* 67(10): 478-480.
11. Menaka, C. 2003. Seed hardening and pelleting technology for maximizing the productivity of sorghum (*Sorghum bicolor* L.,) Moench) and Bajra (*Pennisetum glacum* (L.) R.Br.) under rainfed condition. M.Sc. (Agri.) Thesis, Tamil Nadu Agricultural University, Cbe-3.
12. Paul, S.R. and Choudhury, A.K. 1993. Effect of seed hardening with potassium salts of different concentrations and soaking durations on germination and seedling vigour of wheat. *Ann. Agric. Res.* 14(3): 357-359.

13. Punithavathi, N.1997. Seed hardening and pelleting studies in Ragi cv. CO 13. M.Sc. (Agri.) Thesis, Tamil Nadu Agricultural University, Coimbatore.
14. Rangasamy, A., Purusothaman, S. and Devasenapathy, P. 1993. Seed hardening in relation to seedling quality characters of crop. *Madras Agric. J.* 80(9): 535-537.
15. Shinde, S.S. and Bhalerao, R.K. 1991. Effect of seed treatment with plant growth regulators and yield components of sorghum. *J. MAU.* 16: 447-447.
16. Vanangamudi, K. and Kulandaivelu, R. 1989. Pre-sowing seed treatment for dryland farming. *Seeds Farms.* 15(9-10): 33-34.
17. Vigneshwari, R. 2002. Seed hardening and pelleting in Ragi cv. CO 13 to induce drought resistance and to improve productivity under rainfed condition. M.Sc. (Agri.) Thesis, Tamil Nadu Agricultural University, Cbe-3.
18. Wang, S.Y. and Steffens, G.L. 1985. Effect of paclobutrazol on water stress in induced ethylene biosynthesis and polyamine accumulation in apple seedling leaves. *Phytochem.* 24: 2185-2190.