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Uniformity measurement in lots of rice seeds

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Summary

The objective of this work was to verify the uniformity of lots of rice seeds (*Oryza sativa* L.), cv. BR IRGA 409, by the heterogeneity test. Eight lots of size 1-50, 51-100, 101-150, 151-200, 201-250, 251-300, 301-350 and 351-400 bags were used, being submitted to the sampling intensities of 17, 25, 30, 40, 50, 60, 70 and 80 bags, respectively. The attributes tested were physical purity percentage, number of red and black rice seeds, number of dehulled seeds, germination percentage and number of normal seedlings verified in the cold test. The results obtained allowed the following conclusions to be drawn: the lots up to 100 bags of rice seeds showed high uniformity; independently of the lot sizes and sampling intensities, the values of (H) did not show significant heterogeneity for the attributes studied, and the modified cold test was the best attribute for the determination of rice seed heterogeneity.

Introduction

Maximum size of lots is a constant preoccupation to seed technicians. This feature has often been evaluated by the Bulking and Sampling Committee of the International Seed Testing Association - ISTA (Bould, 1984; Wold, 1981). According to the Rules for Testing Seeds (Brasil, 1992) and the International Rules of Seed Testing (ISTA, 1993), the lot size is a function of the seed species. For rice seeds (*Oryza sativa* L.), these Rules recommend a maximum of 25,000Kg. The uniformity of seed lots is the basic requisite for reliable results in seed analysis. According to Steiner and Meyer (1990), in order to guarantee accuracy, it is recommended to adopt sampling intensities prescribed by the International Rules for Seed Testing.

Coster (1993) has made a bibliographic survey on tests of seed heterogeneity, from 1956 to 1990. He found that almost all authors mention cases of significant heterogeneity in one or other species, including small and large, as well as straw types. The author believes in the importance of the evidence of significant and continued heterogeneity in a great number of species.

This work has been made in order to verify heterogeneity of rice seeds lots, through measuring a number of attributes of seed quality.

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Material and methods

This work was carried out at the Seed Analysis Laboratories of EMBRAPA and UFPel in Pelotas-RS. The material used was rice samples from cv. BR IRGA 409, derived from lots with different numbers of bags.

Methodology

Samples were collected at bagging time after the final phase of seed processing as prescribed by the Rules of Testing Seeds (Brasil, 1992) and with intensity ranging according to the number of bags that composed the lots as follows:

Number of bags/lot	Number of samples
1 - 50	17
51 - 100	25
101 - 150	30
151 - 200	40
201 - 250	50
251 - 300	60
301 - 350	70
351 - 400	80

Once the samples were obtained, they were homogenized by means of a centrifugal divider (Gamet) and reduced in order to obtain the working sample, as recommended by the Rules for Testing Seeds (Brasil, 1992).

The heterogeneity test performed on seeds packed in bags was estimated according to the Rules for Testing Seeds (Brasil, 1992), and the following attributes, were evaluated:

Physical purity analysis – This was carried according to the Rules for Testing Seeds (Brasil, 1992).

Number of dehulled seeds – This was done simultaneously with the purity analysis, as prescribed by Rules for Testing Seeds (Brasil, 1992), being verified in the pure seed portion.

Examination for noxious seeds (black and red rice) – This test was conducted according to the Rules for Testing Seeds (Brasil, 1992), and the sample was examined and shelled in order to verify the presence of prohibited or tolerated seeds, respectively. Results were expressed by number of seeds per 500 g.

Germination test – This was conducted according to the Rules for Testing Seeds (Brasil, 1992).

Cold test in paper roller with soil – Conducted according to the methodology proposed by Vieira and Carvalho (1994), where four replicates of 50 seeds were utilized, distributed in paper towel type Germitest, with a thin layer of soil added. Rolls of paper towel were placed in a cold chamber regulated at 10 °C for 7 days. After this period, the seeds were placed at 25 °C for the same period.

The experiment was carried out in a completely randomized design with eight treatments (lot sizes) and different numbers of replications. The variables with results expressed in percentage had their values transformed to arc.sin%/100, while the others had their values transformed to x + 1.

Results and discussion

Verifying the purity results (Table 1), it can be seen that the differences are not agriculturally important, although statistically differences between averages can be observed. As the results of this variable reached percentages above 99.8%, the heterogeneity test was not performed, since according to Brasil (1992) and ISTA (1993), values above this value should not be used for this test. These values did not show significant differences between maximum and minimum percentages; this is, probably, due to the constitution of the lots originating from the same source and submitted to the same cleaning equipment. This uniformity, according to Chowings (1968) and Cabral (1972), could be attributed to the cleaning process, which could remove the heterogeneity of some quality attributes. However, it is known that even a clean seed lot is not necessarily homogeneous in all its features.

It can be seen (Table 1) that black rice seeds, which are considered noxious (Brasil, 1993), were not detected in lots of sizes 1-50 and 351-400 bags. As these seeds appeared in less than 2 units per sample, the heterogeneity test was not used, as specified by Brasil (1993).

Table 1. Average of purity percentage and number of black rice seeds obtained in eight commercial rice seed lots (*Oryza sativa* L.).

Size of lot (bags)	No. of samples	Purity (%)		No. of black rice seeds	
		(1)	(2)	(1)	(2)
001 - 050	17	99.96	88.83 c*	0.00	1.00 a
051 - 100	25	99.99	89.93 a	0.07	1.03 a
101 - 150	30	99.98	89.40 abc	0.06	1.03 a
151 - 200	40	99.99	89.46 abc	0.08	1.04 a
201 - 250	50	99.99	89.48 ab	0.08	1.04 a
251 - 300	60	99.98	89.28 bc	0.04	1.02 a
301 - 350	70	99.99	89.59 ab	0.10	1.05 a
351 - 400	80	99.98	89.30 bc	0.00	1.00 a

* Different letters, in the column, differ statistically among them in the level of 1% of probability, by the Duncan test.

1 = Original values. 2 = Transformed values.

The average number of dehulled rice seeds (Table 2) was rather lower than is tolerated for certified seeds (Brasil 1993), which set up a maximum of 30 seeds per 100 grams. It was observed in some individual samples that the number of unhulled seeds was higher than 2. Based on these results, it was calculated that the value of (H) was highly uniform for this attribute (Table 4). However, according to the results presented in Table 2, the median number of red rice, for which the maximum level is 2 seeds in 500 grams (Brasil, 1993), did not register significant differences. It is shown in Table 4 that, independently of lot sizes and sampling intensities, the results did not indicate evidence of significant heterogeneity.

The average germination percentage, from different sampling frequencies, was about 90%, higher than the minimum established to commercialize certified seeds (Brasil,

Table 2. Average of dehulled and red rice seeds obtained in eight commercial rice seed lots (*Oryza sativa* L.).

Size of lot (bags)	No. of samples	No. of shelled seeds (1)	(2)	No. of seeds of red rice (1)	(2)
001 - 050	17	2.48	1.87 a*	3.03	2.01 a
051 - 100	25	1.64	1.62 abc	2.38	1.84 a
101 - 150	30	1.04	1.43 bc	2.00	1.73 a
151 - 200	40	1.63	1.62 abc	2.01	1.73 a
201 - 250	50	0.97	1.40 c	2.34	1.83 a
251 - 300	60	1.31	1.52 bc	2.63	1.91 a
301 - 350	70	1.37	1.54 bc	2.01	1.73 a
351 - 400	80	1.72	1.65 ab	2.21	1.79 a

* Different letters, in the column, differ statistically among them in the level of 1% of probability, by the Duncan test.
1 = Original values.
2 = Transformed values.

Table 3. Average of germination percentage and normal seedlings in the cold test with eight commercial rice seed lots (*Oryza sativa* L.).

Size of lot (bags)	No. of samples	Germination (%) (1)	(2)	Normal seedlings (%) (1)	(2)
001 - 050	17	90.31	71.87 b*	84.26	66.62 a
051 - 100	25	90.55	72.10 b	84.32	66.68 a
101 - 150	30	89.78	71.36 b	83.89	66.33 a
151 - 200	40	90.73	72.28 b	83.85	66.30 a
201 - 250	50	90.37	71.92 b	83.63	66.13 a
251 - 300	60	91.10	72.74 b	82.91	65.58 a
301 - 350	70	92.29	73.88 a	83.99	66.41 a
351 - 400	80	91.60	72.71 b	83.50	66.06 a

* Different letters, in the column, differ statistically among them in the level of 1% of probability, by the Duncan test.
1 = Original values.
2 = Transformed values.

Table 4. Heterogeneity values for red rice seeds (1), dehulled rice seeds (2), germination percentage (3) and normal seedlings in the cold test (4), obtained with commercial rice seed lots (*Oryza sativa* L.).

Size of lot (bags)	No. of samples	Value (H)* scheduled	Heterogeneity value			
			1	2	3	4
001 - 050	17	1.00	0	0	0	0
051 - 100	25	0.79	0	0	0	0
101 - 150	30	0.71	0	0	0	0.58
151 - 200	40	0.70	0	0	0	0
201 - 250	50	0.70	0	0	0	0.06
251 - 300	60	0.70	0	0	0	0
301 - 350	70	0.70	0	0	0	0.08
351 - 400	80	0.70	0	0	0.35	0.04

* Rules for Testing Seeds (Brazil, 1992).

1993). In Table 4, it can be seen that this attribute has shown results of (H) equal to zero for 87% of the lots. Analogous results were found by Cabral (1972), when evaluating, during two years, the heterogeneity of *Trifolium resupinatum* seeds, where germination showed a value of (H) equal to zero for 87.3% of 134 lots. A value of (H) equal to 0.35 for larger lot sizes supports the theory which emphasizes that risk of heterogeneity increases with lot size (Tattersfield, 1977).

The cold test presented results of normal seedlings at about 83% (Table 3). This value is in agreement with the observations of Grabe (1976), who says that although this test does not have established standards, lots of good quality should present, at least, 70% of normal seedlings. In Table 4, values of (H) for this attribute showed no significant heterogeneity, however the lot size of 101-150 bags showed a value (H) equal to 0.58, an acceptable value for heterogeneity. According to Miles (1962), there is a need to define a critical value of (H), which is the value obtained for the most heterogeneous lot, which is still considered acceptable. Yet according to this author, critical values of (H) for a given species, will probably be different for purity, germination and noxious seeds.

Analysing the results on Table 4, it can be seen that the cold test was more sensitive than the others for identification of differences in quality among lots, since for both red rice seeds and number of dehulled seeds, the heterogeneity was zero in all the sizes of lots. The cold test, by magnifying the differences in quality among seed lots, resulted in positive values of heterogeneity for the lots of 101-150, 201-250, 301-350, and 351-400 bags, although the values had been inferior to the Table (H) value. This indicates that the cold test is a very useful attribute for determining heterogeneity in lots of rice seeds.

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