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Multivariate analysis and vigor tests to determine the quality of *Brachiaria decumbens* seeds[1]

Análise multivariada e testes de vigor na determinação da qualidade de sementes de *Brachiaria decumbens*

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ABSTRACT - This study aimed to verify the efficiency of multivariate analysis in the identification of promising vigor tests for the evaluation of the physiological quality of seed lots of *Brachiaria decumbens* cv. Basilisk. Seeds of *B. decumbens* cv. Basilisk were tested for the following parameters: water content, germination, first germination count, cold test, electrical conductivity, seedling growth, seedling dry mass, first count and emergence percentage of seedlings in laboratory substrate, and seedling emergence in the field. The data obtained in each test—all completely randomized experimental designs—were analyzed separately by means of analysis of variance, Scott-Knott's test, and multivariate analysis. Principal component analysis is efficient to discriminate vigor and seed germination tests capable of identifying the top performance batch in the field. Germination, first germination count, emergence of seedlings in sand, first seedling emergence count in sand, shoot length, and the cold test are promising in the evaluation of the physiological quality of seed lots of *B. decumbens* cv. Basilisk, providing similar information to that from the emergence of field seedlings.

Key words: Physiological quality. Control quality. Principal component analysis. Grass forage. Seedling emergence in field.

RESUMO - Este estudo teve por objetivo verificar a eficiência da análise multivariada na identificação de testes de vigor promissores para a avaliação da qualidade fisiológica de lotes de sementes de *Brachiaria decumbens* cv. Basilisk. Foram avaliados 13 lotes de sementes de *B. decumbens*, cv. Basilisk, quanto aos seguintes parâmetros: teor de água, germinação, primeira contagem de germinação, teste de frio, condutividade elétrica, crescimento de plântulas, massa seca de plântulas, primeira contagem e porcentagem de emergência de plântulas em substrato areia no laboratório e emergência de plântulas em campo. Os dados obtidos em cada teste, em delineamento inteiramente casualizado, foram analisados separadamente por meio de análise de variância, teste de Scott-Knott e análise multivariada. A análise multivariada de componentes principais é eficiente para discriminar os testes de vigor e de germinação de sementes *B. decumbens*, cv. Basilisk, capazes de identificar os lotes de desempenho superior em campo. Os testes de germinação, primeira contagem de germinação, emergência de plântulas em areia, primeira contagem de emergência de plântulas em areia, comprimento da parte aérea de plântulas e o teste de frio são promissores na avaliação da qualidade fisiológica de lotes de sementes de *B. decumbens*, cv. Basilisk, fornecendo informações semelhantes à emergência de plântulas em campo.

Palavras-chave: Qualidade fisiológica. Controle de qualidade. Análise de componente principal. Gramínea forrageira. Emergência de plântulas em campo.

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INTRODUCTION

In Brazil, there are approximately 172 million ha of pasture grown in extensive livestock systems (TIMBÓ *et al*., 2014), placing the country as the world's largest producer, consumer, and exporter of grass seed (VIGNA *et al*., 2011).

Brachiaria decumbens Stapf. is the oldest species of forage grass and continues to have high demand, ranking second in terms of importance in the forage grass seed market. It is rustic and adapted to different growing conditions, both in terms of climate and soil (CARDOSO *et al*., 2014; PEREIRA *et al*., 2011). However, the seed quality of *Brachiaria* spp. is not always satisfactory, and research in this area is necessary (CARDOSO *et al*., 2014; PEREIRA *et al*., 2011).

The evolution of the forage grass sector and the increased competition for the international seed market among companies from Brazil, Colombia, and Australia mean that these companies aim to improve quality control testing to a level similar to that for large crops (QUADROS *et al*., 2012; TOMAZ *et al*., 2015).

Germination and vigor tests are used to evaluate the physiological quality of seed batches for the identification of those with the best field or storage potential (GRZYBOWSKI; VIEIRA; PANOBIANCO, 2015; MARCOS FILHO, 2015a). This information may assist in the internal decision-making of companies about the best destination of the seed, the geographical area to be targeted, whether it can be conveniently stored, or if it is necessary for them to be quickly sold (MARCOS FILHO, 2015a).

Therefore, a priority for many companies involved in the quality control of seed batches is research into which vigor tests and evaluation methods are most effective for a particular plant species (MARCOS FILHO, 2015a). Tests should be performed using as many batches as possible to increase the representation validity and reliability of the results (MARCOS FILHO, 2015a, 2015b).

However, the simultaneous analysis of several seed batches, including several parameters, makes it difficult to interpret the data using univariate statistical analysis, as is the case for comparison of means tests. For this purpose, multivariate analysis could be used; it is a statistical method that simultaneously analyzes multiple variables of an individual or object under investigation, with principal component analysis being the most used (HAIR *et al*., 2009).

This analysis has been used to select superior populations in plant breeding programs, in which dozens or hundreds of progenies are evaluated for a set of traits (FERRAUDO, 2014; HONGYU; SANDANIELO; OLIVEIRA JUNIOR, 2015; OLIVERIA *et al*., 2014). In this area of agronomy, multivariate exploratory techniques allow the selection and grouping of populations based on a new and less numerous set of variables, keeping the information contained in the original variables and also showing the linear relationships between them (BARBOSA *et al*., 2013; FERRAUDO, 2014). In studies on vigor tests on soybean and rice seeds, this statistical tool was successfully applied (BARBOSA *et al*., 2013; LORENTZ; NUNES, 2013), allowing the ranking of batches into groups according to quality.

The objective of this study was to verify the efficiency of multivariate analysis in the identification of promising vigor tests for the evaluation of *Brachiaria decumbens* cv. Basilisk seeds in terms of physiological quality and seedling emergence in the field.

MATERIAL AND METHODS

The research was conducted at the Seed Analysis Laboratory of the Department of Plant Production, Faculty of Agrarian and Veterinary Sciences, São Paulo State University, in Jaboticabal, SP. Thirteen seed batches of *B. decumbens* cv. Basilisk were evaluated: eight from the State of Minas Gerais, from the municipalities of Tupaciguara (batches 2, 3, and 6), Unaí (batches 7 and 12) and Monte Santo de Minas (batches 9, 10, and 13); three from São Paulo, from the municipalities of Santo Antônio da Alegria (batches 4 and 11) and Cássia dos Coqueiros (batch 1); and one each from Jataí, GO and Treasure, MT (batches 5 and 8, respectively).

All batches were sampled at the time of receipt from the company, homogenized, and cleaned to obtain the pure seeds. The water content was determined by the oven method at 105 ± 3 °C for 24 h (BRASIL, 2009), with three subsamples of 0.5 g of seeds.

The tests applied to the seeds to determine emergence in the field were used as reference for the selection of vigor tests, as described below:

Seedling emergence in the field was evaluated by sowing four subsamples of 50 seeds per treatment in beds in the field in lines of 1.5 m in length, with rows spaced 0.2 m apart, at a depth of 2 cm, with counts performed at 21 days after sowing and results expressed as percentages (SILVA *et al*., 2017). During this test, environmental conditions showed temperatures of 24 ± 5 °C, rainfall of 132.9 mm, and an average relative humidity of 79.3% (Agrometeorological Station, UNESP, Jaboticabal, SP).

Germination was evaluated with eight subsamples of 50 seeds, sown on two sheets of filter paper moistened with 0.2% KNO_3 solution, in the amount equivalent to 2.5

times the dry mass of the substrate, packed in transparent plastic boxes (11.0 × 11.0 × 3.5 cm), kept at 20-35 °C. Normal seedling counts were performed on the 21st day after sowing (BRASIL, 2009; TOMAZ *et al*., 2015). The first count, performed in conjunction with the germination test, involved counting the normal seedlings present on the seventh day after sowing and represented as a percentage (BRASIL, 2009).

Seedling emergence in sand was conducted with four subsamples of 50 seeds, which were sown in sand packed in plastic boxes (22.0 × 15.0 × 5.0 cm) and kept at 26 ± 3 °C. The percentage of emerged seedling at 21 days after sowing was counted and calculated. Concomitantly, the first emergence count was evaluated 7 days after sowing.

The cold test was performed with four subsamples of 50 seeds, on rolls of paper towel moistened with distilled water in the amount equivalent to 2.5 times the dry mass of the substrate. The seeds were maintained at 10 °C for 7 days and then at 20-35 °C for 7 days, and the percentage of normal seedlings was evaluated at the end of the period (MARCOS FILHO, 2015b).

The seedling growth test was performed with four subsamples of 20 seeds per batch, sown on a line drawn on the upper third of the paper towel, pre-wetted in water 2.5 times the mass (g) of the paper. The rolls of paper were placed upright in the germinator and packed in plastic bags to prevent dehydration. The test was conducted at 25 °C and completed on the seventh day after sowing, upon which the average root and shoot lengths were measured and calculated with a ruler in mm (PEREIRA *et al*., 2009).

The dry mass of the seedlings was evaluated after they were measured during the growth test. The seedlings were sectioned by separating the aerial part from the root part. These structures were separately packaged in Kraft paper bags and oven-dried forced air circulation at 65 °C for 48 h, with the results expressed in g·seedling^{-1} (NAKAGAWA, 1999).

Electrical conductivity - four subsamples of 1.5 mL of seeds per batch (approximately 140 seeds) were quantified with the aid of an Eppendorf type tube and weighed using a scale with an accuracy of 0.001 g. Sampling by volume rather than the traditional method, number of seeds, was adopted in order to facilitate and make the testing of small seeds more practical and to easily adapt it to the procedures followed in a typical company laboratory. The seeds were soaked in plastic cups containing two volumes of deionized water, 50 mL and 75 mL, at 25 °C, and the readings were carried out after 2, 4, 6, 8, and 24 h using a conductivity meter, with the results expressed in µS·cm^{-1}·g^{-1}.

The experimental design was completely randomized, except for the seedling emergence in the field, which was conducted in randomized blocks with four replicates per treatment. The data was firstly tested for normality (Shapiro–Wilk test) and homoscedasticity (Cochran test), and then submitted to analysis of variance (ANOVA). The data obtained in each test was analyzed separately by means of ANOVA, and the means of the treatments were compared using the Scott-Knott test, with 5% of the probability realized in the program AgroEstat. Principal component analysis was processed using the R program (R CORE TEAM, 2016).

RESULTS AND DISCUSSION

The water content of the seed batches of *B. decumbens* cv. Basilisk, were between 8.5% and 10.5% (Table 1). These values are within the range of four percentage points, which gives reliability to the test results (MARCOS FILHO, 2015b).

The seedling emergence in the field was used as a reference for the selection of vigor tests, and it was possible to classify the performance of the batches in decreasing order of vigor from 1-13 and to group them into two vigor classes: high (batches 1-5) and low (batches of 6-13). This criterion was used because one of the purposes of the vigor test is to evaluate the physiological quality of the seeds to differentiate batches in terms of vigor level and predict seedling emergence in the field (BARBOSA *et al*., 2013; COIMBRA *et al*., 2009; MARCOS FILHO, 2015a; OLIVEIRA *et al*., 2014).

All batches used in the study had a germination rate of higher than 60% (Table 1). Therefore, they can be considered commercial seeds, as this is the minimum percentage allowed by the standards for the commercialization of seeds of *B. decumbens* cv. Basilisk (BRASIL, 2008). This value is comparatively low in relation to those prescribed for large crops such as corn, soybean, and rice, which are between 80%–85% (BRASIL, 2013).

The germination test allowed for the physiological potential of the seed batches of *B. decumbens* cv. Basilisk to be differentiated into three levels of quality: high (batches 1 and 4), medium (batches 2, 3, 5, 6, 7, 9, 10, and 12), and low (batches 8, 11, and 13). However, the first germination count was separated into four vigor levels: high (batches 1, 2, and 4), medium-high, (batches 3 and 5-9), medium-low (batches 10 and 13), and low (batches 11 and 12).

It should be noted that the first count vigor test indirectly evaluates the germination rate of the seeds,

Table 1 - Water content (WC), Seedling emergence in the field (EF), germination (G) and first germination count (FGC), emergence (E), and first emergence count (FEC) of seedlings in boxes with sand in the laboratory; and cold test (CT), root length (RL) and shoot length (SL), dry matter of the roots (DMR), and the aerial part of seedlings (DMAP) of 13 seed batches of *Brachiaria decumbens* cv. Basilisk

Lots	WC	EF	G	FGC	E	FEC	CT	RL	SL	DMR	DMAP
	%							cm		g/ seedling	
1	8.6	76 a	83 a	81 a	76 a	73 a	63 a	9.9 b	5.8 a	0.66 b	1.57 a
2	9.5	58 a	77 b	76 a	70 a	66 a	68 a	9.4 b	5.0 a	0.54 c	1.38 b
3	9.0	63 a	79 b	70 b	62 a	54 a	62 a	12.2 a	5.5 a	0.72 b	1.45 b
4	8.8	57 a	87 a	77 a	65 a	57 a	64 a	9.7 b	5.9 a	0.57 c	1.31 b
5	9.4	65 a	74 b	71 b	62 a	61 a	52 a	7.8 c	5.4 a	0.43 c	1.37 b
6	8.5	40 b	78 b	69 b	65 a	63 a	65 a	9.9 b	5.7 a	0.44 c	1.20 b
7	10.0	43 b	77 b	71 b	67 a	66 a	62 a	9.1 b	5.0 b	0.55 c	1.32 b
8	9.9	42 b	63 c	62 b	61 a	61 a	59 a	10.6 a	5.0 b	0.68 b	1.50 a
9	9.7	48 b	74 b	64 b	29 b	27 b	37 b	12.1 a	4.8 b	0.92 a	1.71 a
10	10.5	40 b	75 b	57 c	29 b	27 b	28 c	11.3 a	4.4 b	0.42 c	1.07 b
11	9.9	40 b	63 c	45 d	32 b	29 b	33 c	7.8 c	5.4 a	0.77 b	1.74 a
12	9.2	37 b	74 b	50 d	25 b	20 b	45 b	9.7 b	4.7 b	0.58 c	1.35 b
13	10.1	36 b	65 c	55 c	31 b	25 b	28 c	10.7 a	4.4 b	0.71 b	1.38 b
F	-	3.7**	5.9**	13.5**	31.1**	29.5**	21.7**	5.7**	6.5**	6.8**	4.7**
CV (%)	-	26.9	8.2	9.0	13.2	14.9	12.6	11.7	7.7	18.4	12.1

** Significant at 1% probability by the *F*-test. Averages followed by the same letter in the column do not differ from each other using the Scott-Knott test at 5% probability

which is a desired trait when cultivating pastures (PARIZ *et al*., 2010).

Slow germination is a characteristic of vigor that precedes germination loss, since the speed of germination is one of the first characteristics to be affected by seed deterioration (MARCOS FILHO, 2015b). Therefore, the first count test was more effective in detecting the loss of physiological potential than was the germination test.

Therefore, based on the seedling emergence in the field, the first count and seedling emergence tests, both carried out in boxes with sand in the laboratory, stand out. The results of these tests made it possible to classify the batches into two vigor classes: high (batches 1–8) and low (batches 9-13), similar to those observed in the seedling emergence in the field. Similarly, Melo *et al*. (2017) verified the efficiency of the seedling emergence test in sand to evaluate the seed quality of xaraés grass. Quadros *et al*. (2012) also verified the efficiency of the seedling emergence test in sand to evaluate the vigor of seed batches of *B. brizantha* after sweeping and manual harvesting.

Similar to the emergence test and the first count of seedlings in sand, the cold test classified seed batches 1-8 as high vigor. However, this test was less efficient in the differentiation of low vigor batches, as it ranked batches 9 and 12 as medium vigor and batches 10, 11, and 13 as low vigor.

The length of the seedling shoots of *B. decumbens* cv. Basilisk ranked the batches in two vigor classes: high (batches 1-6 and 11) and low (the other batches) (Table 1). Similarly, research on seeds of *Panicum maximum* cv. Tanzania (MELO *et al*., 2016) and *Avena sativa* L. (LAURA *et al*., 2009) verified the efficacy of the length test of the aerial part of seedlings in the classification of vigor. This test has advantages over others; it is simply executed, the equipment used is common in any seed laboratory, and it is recommended for species where there is little research on seed vigor tests (MARCOS FILHO, 2015a), as is the case with forage grass crops.

The other vigor tests, such as root length and dry masses of the roots and shoots, showed only 30.76%, 23.08%, and 46.15%, respectively, and were not efficient in the classification of batches when compared to the seedling emergence in the field, possibly due to the high variability in the growth of forage grass affecting these variables. This discrepancy in relation to emergence in the field was also observed by Silva *et al*. (2017) when evaluating seedling length in *B. brizantha*.

The results obtained in the electrical conductivity test for both volumes (50 mL and 75 mL) were also not promising (Table 2). This test differentiated the seed batches of *B. decumbens* cv. Basilisk into vigor classes, but these were in conflict with the results verified by the seedling emergence in the field test and other vigor tests.

The main discrepancies were verified for batches 2, 4, and 5; these batches were considered to have high vigor according to the field emergence test, but low vigor according to the electrical conductivity test, as they resulted in high conductivity readings, which led to the assertion that the membrane systems of the seeds were unstructured and had low vigor. The opposite phenomenon was verified for batches 8; 10 and 13. Harvesting the seeds of *B. decumbens* cv. Basilisk is performed by sweeping the soil, which exposes the seeds to contact with the soil, and in turn with fertilizers and organic matter, which impregnates them with ions that interfere with the results.

When analyzing the set of tests, the most promising ones for evaluating the vigor of seed batches of *B. decumbens* cv. Basilisk would be those whose results were similar to each other and to the seedling emergence in the field, i.e., seedling shoot length, cold test, first count, and seedling emergence in boxes with sand in the laboratory. In this case, it is necessary to apply multiple vigor tests, using at least three (MARCOS FILHO, 2015a).

By applying cluster analysis, it was possible to verify the formation of four groups of differentiated batches in terms of seed quality (Figure 1).

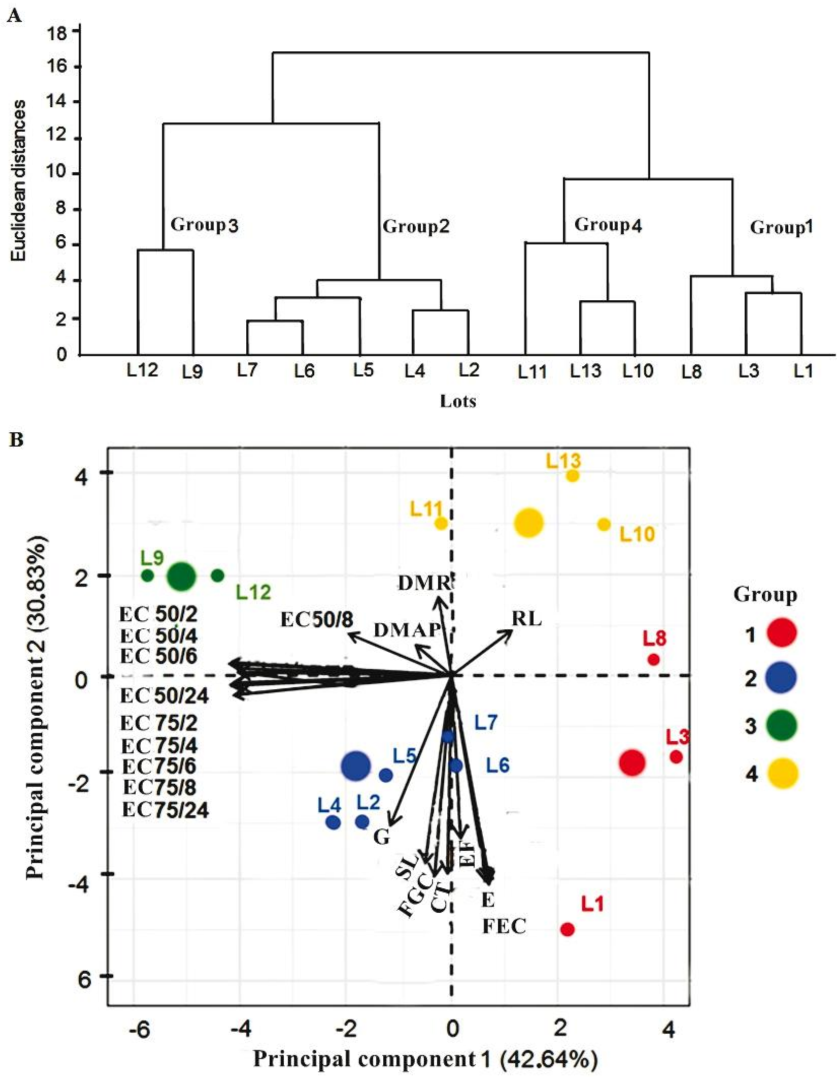
The Euclidean distance adopted for this purpose was 9.0. To explain the variability of the data in the principal component analysis of the 13 batches of *B. decumbens* cv. Basilisk, two components with a total variance of 42.64% and 30.83% were required. The sum of these values totaled 73.47% of the accumulated

Table 2 - Electrical conductivity test performed in 50 mL and 75 mL of water over periods of 2, 4, 6, 8, and 24 h in the quality evaluation of 13 seed batches of *Brachiaria decumbens* cv. Basilisk

Lots	Electrical conductivity (μS cm^{-1} g^{-1})									
	50 mL					75 mL				
	2h	4h	6h	8h	24h	2h	4h	6h	8h	24h
1	15.6 a	19.4 a	22.2 a	25.0 a	43.0 a	13.7 a	15.0 a	16.9 a	18.8 b	30.6 b
2	27.8 d	32.9 c	35.5 c	39.2 c	61.7 c	17.1 b	19.9 c	21.5 c	24.0 c	36.7 c
3	15.1 a	17.6 a	19.4 a	21.6 a	33.4 a	10.9 a	12.2 a	13.2 a	14.6 a	23.5 a
4	24.1 c	28.4 b	32.0 b	34.4 b	57.0 c	20.2 c	22.9 c	24.7 d	27.2 d	41.1 c
5	22.8 c	27.2 b	30.3 b	34.0 b	50.0 b	16.5 b	19.8 b	22.1 c	24.7 c	37.3 c
6	19.2 b	26.2 b	29.1 b	32.0 b	52.3 b	15.9 b	18.5 b	20.3 b	22.8 c	35.8 c
7	20.9 b	24.6 b	26.7 b	30.0 b	50.8 b	16.4 b	18.4 b	20.3 b	22.5 c	38.4 c
8	13.9 a	17.7 a	20.3 a	23.0 a	36.9 a	11.4 a	13.4 a	15.1 a	16.9 a	27.2 a
9	25.4 c	30.7 c	34.0 c	37. 9 c	56.7 c	24.2 d	27.9 d	31.2 e	33.9 e	51.5 d
10	16.1 a	18.9 a	20.6 a	23.1 a	37.4 a	11.8 a	13.4 a	14.7 a	16.5 a	26.1 a
11	20.1 b	24.2 b	27.6 b	30.1 b	49.9 b	15.7 b	17.6 b	19.2 b	21.5 b	33.1 b
12	30.5 d	34.9 c	37.6 c	41.2 c	62.0 c	22.1 c	24.8 c	26.3 d	28.8 d	42.5 c
13	15.6 a	18.8 a	21.0 a	23.7 a	41.3 a	11.5 a	13.5 a	15.1 a	17.2 a	28.1 a
F	24.98**	22.26**	19.77**	18.93**	13.96**	18.83**	18.85**	20.08**	16.07**	13.98**
CV (%)	10.41	10.23	10.33	10.15	10.47	12.24	12.17	11.61	12.45	11.99

** Significant at 1% probability by the *F*-test. Averages followed by the same letter do not differ from each other according to Scott-Knott's test at 5% probability

Figure 1 - Dendrogram resulting from hierarchical grouping analysis with the formation of groups (A) and dispersion of eigenvectors along a circle plane, and group formation (B) obtained by principal component analysis according to the seedling emergence in the field (EF), germination (G) and first germination count (FGC), and emergence (E) and first emergence count (FEC) of seedlings in boxes with sand in the laboratory; and cold test (CT), root length (RL), shoot length (SL), dry mass of the roots (DMR) and the aerial part of the seedlings (DMAP), and electrical conductivity (EC) in 50 mL and 75 mL of water over 2, 4, 6, 8, and 24 h periods (EC50/2, EC50/4, EC50/6, EC50/8, EC50/24, EC75/2, EC75/4, EC75/6, EC75/8, and EC75/24, respectively) of seeds from 13 batches of *Brachiaria decumbens* cv. Basilisk



variance (Figure 1 B). Similarly, studies on vigor tests of soybean seeds (BARBOSA *et al*., 2013 and piatã grass seeds (SILVA *et al*., 2017) also found that two principal components were sufficient to explain 65.86% and 74.23% of the variance in the discrimination of variables, respectively. However, Lorentz and Nunes (2013), in a similar study with rice, found the need for three principal components, which explained 80.42% of the characteristics.

In Figure 1B, high correlations were observed between the seedling emergence in the field, emergence and first emergence of seedlings in sand, the cold test, germination, and first count of germination, since the vectors indicative of these parameters formed acute angles among themselves. However, for the electrical conductivity performed in the two volumes and over various soaking periods, the root length and dry masses of root and aerial part of the seedlings did not present high

Table 3 - Correlation between each principal component and evaluation of the physiological performance of seeds of 13 batches of *Brachiaria decumbens* cv. Basilisk

Variables	Component 1	Component 2
Seedling emergence in the field	0.13	-0.71
Seedling emergence in sand	0.31	-0.93
First emergence count	0.30	-0.91
Germination	-0.17	-0.71
First germination count	0.09	-0.90
Cold test	0.07	-0.92
Root length	0.18	0.29
Shoot length	0.02	-0.85
Dry mass of the roots	-0.17	0.40
Dry mass of the aerial part	-0.22	0.15
Electrical conductivity (EC) 50 mL/2h	-0.92	-0.15
Electrical conductivity (EC) 50 mL/4h	-0.93	-0.19
Electrical conductivity (EC) 50 mL/6h	-0.94	-0.20
Electrical conductivity (EC) 50 mL/8h	-0.57	-0.26
Electrical conductivity (EC) 50 mL/24h	-0.91	-0.24
Electrical conductivity (EC) 75 mL/2h	-0.98	-0.08
Electrical conductivity (EC) 75 mL/4h	-0.99	-0.08
Electrical conductivity (EC) 75 mL/6h	-0.98	-0.08
Electrical conductivity (EC) 75 mL/8h	-0.98	-0.08
Electrical conductivity (EC) 75 mL/24h	-0.96	-0.11
Eigenvalues	8.95	6.48
Total Variance (%)	42.64	73.47

correlations with the seedling emergence in the field, since the vectors formed angles greater than 90 degrees relative to this parameter.

According to Hongyu, Sandanielo and Oliveira Junior (2015), the discriminatory power of the variables in each principal component is measured by correlation. Therefore, based on the values in Table 3, it can be inferred that the seedling emergence in the field (-0.71), emergence in sand (-0.93), first count in sand (-0.91), germination (-0.71), first germination count (-0.90), cold test (-0.92), and shoot length (-0.85) were correlated with the second principal component. These negative correlations allowed the discrimination of group 1, shown at the bottom of Figure 1B.

Therefore, group 1 was characterized by seed batches with greater viability and vigor by the germination and vigor tests mentioned. It can also be stated that group 4 comprises batches of seeds with low vigor because it is in the quadrant opposite these variables.

For the electrical conductivity test of the seeds obtained over different times and at different soaking volumes, negative correlations were verified between -0.91 and -0.99 with the first principal component, except for when soaking in 50 mL of water for 8 h (Table 3). Therefore, with principal component analysis, it is possible to verify the formation of group 3, in which batches 9 and 12 were separated as inferior because they presented high values of electrical conductivity, and batches 1, 3 and 8 as belonging to group 1 with higher quality due to the lower release of leachate.

It is worth noting that besides ranking the batches according to vigor, the evaluation tests of interest to seed analysis laboratories are those that present results correlated with the seedling emergence in the field (MARCOS FILHO, 2015a).

CONCLUSION

1. Multivariate principal components analysis is efficient in discriminating between the vigor and germination tests of *B. decumbens* cv. Basilisk seeds that are capable of identifying batches with superior performance in the field;
2. Germination, first germination count, seedling emergence in sand, first seedling count in sand, seedling length, and the cold test are promising in the evaluation of the physiological quality of seed batches of *B. decumbens* cv. Basilisk, providing information similar to that of the seedling emergence in the field test.

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