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Redefining IMSCS 2013 for seed standard ODV in Rice

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ABSTRACT: Seed certification is a legally recognised framework for quality control, seed multiplication, and production because high-quality seeds are the foundation of the agricultural industry, ensuring national economy and food security. The quality seed must adhere to Indian Minimum Seed Certification Standards (IMSCS), but on a global scale, seed quality assurance systems for seed export are governed by International Seed Testing Association and Organization for Economic Cooperation and Development (OECD) standards (ISTA). The focus of this study has been on whether the field criteria defined in the Indian Minimum Seed Certification criteria (IMSCS, 2013) continue to hold good in today's era of mechanization used in the field to avoid genetic contamination in paddy. The Foundation and Certified seed samples (Three samples of three different varieties) from Telangana state seed corporation and Seed certification agency were used for testing ODVs in paddy. The samples were thoroughly examined for the existence of ODV while maintaining reference samples in hand. From the mean results of 3 years of experimentation, it was observed that over all mean value of 10.63 ODV/ kg seed were observed which is on par with the recommendations given by IMSCS 2013 for foundation seeds and 31.33 ODV /kg seed over all mean value was recorded which is higher than recommended 20 ODV/kg seed as by IMSCS2013 in case of Certified Seed of fine (small), medium and coarse (long) varieties of paddy. To boost production and productivity while mitigating the negative effects of climate change, a consistent as well as timely delivery of high-quality seed for all crops and varieties at reasonable costs at the local level is required.

Keywords: Rice, Quality Seed, ODV, IMSC, Seed Certification, and quality parameters.

INTRODUCTION

Seed production is a well-planned procedure that typically follows the restricted seed generation principle method in a stepwise manner in the multiplication chain. In general, four generations were recognised by the seed production system i.e. breeder seeds, foundation seeds, and certified seeds. In the programme for seed production quality control is an inherent component and any seed programme that does not include provisions for regulating seed quality control measures will fail (Prasad *et al.*, 2022). Two aspects of quality control should be validated by producing agency: Maintaining genetic purity of the seed during production, processing and marketing, as well as retaining with appropriate attributes such as strong germination potential, physical purity, being free of disease infection, weed seeds, and having an optimal moisture content (Vaibhav, 2022).

In today's world, when climate change is reducing both the quality and quantity of cultivable areas, meeting the rising population's food requirement is a major concern. Crop output is exacerbated further by manpower migration from the agriculture sector to the non-farm sector. The genetic and physical purity of quality seed production is maintained in accordance with seed and field standards to ensure good quality seed in the next generation (Srivastava and Lal 2021).

At the national level, the average crop production expense per farming household was almost 24% on fertilizers, 21% on labour costs, and roughly 11% on seeds which is a prerequisite for agricultural production and ultimately for food security (Anonymous, 2016). It has been established that great seed alone can yield increased productivity due to having the lowest cost of seed as an input with correspondingly high output.

The fundamental purpose of seed certification is to preserve while making available to consumers high-quality seeds of notified kind/variety/cultivar that were grown and distributed in such a way that genetic uniqueness and purity are assured. Seed certification is also intended to meet predetermined norms. Certification shall be carried out by the Certification Agency designated under Section 8 of the Seeds Act of 1966 (Prasad *et al.*, 2017). The seed certification system is a scientifically established method for meeting required Indian Minimum Seed Certification Standards for field and seed, which were amended in 2013. Furthermore, in this system at national level, three classes of seeds are followed: breeder seed, foundation seed, and certified seed, while the foundation and certified seed classes falling within the jurisdiction of the Certification Agency. The seed that has been certified is labelled, as a result, while all certified seeds must be labelled, not every labelled seed is necessarily certified. After ensuring that all stipulated field and seed standards have been met, the agency issues white colour and Azure blue colour (ISI 104) tags for the foundation and certified seed class, accordingly (Joshi and Singh 2020).

Due to the growing demand for quality seed among farmers, cooperative efforts are essential to create most effective seed production technologies for improved kinds. A good seed production system is intended to maintain and make accessible to everyone, through certification, high-quality seeds of recognised type and variety that have been developed and distributed in such a way that genetic identity and genetic purity are guaranteed (Muralidharan *et al.*, 2019). Producers of seeds are now extra-concerned about maintaining purity, in addition to the earlier mentioned requirements by enforcing tight technical standards during seed manufacturing and subsequent processing. Previously, the quality of any crop seed was primarily defined by its germinability. However, the potential for yield of a particular variety or hybrid, as well as the enticing problem of proprietary rights (IPR), have increasingly persuaded growers to reconsider seed quality in terms of physical and genetic purity, physiological vigour, and disease-pest resistance (Singh and Sarbananda Sahoo 2019).

The seed is a critical component in enhancing agricultural output. Using Seeds of superior quality can boost output by 15 to 20% (Seed net, 2021). The seed has evolved as a trade commodity over time as a carrier of technology; harsh climate change and rising production costs continue to rise. As a result, there is a need to develop seed much faster so as to address the growing need for crop seeds while simultaneously replacing obsolete varieties with new, high-yielding varieties. The Indian Seed Programme is vital to Indian agriculture and has the potential for prospective growth (NITI Aayog, 2018). As a result, redefining the ODVs established in 2013 and validating the maximum allowable limits of ODVs for foundation and certified seed classes established by IMSCS 2013 availability of high-quality seeds developed from hybrids or high-yielding types is crucial for increasing crop production rates. In view of this, this particular study was conducted with a couple of goals in mind:

1. To redefine IMSCS 2013 norms for ODVs (no/kg) in the foundation seed class of rice.
2. To redefine IMSCS 2013 norms for ODVs (no/kg) in the certified seed class of rice.

MATERIALS AND METHODS

The testing was conducted from Kharif 2018 to Kharif 2020 at Seed Research and Technology Centre, Rajendranagar, Hyderabad. The experiment consisted of three different paddy varieties selected under different seed segments and was sown in a randomized block design with four replications. The experiment was conducted in two sets separately comprising foundation seed and the certified seed of small (RNR 15048), medium (BPT 5204) and long-seeded (KNM118) paddy varieties.

The Foundation and Certified seed samples; three samples of three different varieties (Table 1) were collected. Selected seed samples were 100% physically and genetically pure. Sowing was done following recommended agronomic practices in a plot size of 40 m^2 (10 m × 4 m) with a spacing of 20 ×10 cm and maintained 2000 plants/plot with four replications.

Table 1: Details of paddy varieties selected for the study.

Sr. No.	Variety name	Seed segment	Released year	Particulars
1.	RNR 15048	Super fine	2015	Released from Rice Research Centre, PJTSAU. Every year approximately 300 -350 Q breeder seed is produced for seed indents and 1000-1250q of quality seed for farmers distribution.
2.	BPT 5204	Fine	1985	Released from Bapatla Research Centre, ANGRAU. Every year approximately 200 -250 Q breeder seed is produced for seed indents and 750-1000q of quality seed for farmers distribution.
3.	KNM 118	Coarse	2015	Released from Kunaram Research Centre, PJTSAU. Every year approximately 300 -350 Q breeder seed is produced for seed indents and 1250-1500q of quality seed for farmers distribution.

When compared to chosen rice varieties, an admixture can be physically recognised as a different variety at the seed level (although with very similar seed size to selected rice varieties in each group) *viz*., small, medium & long). The presence of off-type (mixed ODV seed) plant/s were planted (one for foundation class seed & four for certified class seed) in the each replication. Plant population and plot yield at harvest were taken to judge the actual SMR of the varieties in consideration.

For the foundation seed class (maximum permitted off-types as per IMSCS, 2013 is 0.05%), so 2000 seeds (breeder seed) of each variety from every individual group *viz*., small, medium & long) were selected and one seedling (ODV) was deliberately blended in this specific experimentation. All the selected entries nurseries were sown with known one admixture (ODV).

The admixture/ ODV of small, medium and long-seeded varieties were Swarna sub 1, WGL 44 and MTU 1010, respectively (Trivedi and Gunasekaran 2013).

For the certified seed class (maximum permitted off-types as per IMSCS, 2013 is 0.2%) so 2000 seeds (foundation seed) with each variety from each distinct group *viz.*, small, medium & long) were selected and four seedlings (ODV) was deliberately blended in this specific experimentation. All the selected entries' nursery was sown with known four admixture seeds (ODV) (Trivedi and Gunasekaran 2015).

The total amount of seed generated each plot (replication and variety were handled individually). The gathered produce was properly combined (BS to FS and FS to CS). A 1000 g working sample was collected from each plot's product by properly combining and splitting. All samples were thoroughly tested for the detection of ODV using reference samples as controls.

RESULTS AND DISCUSSION

Sampling of seed lots for ODV testing was done as per IMSCS 2013 norms. Theoretically for foundation seed planting at a distance of 20 × 10 cm brings about 5, 00,000 plant population; as the Seed Multiplication Rate of paddy is 80; while the field standard (off-type) of 0.05% is equivalent to 250 off-type plants/ha i.e. 250*80 = 20,000 seeds/25 q, while ODV/kg is equivalent to 8/kg through field standard calculation. However, the prescribed limit for ODV is 10/kg as per IMSCS standards, 2013 (ICAR-ISS Annual report 2018).

For Certified seeds planting at a distance of 20 × 10 cm brings about 5, 00,000 plant population; as the Seed Multiplication Rate of paddy is 80; while the field standard (off-type) of 0.2% is equivalent to 1000 off-type plants/ha i.e. 1000*80 = 80,000 seeds / 25 q and while ODV/kg is equivalent to 32/kg through field standard calculation. However prescribed seed standard for ODV is 20/kg as per IMSCS, 2013 (Table 3).

Each class samples of 1000 g were derived from each replication group in the laboratory. The ODV was counted on the sample drawn of1000 g from each replication pertaining to a two different classes of three different groups. The results presented in Table 2 revealed that seeds from foundation seed plots recorded a lower number of ODVs for small (11.89 per kg), medium (10.67 per kg) and long grain (9.33 per kg) varieties.

In the stage of foundation seed multiplication, observed ODVs (10.63 no/kg) mean of different groups i.e. small, medium and long were observed to be within the standard limit of 10/kg of seed. The observed ODVs were found to be within the IMSCS prescribed limit (10 /kg). Thus, there is no need of redefining ODV standards in foundation seed as observed ODV (10.63/Kg) was on par with the existing ODV as per IMSCS 2013 (10/kg).

Table 2: Redefining IMSCS 2013 for seed standard ODV in rice.

Class of seed	Observed ODVs (No./kg)				Permissible ODVs (as per IMSCS, 2013) (No./kg)
	2018-19	2019-2020	2020-21	Over all Mean of 3 years	
Breeder seed used for Foundation class					
Small (RNR 15048)	11.33	13.67	10.67	11.89	10
Medium (BPT 5204)	11.00	11.00	10.00	10.67	10
Long (KNM 118)	10.33	9.33	8.33	9.33	10
Mean	10.88	11.33	9.67	10.63	
Foundation seed used for Certified class					
Small (RNR 15048)	28.33	31.00	25.00	29.11	20
Medium (BPT 5204)	35.0	37.67	30.00	34.22	20
Long (KNM 118)	30.33	32.00	32.67	31.67	20
Mean	31.22	33.55	29.22	31.33	

Table 3: Seed Standards factor for seed certification in Paddy.

Factors	Standards for each class	
	Foundation	Certified
Pure seed (minimum)	98.0%	98.0%
Inert matter (maximum)	2.0%	2.0%
Huskless seeds (maximum)	2.0%	2.0%
Other crop seeds (maximum)	10/kg	20/kg
Other distinguishable varieties (maximum)	10/kg	20/kg
Total Weed seeds (maximum)	10/kg	20/kg
*Objectionable weed seeds (maximum)	2/kg	5/kg
Seeds infected by paddy bunt (Neovossia horrida (Tak.) (maximum)	0.10% (by number)	0.50% (by number)
Germination (minimum)	80%	80%
Moisture (maximum)	13.0%	13.0%
For vapour-proof containers (maximum)	8.0%	8.0%

The certified seed plots recorded a higher number of ODVs for small (29.11 /kg), medium (34.22 /kg) and long grain (31.67 /kg) rice varieties. In small, medium and long grain groups, the observed ODVs were found to be higher than the IMSCS prescribed limit (31.33/kg). Based on the results obtained, it is clear that there is no correlation between the allowed number of off-types in the field standards and set ODV seed standards that are very low (Table 2).

Hence, the ODV seed standard in rice has to be increased. The results revealed that it is out most necessary for a revision of ODV standards in the case of certified seed, as observed ODVs (31.33/kg) were considerably greater than usual referral ODV as per IMSCS 2013 (20/Kg) (ICAR-ISS Annual report 2021).

The Seed Certification criteria applies to all certified crops and, coupled with field and seed standards for specific crops, comprise the Minimum Seed Certification Standards. The isolation need varies by crop, being minimal in self-pollinated crops, moderate in often cross-pollinated crops, and high in cross-pollinated crops, where wind/insects function as pollinators. As a result, seed standards that aid in monitoring all of the aforementioned difficulties must be maintained in order to produce high-quality seeds (Donovan *et al.*, 2021).

To assure farmer profits, the procedure of notification, receipt of indent for BS from states, allocation and BS production, and de-notification of a cultivar by the GOI must be reviewed (Sastry *et al.*, 2004). Because the 1000-seed weight varies between cultivars, the GOI must be notified in order to alter the seed rate and keep the appropriate plant population at the farms (GOI 2021). There is room to improve the priceless BS production in cultivars in order to boost the country's output, enable export, and assure profits for all stakeholders (Singh and Agarwal 2018).

Seed certification is a scientifically defined system for preserving and making accessible to the farming community a continuous supply of superior quality seeds/ of registered varieties, cultivars, and hybrids, among others (Chauhan *et al.*, 2016). Farmers must be aware of the need of using certified seed, particularly in autogamous crops where the use of farm-saved seed is most widespread in order to preserve the quality status of seeds along the seed supply. Despite the PPV & FR Act framework, farmers, seed producers, and scientists must be cognizant of their obligations, duties, and potential problems in the Indian seed business (Singh *et.al.*, 2017).

CONCLUSION

Single seed lot for paddy seeds should not be more than 200 quintals (≤1 to ≥200q). Seed from fields that met certification criteria at the field stage must be transported to the processing facility as soon as feasible after harvesting. The Certification Agency, on the other hand, is authorized to employ a screen with a smaller aperture size than required. With proper justifications for screen aperture lowering as a result, no seed smaller than the bottom screen utilized in the final processed seed may exceed 5.0% (by weight). Keeping this type of alternatives at hand and with increasing change to the adoption of seed-to-seed mechanization, there is an out most necessary for a revision of ODV standards in the case of certified seed class, as observed ODVs (31.33/kg. of seed) were much more than ODV seed standards as per IMSCS, 2013 (20 no./kg).

However, in the case of foundation seed, there is no need to redefine ODV seed standards, as observed ODVs (10.63 no./kg.) were within the permissible limits as per IMSCS, 2013 (10 no./kg). Hence, the seed standards for the maximum permissible limit of ODVs can be maintained at the current level of 10/kg seed in the foundation seed class.

FUTURE SCOPE

Mechanization plays a larger role in allowing farmers to conduct timely and quality agricultural operations, lowering production costs and boosting output, as well as decreasing drudgery related to agriculture operations and enhancing agricultural input utilization efficiency, there is an out most necessary for a revision of ODV standards in the case of quality seed classes.

Conflict of Interest. The authors do not have any conflict of interest.

Author contributions. V. Swarnalatha significantly contributed to the design, data gathering, analysis, and writing of the work. Along with helping to analyze and interpret the data, K. Prabhavathi and K. Parimala contributed to the article's drafting, while Dr. T. Pradeep critically revised the work.

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