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.
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 five replications.

Treatments
- **T₁**: Control (untreated seeds)
- **T₂**: Seed hardening with Brassinolide @ 0.1 ppm
- **T₃**: Seed hardening with pungam leaf extract @ 2%
- **T₄**: Seed hardening with prosopis leaf extract @ 2%
- **T₅**: T₁+ seed pelleting with DAP @ 30 g kg⁻¹ + micro nutrient @ 20 g kg⁻¹ + arappu leaf powder @ 300 g kg⁻¹.

Varieties
- **V₁**: Paiyur 1
- **V₂**: Trichy 1
- **V₃**: CO 13
- **V₄**: 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 T₁ to T₅ and varieties V₁ to V₄ 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 m² 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.

<table>
<thead>
<tr>
<th>Varieties (V)</th>
<th>Field emergence (%)</th>
<th>Number of productive tillers plant⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Treatments (T)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>T₁</strong></td>
<td><strong>T₂</strong></td>
<td><strong>T₃</strong></td>
</tr>
<tr>
<td>V₁</td>
<td>70</td>
<td>61</td>
</tr>
<tr>
<td>(56.79)</td>
<td>(61.14)</td>
<td>(53.73)</td>
</tr>
<tr>
<td>V₂</td>
<td>70</td>
<td>77</td>
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<tr>
<td>(64.10)</td>
<td>(69.16)</td>
<td>(65.72)</td>
</tr>
<tr>
<td>V₃</td>
<td>74</td>
<td>61</td>
</tr>
<tr>
<td>(59.35)</td>
<td>(53.73)</td>
<td>(55.33)</td>
</tr>
<tr>
<td>V₄</td>
<td>78</td>
<td>78</td>
</tr>
<tr>
<td>(61.91)</td>
<td>(61.91)</td>
<td>(67.22)</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>78</td>
<td>78</td>
</tr>
</tbody>
</table>

Figures in parentheses indicate arc sine values.
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 T₅ (6.4) followed by T₂ (5.9) (Table 2). Among the varieties, V₁ recorded more number of productive tillers (6.4) when compared to V₄ (4.6). The interaction between treatments and varieties were significant. Highest number of productive tillers was recorded in V₁T₅ (7.6), while the lowest number recorded in V₁T₁ (3.4).

Number of fingers per ear head⁻¹: Treatment effect on number of finger per ear head⁻¹ varied significantly and the treatment T₅ recorded maximum number of finger (7.6) followed by T₂ (7.1). Among all varieties, V₁ recorded maximum number of fingers (7.5) compared to V₄ (6.6). The interaction between treatments and varieties were significant. Maximum number of fingers were recorded in V₃T₅ (8.7) followed by V₁T₅ (7.8), while the minimum number was recorded in V₁T₁ (3.5) (Table 3).

Seed yield (g plant⁻¹): The single plant yield was significantly due to seed hardening and pelleting treatments. Among the different treatments, T₅ gave the maximum seed yield (6.35 g) followed by T₂ (6.10 g) (Table 3). Whereas, the minimum seed yield of 4.28 g was recorded by T₁. Among all varieties, V₁ recorded higher seed yield of 6.17 g when compared to V₄ which recorded lowest yield of 3.89 g. The interaction between treatments and varieties were significant. Higher seed yield was recorded in V₂T₅ (6.77 g) followed by V₁T₅ (5.95 g), while the minimum yield was recorded in V₄T₁ (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; Mahtra et al., 1997; Punithavathi, 1997; Kalarari 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).
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

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.


