PRODUCTION FIELDS AND PHYSIOLOGICAL QUALITY OF *PANICUM MAXIMUM* JACQ. CV. MOMBASA SEEDS

CAMPOS DE PRODUÇÃO E QUALIDADE FISIOLÓGICA DE SEMENTES DE PANICUM MAXIMUM JACQ. CV. MOMBAÇA

José de Oliveira CRUZ[1]; Cibele Chalita MARTINS[2]; Tatiane Sanches JEROMINI[2]; Givanildo Zildo da Silva[3]

1. Universidade de Brasília, Faculdade de Agronomia e Medicina Veterinária, Brasília, DF, Brasil. josecruz08@yahoo.com; 2. Universidade Estadual Paulista "Júlio de Mesquita Filho", Departamento de Produção Vegetal, Jaboticabal, SP, Brasil; 3. Universidade Federal de Jataí, Programa de Pós-Graduação em Agronomia, Jataí, GO, Brasil.

ABSTRACT: The physiological quality of seeds is influenced by the climatic factors of production fields. The identification of the best conditions of *P. maximum* cv. Mombasa production fields allows the improvement of the seed sector. The aim of this work was to identify which climatic conditions of production fields can affect the physiological quality of *P. maximum* cv. Mombasa seeds. Nineteen plots from states of São Paulo (six from municipalities of Auriflama and three from Guzolândia) and Goiás (eight from Quirinópolis and two from Serranópolis), were collected by soil sweeping. The following parameters were evaluated: water content, germination rate, first germination count and germination rate index, seedling emergence in sand and field. Completely randomized design was used for all variables, with the exception of seedling emergence in field, since this variable required block design. Means were compared by the Scott-Knott test, at 5% probability. For the identification of the influence of climatic conditions on the physiological quality of seeds, multivariate statistical analysis was applied through Group and Principal Component Analysis. Production fields of *Panicum maximum* cv. Mombasa seeds presenting maximum temperatures above 32 ºC at flowering and natural fall stages produce seeds of low physiological quality. Production fields in which precipitation and high temperatures occur during natural fall and harvest of *P. maximum* cv. Mombasa seeds are not favorable to the production of seeds with high physiological quality.

KEYWORDS: Climatic conditions. Cumulative precipitation. Forage grass. Multivariate analysis. Vigor.

INTRODUCTION

In Brazil, *Panicum maximum* Jacq., is the second forage grass in importance regarding the volume of marketed seeds (ABRASEM, 2016). Mombasa cultivar is the most productive forage grass, has large size, vigorous tillers, tolerance to drought, adaptability and ease of establishment (CANTO et al., 2012; EUCLIDES et al., 2010; JANK; VALLE; RESENDE, 2011;). These attributes of *P. maximum* cv. Mombasa have increased the expressive demand for its seeds (CANTO et al., 2012).

There are reports of differences in seed lot quality of other forage grasses such as *Urochloa decumbens* (LAURA et al., 2009), *Urochloa brizantha* cv. BRS Piata (SILVA et al., 2017) and *U. brizantha* cv. Marandú. (NUNES; BATISTA; NÓBREGA, 2016) due to the climatic conditions of production fields such as temperature, precipitation and relative humidity (SILVA et al., 2017).

Some authors have found that seeds from production fields with low temperatures have better physiological quality than those produced in hot and humid climates (MINUZZI et al., 2010). However, no information was found associating quality of *P. maximum* cv. Mombasa seeds with the climatic conditions of production fields.

For this type of research, the use of multivariate techniques such as Principal Component Analysis (PCA) in data analysis has been shown to be an important tool, since it allows evaluating a large number of lots and different environmental conditions simultaneously (SILVA et al., 2017).

The identification of the conditions that favor production and quality of forage grass seeds allows the recognition of new areas with potential for the implantation of new production fields (MARCOS-FILHO, 2016; SILVA et al., 2019bc;). The selection of the best areas for the production of these seeds enables reducing costs through sectorization logistics, identification of producing areas and production of high-quality seeds (SILVA et al., 2019a).

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There are studies that verify differences in the physiological quality of forage seeds such as *P. maximum* cv. Mombasa (MELO et al., 2016a), cv. Tanzania (MELO et al., 2016b) and *U. brizantha* cv. BRS Piata (SILVA et al., 2017). The authors verified that the test of seedling emergence in sand and field was efficient to evaluate the physiological quality of lots.

The aim of this study was to verify which climatic conditions of production fields affect the physiological quality of *P. maximum* cv. Mombasa seeds.

MATERIAL AND METHODS

In this study, 19 *P. maximum* cv. Mombasa seed lots were evaluated after mechanized harvesting in production fields of different origins from municipalities of Auriflama – SP (lots 1 to 6), Guzolândia – SP (lots 7 to 9), Quirinópolis - GO (lots 10 to 17) and Serranópolis - GO (lots 18 and 19). During seed production, climatic factors such as temperatures (minimum, average and maximum) and cumulative precipitation during flowering, natural fall and harvesting seasons were recorded.

Seeds were harvested using a soil sweeping harvester, in which plants were cut with a cutter blade and a machine put the material together in sheds. The harvester swept the soil mixture from the soil surface along with seeds and removed some of impurities that were mixed with seeds.

Still in the field, the collected material was submitted to a cylindrical sieve machine (typhoon) attached to the tractor power take-off for pre-cleaning. Then, 5-kg homogenized samples from each lot of crude seed were obtained. These were packaged in paper bags and sent to the Laboratory of Seed Analysis of the Faculty of Agrarian and Veterinary Sciences, "Universidade Estadual Paulista", Campus of Jaboticabal - SP, to determine the following quality parameters.

Water content - determined using the method of oven at 105 ± 3 ºC for 24 hours. Three 2-g seed sub-samples weighted in precision analytical scale were used (0.001 g) and data were expressed as percentage (wet basis), with one decimal place (BRASIL, 2009).

Germination test - Eight 50-seed sub-samples were sown on two paper sheets moistened with 2.5 times their weight in water and packed in transparent plastic boxes with lid (11.0 x 11.0 x 3.5 cm), under alternating temperature of 20-30 ºC and 8 hour photoperiod (BRASIL, 2009; TOMAZ et al., 2010). Normal seedlings were counted on the 28th day after sowing (BRASIL, 2009). After germination count, the remaining seeds were submitted to the tetrazolium test for the detection of dormant seeds that were counted (TOMAZ et al., 2010).

First germination count - performed together with the germination test by counting normal seedlings present on the seventh day after sowing. Results were presented as percentage (BRASIL, 2009).

Germination rate index - daily counting of germinated seedlings from the seventh to the 28th day after sowing was carried out and the methodology and formula proposed by Maguire (1962) were applied.

Seedling emergence in sand - conducted with four 50-seed sub-samples sown at the depth of 1.0 cm on sand substrate moistened with water in amount corresponding to 60% of its retention capacity (BRASIL, 2009) inside plastic boxes of 22.0 x 15.0 x 5.0 cm. The test was conducted in greenhouse (25 ± 2 ºC and RH = 60%) and, whenever necessary, the substrate was remoistened. At 28 days after sowing, the percentage of emerged seedlings was recorded and results were expressed as percentage (SILVA et al., 2017).

Seedlings emergence in field – the experiment was installed in the experimental area of the Department of Plant Production - UNESP, during the first half of November 2017. Four 50 seed sub-samples were sown at the depth of 1 centimeter in lines of 1.0 m in length, spaced 0.3 m. The count of emerged seedlings was performed at 28 days after sowing and the result was expressed as percentage (OLIVEIRA et al., 2014). During the test conduction period, the daily maximum and minimum temperatures of the field environment were 17.5 and 36.0 °C, respectively. The mean relative humidity was 75% and precipitation was 221 mm distributed over 28 days. Irrigation was carried out whenever necessary.

Statistical procedures - A completely randomized design was used, except for the test of seedling emergence in field, since it had random block design.

Data were previously tested for normality by the Shapiro-Wilk test. Variables germination, first count of seed germination and seedling emergence in sand were transformed into sine arch. Data were then submitted to the Scott-Knott test at 5% probability.

For the identification of the influence of climatic conditions on the physiological quality of seeds, multivariate statistical analysis was applied, with standardization of variables in average equal to zero and variance equal to one. To obtain similar groupings, the hierarchical method was used from the Euclidean distance between lots in the set of variables (SNEATH; SOKAL, 1973). Principal component analysis was based on the Ward groups (HAIR et al., 2005).

RESULTS AND DISCUSSION

Production fields of *P. maximum* cv. Mombasa seeds presented different climatic conditions, even for some lots produced in fields of the same municipality (Table 1).

Table 1. Minimum (Mi), average (Av) and maximum (Ma) temperatures (ºC), cumulative precipitation in mm (P) during flowering, natural fall and harvesting of 19 lots (L) of *P. maximum* cv. Mombasa seeds of different production fields.

Municipality	L	Flowering				Natural fall				Harvesting			
		Mi	Av	Ma	P	Mi	Av	Ma	P	Mi	Av	Ma	P
Auriflama - SP	1	12	25	32	65	13	22	32	15	13	22	29	0
	2	11	23	35	76	12	22	33	28	12	21	33	14
	3	11	23	34	62	12	22	33	23	12	21	33	50
	4	11	22	34	62	12	23	33	23	12	20	33	50
	5	11	25	34	25	12	22	33	63	12	22	32	24
	6	14	23	31	65	14	22	32	15	13	21	30	0
Guzolândia – SP	1	13	23	30	108	13	22	30	26	14	20	30	0
	2	13	24	29	128	13	22	31	26	13	22	27	0
	3	13	23	30	32	14	22	31	8	13	21	28	0
Quirinópolis – GO	1	15	24	33	4	12	22	33	19	16	22	32	16
	2	15	22	29	15	16	22	31	4	15	23	29	0
	3	15	22	32	100	14	22	33	43	17	20	25	14
	4	15	22	34	93	14	22	28	49	16	23	30	6
	5	15	22	29	15	16	23	31	4	14	22	29	0
	6	15	22	34	93	14	22	33	49	16	21	30	6
	7	15	24	29	45	16	22	31	4	14	22	29	0
	8	15	24	29	49	16	22	31	5	14	22	29	0
Serranópolis - GO	1	19	23	31	68	15	22	32	6	16	23	30	0
	2	17	24	34	98	14	22	33	77	13	22	32	6

In the vegetative and reproductive growth phases of *P. maximum* cv. Mombasa, minimum temperatures of 11 ºC and maximum temperatures of 35 ºC were registered. The occurrence of frost was not verified in production fields, although there are reports that municipalities of Auriflama - SP (541 m) and Serranópolis - GO (718 m) would be susceptible to this event (ASTOLPHO et al., 2004). Frost severely compromises the production of pasture seeds (SOUZA, 2001) and locations subject to this climatic phenomenon should be avoided.

During the flowering phase of plants, temperatures between 11 and 19 °C and maximum temperatures between 29 and 35 °C were observed in all production fields. The highest cumulative precipitation of 128 mm was observed during the flowering of lot 2 from Guzolândia-SP and the lowest in lot 1 from Quirinópolis-GO (4 mm).

Zanuzo, Muller and Miranda (2010) studied the influence of climatic conditions of the flowering season on the quality of *U. brizantha* seeds and verified that the association of high diurnal temperatures and low nocturnal temperatures during seed maturation caused an increase in carbohydrate accumulation, which leads to the formation of seeds with high physiological quality.

In the natural fall phase, temperatures between 12 and 16 ºC and maximum temperatures between 28 and 33 ºC were observed in all production fields. The maximum cumulative precipitation in this phase was 77 mm during the production of seeds of lot 2 from Serranópolis - GO and the minimum was 4 mm in lots 2, 5 and 7 from Quirinópolis - GO.

At the harvesting of seed fields, minimum temperatures were between 12 and 17 ºC and maximum temperatures between 25 and 33 ºC were observed. Maximum cumulative precipitation was observed during the harvest of seeds of lots 3 and 4 from Auriflama - SP (50 mm) and absence of rainfall was observed in the harvest of seeds of lots 1 and 6 from Auriflama - SP; 1, 2 and 3 from

Guzolândia - SP; 2, 5, 7 and 8 from Quirinópolis - GO and 1 from Serranópolis - GO.

The occurrence of precipitations during natural fall and harvesting may lead to deterioration and increase of the incidence of fungi in seeds and also impair the work of harvesting machines (MARCOS-FILHO, 2016; SOUZA, 2001). Thus, in the choice of seed production fields, priority should be given to sites that allow harvesting the field in drought periods (SILVA et al., 2019a).

Table 2 presents the results of the physiological quality analysis of seeds that was also different among lots of production fields.

Table 2. Water content (WC), germination (G), first germination count (FGC), germination rate index (GRI), seedling emergence in sand (SES) and seedling emergence in field (SEF) of 19 lots of *P. maximum* cv. Mombasa seeds from different regions.

Procedência	Lots	WC	G	FGC	GRI	SES	SEF
		--------------%--------------				--------%--------	
Auriflama - SP	1	11	79 b	79 b	4.4 b	80 a	49 a
	2	11	66 c	65 c	3.4 c	71 a	40 a
	3	10	71 c	70 c	3.8 c	74 a	36 b
	4	12	70 c	70 c	4.3 b	55 b	26 c
	5	11	68 c	68 c	3.6 c	64 b	36 b
	6	11	92 a	92 a	4.9 b	85 a	56 a
Guzolândia - SP	1	11	83 b	82 b	5.0 b	74 a	34 b
	2	11	86 b	86 a	4.8 b	78 a	33 b
	3	11	96 a	96 a	6.0 a	87 a	58 a
Quirinópolis - GO	1	10	69 c	69 c	3.5 c	78 a	48 a
	2	9,7	81 b	81 b	3.9 c	73 a	40 a
	3	9,7	61 c	60 c	2.5 d	58 b	32 b
	4	9,8	70 c	68 c	3.3 c	54 b	16 c
	5	10	89 a	89 a	3.7 c	78 a	40 a
	6	12	48 d	44 d	1.8 d	39 c	19 c
	7	11	83 b	82 b	4.2 b	85 a	47 a
	8	12	83 b	83 b	4.2 b	78 a	51 a
Serranópolis - GO	1	11	83 b	83 b	3.2 c	82 a	44 a
	2	9,8	76 c	76 b	3.9 c	67 b	25 c
F	-	-	9.2**	8.9**	8.6**	11.5**	5.9**
CV (%)	-	-	10.2	11.0	16.5	10.4	25.3

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

The water content of *P. maximum* cv. Mombasa seeds ranged from 9.7 to 11.7% among lots (Table 2). Therefore, it was considered uniform, and Silva et al. (2017) recommended differences in water content close to two percentage points for the reliability of results of tests that evaluate the physiological quality of forage grass seeds.

It was possible to observe that seeds from all production fields presented germination rate between 96 and 48% (Table 2). Thus, all lots under study showed germination rate higher than 40%, according to official standards for the commercialization of *P. maximum* seeds (BRASIL, 2008). However, it should be highlighted that in this work, unprocessed crude seed samples were evaluated. Therefore, quality can still be improved after being submitted to the Seed Processing Unit (UBS) of companies (MELO et al., 2016a).

Seeds of lot 6 from Auriflama - SP; 3 from Guzolândia - SP and 5 from Quirinópolis - GO presented the highest germination rates, 92, 96 and 89%, respectively. Lots 1 from Auriflama - SP; 1 and 2 from Guzolândia - SP; 2, 7 and 8 from Quirinópolis - GO and 1 from Serranópolis - GO, presented germination rates between 79 and 86%, and were the second group of lots regarding germination lower than the first one. The high quality of these lots can be attributed to the absence of rainfall in the period during seed harvesting (Table 1).

Therefore, these results allow inferring that the choice of production fields located in places where the harvesting season of forage grass seeds coincides with periods of drought is fundamental to obtain seeds with high physiological quality.

Souza (2001) and Marcos-Filho (2016) stated that rainfall during harvesting causes deterioration of forage grass seeds and causes harvesting delays according to the time required to dry the soil and run the machines.

The lowest germination rate of 48% was verified in lot 6 from Quirinópolis – GO. The study lots did not contain dormant seeds, only dead (data not shown). A similar fact was found by Melo et al. (2016a) in seeds of the same species and cultivar and has been frequently observed in lots of *P. maximum* seeds, since the sweeping harvest adopted in the last decades favors the natural overcoming of seed dormancy before harvest (TOMAZ et al., 2010).

The first germination count test presented result like germination. Verifying the results of these tests, it was verified that within each municipality, the climatic conditions influenced the physiological quality of seeds. Maximum temperatures above 33 °C during flowering and natural fall and higher than 30 ° C during harvest possibly reduced seed quality (Table 1).

The germination rate, evaluated by the germination rate index, was only severely affected by unfavorable weather conditions. The lowest indexes were verified for seeds of lots 3 and 6 from Quirinópolis - GO (2.5 and 1.8, respectively); which also presented lower germination rates.

The germination process of seeds with low vigor tends to occur in a slower way (MAGUIRE, 1962; TOMAZ et al., 2010), and lots of seeds with slower germination cause problems to farmers, hampering pasture formation and favoring the emergence of invasive plants (ROCKENBACH et al., 2018).

The seed lots under study presented seedling emergence in sand between 39 and 87% and these values were higher than those obtained in the standard germination test. The greenhouse temperature, humidity, brightness and substrate disinfection conditions used in tests were more favorable to the germination of seeds, and most plots showed maximum performance, above 71% seedling emergence in sand.

Seed of lots 4 and 5 from Auriflama - SP; 3 and 4 from Quirinópolis - GO and 2 from Serranópolis - GO presented lower vigor, and the rate of seedling emergence in sand was between 39 and 67%. Lots produced in these production fields were those with lower physiological quality in all other vigor and germination tests.

Vigor evaluated by seedling emergence in field was between 16 and 58%. Despite the low seedling emergence in field when compared with germination results, lots 1, 2, and 6 from Auriflama - SP; lot 3 from Guzolândia - SP; lots 1, 2, 5, 7 and 8 from Quirinópolis - GO and lot 1 from Serranópolis - GO, could be considered of high vigor when evaluated by this variable. In the field, air temperature and precipitation interact with other environmental variables, such as soil fertility, to provide adequate conditions for seed germination and seedling emergence (WALCK et al., 2011).

The greenhouse conditions where the seedling emergence in sand (temperature 25 ± 2 ºC) and sowing in sterilized substrate tests were carried out were like the ideal conditions used in the germination test at 20 - 30 ºC recommended by Brasil (2009). Conversely, the field environment conditions during seedling emergence tests were unfavorable because soil had microorganisms that could damage seeds and the temperature recorded ranged from 17.5 to 36 °C. Therefore, these factors may justify the better performance of seeds in the seedling germination and emergence in sand when compared to results of seedling emergence in field, as was also verified for *P. maximum* cv. Tanzania seeds (MELO et al., 2016b).

Considering all evaluations performed, it was possible to verify that the production field of lot 3 from Guzolândia - SP produced seeds of higher physiological quality and the production field of lot 6 from Quirinópolis - GO, seeds of lower quality.

Even with the separation of lots according to the physiological quality based on variables by the means test, the effect of climatic factors during production on the quality of seeds was evaluated. For this reason, Principal Component Analysis was used, as recommended by Silva et al. (2017).

Due to the large amount of information, it is difficult to elucidate the influence of each of the climatic factors on each seed quality parameter, so it was necessary to analyze the correlation of the principal components (Table 3), as performed by Silva et al. (2017).

Thus, the correlations between principal components and variables germination, first germination count, germination rate index, seedling emergence in sand and field, minimum and maximum temperatures and cumulative precipitation at flowering, natural fall and harvest were initially analyzed (Table 3). The discriminatory power of study variables in each component was analyzed by means of the principal component correlation (HONGYU; SANDANIELO; OLIVEIRA-JUNIOR, 2015).

Table 3. Correlation of the physiological quality tests and climatic factors of production fields of the 19 lots of *P. maximum* cv. Mombasa seeds with each principal component.

Variables		Principal components	
		1	2
Quality of seeds	Germination	**0.91**	0.27
	First germination count	**0.90**	0.30
	Germination rate index	**0.64**	**0.61**
	Seedling emergence in sand	**0.83**	0.41
	Seedling emergence in field	**0.73**	0.43
Fatores climáticos	Minimum temperature at flowering	0.30	**-0.73**
	Maximum temperature at flowering	**-0.90**	0.21
	Minimum temperature at natural fall	**0.63**	**-0.63**
	Maximum temperature at natural fall	-0.50	0.32
	Minimum temperature at harvest	0.24	**-0.80**
	Maximum temperature at harvest	-0.50	**0.60**
	Cumulative precipitation at flowering	-0.32	-0.21
	Cumulative precipitation at natural fall	**-0.74**	-0.14
	Cumulative precipitation at harvest	**-0.65**	0.50
Eigenvalues		6.21	3.18
Total variance (%)		44.33	22.71
Accumulated variance (%)		67.04	

Note: Variables indicated in bold have significant importance for the factor.

In order to explain the variability of data in the principal component analysis, two components with variance of 44.33% in PC1 and 22.71% in PC2 were required (Table 3). The cumulative variance was 67.04%. This value was sufficient to explain the variables analyzed, since the cumulative variance should be approximately 70% (RENCHER, 2002; SILVA et al., 2017).

In each principal component, the correlation values should be equal to or greater than 0.6 to be considered relevant and discriminatory (LORENTZ; NUNES, 2013; SILVA et al., 2017). Thus, in the correlation analysis, all variables were able to explain data with reliability, except for maximum temperature in natural fall and cumulative precipitation in flowering, which did not have discriminatory power in at least one of the two principal components. The germination rate and the minimum temperature in natural fall presented correlation in the two principal components studied.

In the correlation analysis of principal component 1, it was verified that all variables that evaluated the physiological quality of seeds such as germination (0.91), first germination count (0.90), germination rate index (0.64), seedling emergence in sand (0.83) and in field (0.73) and climatic factors of maximum temperature at flowering (-0.90), minimum temperature at natural fall (0.63), cumulative precipitation at natural fall (-0.74) and harvest (-0.65), presented discriminatory power (Table 3).

In principal component 1, physiological quality variables of seed lots were inversely proportional to climatic conditions of maximum temperature at flowering, cumulative precipitation at natural fall and harvesting. This phenomenon can be verified by positive and negative numerical values.

According to the correlation analysis of principal components, it was verified that the higher the maximum temperature at flowering, the lower the physiological quality of *P. maximum* cv. Mombasa seeds, according to the positive and negative values of table 3, confirming data observed in the comparison of means of table 2 and climatic data of table 1.

Therefore, production fields that showed during flowering maximum temperatures above 32 °C (Table 1) produced seeds with lower physiological quality. This fact was verified in the analysis of germination test, first germination count and germination rate index results (Table 2). In addition, fields where precipitation was observed during harvesting (Table 1), produced seeds with low physiological quality, also verified by previously mentioned tests (Table 2).

Still in this component, the minimum temperature at natural fall presented behavior similar to the physiological quality, i.e., as the minimum temperature increased, there was an increase in germination and vigor (first count and germination rate index), as verified in the positive correlation values (Table 3).

Thus, production fields with minimum temperatures lower than 13 ºC and 15 ºC during natural fall (Table 1) of seed lots from the states of São Paulo and Goiás, respectively, produced seeds with low physiological quality, when evaluated by germination and first germination count tests (Table 2). Nery et al. (2012) reported that production fields in which high temperatures and humidity occur during natural fall and harvesting produced higher quality forage grass seeds, but in lower amounts.

In principal component 2, among physiological quality variables, only germination rate index (0.61) presented discriminatory power. Climatic factors that presented this power were minimum temperature at flowering (-0.73), minimum temperature at natural fall (-0.63) and maximum temperature at harvest (0.60) (Table 3).

Among the variables arranged in the dispersion plane, the most representative in principal component 1 were germination, first germination count and maximum temperature at flowering, as they had the highest eigenvectors in the dispersion plane (Figure 1) and the highest discriminatory power, with correlation of ± 0.90 (Table 3). In principal component 2, only minimum temperature at harvest had higher eigenvector in the dispersion plane (Figure 1) and greater discriminatory power (correlation of ± 0.80).

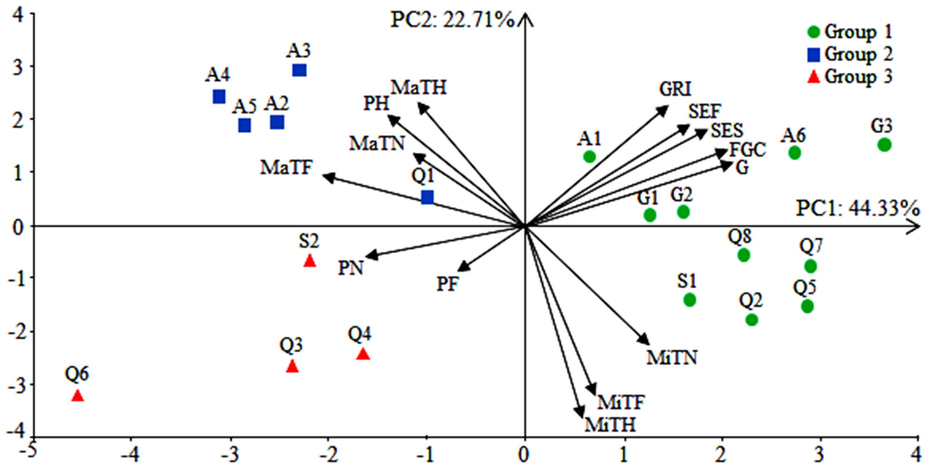

Figure 1. Biplot-type dispersion plane with circle of eigenvectors obtained by the analysis of two principal components (PC1 and PC2) established based on variables germination (G), first germination count (FGC), germination rate index (GRI), seedling emergence in sand (SES), seedling emergence in field (SEF), minimum temperature at flowering (MiTF), natural fall (MiTN) and harvest (MiTH), maximum temperature at flowering (MaTF), natural fall (MaTN) and harvest (MaTH), cumulative precipitation at flowering (PF) natural fall (PN) and harvest (PH) in the evaluation of the physiological quality of 19 lots of *P. maximum* cv. Mombasa seeds.

*Lots identification: A1 to A6 (Auriflama – SP); G1 to G3 (Guzolândia – SP); Q1 to Q8 (Quirinópolis – GO); S1 and S2 (Serranópolis – GO).

In the dispersion graph, the distribution of lots forming three distinct groups was verified (Figure 1). Group 1 consisted of lots 1 and 6 from Auriflama - SP; 1, 2 and 3 from Guzolândia - SP; 2, 5, 7 and 8 from Quirinópolis - GO and lot 1 from Serranópolis - GO. These fields produced seeds with the highest physiological quality indicated by germination eigenvectors, first count and germination rate index, seedling emergence in sand and field closer to these lots. The production fields of these lots also presented low cumulative precipitation at the time of seed natural fall, as verified by the eigenvector that indicates this phenomenon in the opposite quadrant. Therefore, production fields with cumulative precipitation less than 26 mm at the time of natural fall did not have the physiological quality of seeds. Minimum temperatures below 13 ºC at natural fall and harvest of production fields harmed the physiological quality of seeds produced according to germination and vigor tests.

Group 2 was composed of lots 2, 3, 4 and 5 from Auriflama - SP and lot 1 from Quirinópolis - GO. This group of lots presented lower quality seeds compared to those of the previous group, indicated by the distance of physiological quality eigenvectors (germination, first count and germination rate index, seedling emergence in sand and field). At the production sites of these lots, maximum temperatures above 33 °C were recorded during flowering. At harvest, maximum temperatures were higher than 31 ºC and cumulative precipitation above 14 mm. This fact can be verified by the presence of eigenvectors in the same quadrant of lots of the dispersion plane of figure 1 and according to climatic data of table 1.

In this group, it could be verified in almost all plots of this group, minimum temperatures of 11 and 12 ºC occurred in production fields during flowering, natural fall and harvest, according to eigenvectors located in the opposite quadrant (Figure 1) and data from table 1.

Group 3 was formed by the seed production fields of lots 3, 4 and 6 from Quirinópolis - GO and 2 from Serranópolis - GO. These seed lots presented low physiological quality. The presence of germination eigenvectors and vigor tests in the quadrant opposite to lots allowed inferring that there was low affinity between these production fields and the quality of seeds produced. Possibly, high temperatures and high cumulative precipitations during natural fall and harvesting of seeds produced in these fields have reduced their quality. High precipitation during natural fall of forage grass seeds may affect their quality, as it may cause seeds still in formation to fall (SOUZA, 2001).

Thus, it was observed that climatic factors such as minimum and maximum temperatures and cumulative precipitation during the production stages of *P. maximum* cv. Mombasa affected the physiological quality of seeds.

CONCLUSIONS

Production fields of *P. maximum* cv. Mombasa seeds showing maximum temperatures above 32 ºC at flowering and natural fall stages produce seeds of low physiological quality;

Production fields in which precipitations and high temperatures occur during natural fall and harvest of *P. maximum* cv. Mombasa seeds are not favorable to the production of seeds with high physiological quality.

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RESUMO: A qualidade fisiológica das sementes é influenciada pelos fatores climáticas dos campos de produção. A identificação das condições dos melhores campos de produção de *P. maximum* cv. Mombaça permite aprimoramento do setor de sementes. O objetivo desse trabalho foi identificar quais condições climáticas dos campos de produção podem afetar a qualidade fisiológica das sementes de *P. maximum* cv. Mombaça. Foram avaliados dezenove lotes procedentes do estado de São Paulo (seis de Auriflama e três de Guzolândia) e Goiás (oito de Quirinópolis e dois de Serranópolis), colhidos por varredura do solo. Foram avaliados por meio dos seguintes parâmetros: teor de água, germinação, primeira contagem de germinação e índice de velocidade de germinação, emergência de plântulas em areia e em campo. Adotou-se delineamento inteiramente casualizado para todas as variáveis, com exceção da emergência de plântulas em campo, pois neste adotou-se delineamento em blocos. As médias foram comparadas pelo teste Scott-Knott, a 5% de probabilidade. Para a identificação da influência das condições climáticas na qualidade fisiológica das sementes aplicou-se análise estatística multivariada por meio de Análise de Agrupamento e Componentes Principais. Campos de produção de sementes de *Panicum maximum* cv. Mombaça que apresentam temperaturas máximas superiores a 32 ºC nas épocas de florescimento e degrana produzem sementes de baixa qualidade fisiológica. Campos de produção em que ocorram precipitações e altas temperaturas durante a degrana e à colheita de sementes de *P. maximum* cv. Mombaça não são favoráveis a produção de sementes com alta qualidade fisiológica.

PALAVRAS-CHAVE: Análise multivariada. Condições climáticas. Gramínea forrageira. Precipitação acumulada. Vigor.

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