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The genotype does not influence the establishment of elephantgrass (*Pennisetum purpureum* Schum.)

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ABSTRACT. This study investigated whether genotype influences the establishment of *Pennisetum purpureum* Schumach. The experimental design was a randomized complete blocks with four treatments and eight replications (n=8). The treatments were four genotypes of *P. purpureum*, two classified as tall sizes: *P. purpureum* cv. Elephant B and cv. IRI 381; and two as dwarf types: *P. purpureum* cv. Mott and Taiwan A-146 2.37. They were planted in a tropical wet and dry region of Brazil. Tall genotypes showed superior field sprouting rates ($p < 0.05$), ranging between 95-99%, while dwarfs varied between 88-90%, however, Elephant B and IRI 381 produced a much lower average number of tillers (31 and 32 linear m^{-1}, respectively), than Taiwan A-146 2.37 and Mott (56 and 41 linear m^{-1}, respectively) ($p < 0.05$). Dwarf genotypes produced lower biomass yields ($p < 0.05$), but this was genotype-dependent and did not impact on their establishment. The levels of non-structural carbohydrates (NSC) (>10%) in the planted stems were associated with satisfactory field sprouting of the elephantgrass genotypes. Despite some variations between the genotypes in terms of sprouting, tillering, and growth rates, the kind of genotype had no major significance on the establishment of the elephantgrass.

Keywords: Crop establishment; C_4 grasses; pasture growth.

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Introduction

Elephantgrass (*Pennisetum purpureum* Schumach.) is a warm-season grass species known for its elevated potential for biomass accumulation and forage productivity (Freitas et al., 2017). It has been used in animal feeding via grazing (Crestani, Ribeiro Filho, Miguel, Almeida,& Santos, 2013), cut-and-carry fresh (Pereira, Lédo,& Machado, 2017), or conserved (e.g. silage) (Mapato & Wanapat, 2018). Also, it has been grown for bioenergy purposes, due to its rates of biomass accumulation and yields (Na et al., 2015; Rocha et al., 2017). The cultivars of elephantgrass are clustered into five groups (Cameroon, Napier, Mercker, Dwarf and interspecific hybrids) according to their genetical and morphophysiological characteristics. Most of elephantgrass cultivars are categorized as tall genotypes. Elephantgrass is generally planted via vegetative propagation, using stems, as many of the commercially available genotypes have weak seedling vigor (Pozitano & Usberti, 2012; Iki, Ishii, Fukagawa,&Idota, 2016). However, many ecotypes and hybrid cultivars of elephantgrass can be spread by seeds (Souza Sobrinho, Ledo, Pereira, & Oliveira, 2008; Camelo et al., 2020). Morphological features (e.g. plant height, stem diameter, number of meristems) can influence on the sprouting rate and propagation of elephantgrass genotypes (Sollenberger, Jones, Albrecht, & Ruitenberg, 1990), although their success in establishing is very dependent on the environmental and agronomic conditions of the field (Rusland, Sollenberger, & Jones Jr., 1993). In this scenario, it is interesting to understand how these variations in the establishment occur for different types of elephantgrass cultivars.

For achieving a satisfactory level in terms of establishment of elephantgrass, the quality of the stems planted should meet some criteria, which includes enough quantity of non-structural carbohydrates (NSC), preserved meristems, and absence of damage from pests and diseases (Budiman, Soetrisno, Budhi, & Indrianto, 2011; Mullet, 2017). An adequate establishment is achieved by a combination of high rates of field sprouting and tillering, and vigorous plant growth. Consequently, a good establishment phase will increase the chances of greater productivity and sustainability of the cropland.

Planting elephantgrass is generally costly and laborious, requiring massive amounts of stems to be harvested, transported, sectioned and sowed. Generally, tall genotypes produce longer stems with elongated internodes regions, while dwarf genotypes have shorter stems and internodes. In practical terms, tall-sized genotypes require more biomass of stems to provide the same number of meristems compared to a given dwarf genotype. In the literature, some studies suggested that dwarf genotypes might be less efficient in establishing than tall-size ones (Woodard, Prine,& Ocumpaugh, 1986; Silva et al., 2009; Fukagawa & Ishii, 2018). Nevertheless, it still unclear if the size of the genotype can impact the establishment rate of elephantgrass. This study evaluated if the genotype influences the establishment of elephantgrass.

Material and methods

The experiment was carried out on the Experimental Farm at the Universidade Federal Rural de Pernambuco - UFRPE, in the city of Garanhuns, state of Pernambuco - Brazil (08°53'25 "south latitude and 36° 29'34" west longitude). The climate of the region is classified as tropical wet and dry (type Aw in the climatic classification of Köppen-Geiger). The city is located at approximately 900 m a.s.l, and the annual precipitation is around 866 mm (Barbosa, Souza, Galvíncio, & Costa, 2016). During the experimental period, which occurred from April to July 2016, the accumulated precipitation was 199 mm; and the minimum and maximum temperatures were 17 and 26°C, respectively (Instituto Nacional de Meteorologia [INMET], 2019).

Before the beginning of the experiment, soil samples were collected for chemical analyses. The soil of the experimental area was classified as Yellow Argisol (Santos et al., 2018). The correction of the soil pH and fertilization were carried out according to the results of the soil chemical analysis, which showed the following features: pH in water = 5.4; P = 2.0 $mg.dm^{-3}$ ($Mehlich^{-1}$); K = 0.2 $cmol_c.dm^{-3}$ ($Mehlich^{-1}$); Ca = 0.95 $cmol_c.dm^{-3}$, Mg = 0.95 $cmol_c.dm^{-3}$, H + Al = 5.52 $cmol_c.dm^{-3}$, V = 27% and cations exchange capacity (CEC) = 7.6 $cmol_c.dm^{-3}$. The soil was conventionally prepared using heavy harrowing (20 cm depth), followed by smooth harrowing to incorporate limestone and levelling the soil. Furrows of approximately 20-cm depth were made and spaced 1-m apart. Dolomitic limestone [total neutralization relative power (TNRP) = 90%] was applied and incorporated into the soil (20-cm depth), aiming to raise the saturation of bases in the soil to 70%. Potassium chloride (K_2O) and single superphosphate (P_2O_5) were applied in the furrows at a dosage of 80 kg ha^{-1} and 100 kg ha^{-1}, respectively, before planting the stems. The total biomass of the stems used to plant one hectare varied between 855 to 1,672 kg fresh weight (FW) ha^{-1}, being lower in Taiwan A-146 2.37 and greater in Mott, respectively (Table 1).

Table 1. Total biomass planted, non-structural carbohydrates (NSC) and morphological features of the elephantgrass stems used for the establishment of the plantations.

Feature	Elephantgrass genotype*			
	Mott	Taiwan A-146 2.37	Elephant B	IRI 381
[1] Total biomass of stems planted (kg ha^{-1} FW)	1670 ±130	860 ±48	1330 ±85	910 ±85
[2] Concentration of NSC in the stems (g kg^{-1} DW)	131 ±40	128 ±24	103 ±52	164 ±62
Plant height (m)	1.7 ±0.1	1.9 ±0.5	3.2 ±0.3	3.5 ±0.3
Numbers of nodes per tiller	30 ±10	24 ±5.9	24 ±7.4	27 ±5.4
Diameter of stem (mm)	17.9 ±3.6	13.4 ±2.4	22.4 ±6.0	16.1 ±3.9

[1] Biomass of stems used to plant one hectare. [2] NSC= Total non-structural carbohydrates. DW = dry weight; FW= fresh weight ± standard deviation (n= 9). *All stems were from genotypes with approximately 10 months old.

Four genotypes of *Pennisetum purpureum* Schumach. were tested, two of them classified as tall-sized genotypes (IRI 381 and Elephant B), and two as dwarf types (Taiwan A-146 2.37 and Mott) (Table 1). IRI 381 originated from IRI (IBEC *Research Institute*). Elephant B, also known as Merker, was introduced in Brazil via Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA) CNPGL, and Taiwan A-146 2.37 originated from a partnership program of plant breeding between UFRPE and the Instituto Agronômico de Pernambuco (IPA-PE). Mott cultivar was developed in Tifton, GA United States and evaluated and released as a cultivar at the University of Florida (Sollenberger et al., 1989). It was brought to Brazil during the 1980s. The genotypes were planted by vegetative propagation, using stems of 10-month-old plants (Table 1).

The nursery genotypes were grown at the experimental station of sugar cane in the UFRPE campus, located in the city of Carpina, state of Pernambuco. The soil of the area was classified as Yellow Argisol, and had the following chemical features: pH in water = 5.2; P = 40 $mg.dm^{-3}$ ($Mehlich^{-1}$); K = 0.28 $cmol_c.dm^{-3}$ ($Mehlich^{-1}$); Ca = 3.80

$cmol_c.dm^{-3}$, Mg = 1.40 $cmol_c.dm^{-3}$, Na= 0.09 $cmol_c.dm^{-3}$, Al= 0.1 $cmol_c.dm^{-3}$, V = 49.8% and cations exchange capacity (CEC) = 11.1 $cmol_c.dm^{-3}$. The nursery stems were grown in furrow rows of 30 cm depth at field conditions. There was no lime or fertilizer application before planting. Nevertheless, approximately 20 days after the nursery plants started growing, there was an application of 100 kg ha^{-1} of N (urea) and 80 kg ha^{-1} K_2O. Periodically, weeds were removed using manual techniques. The nursery plants were not subjected to defoliation before the cut for transporting the seedling stems. The plants were cut at the soil level. The nursery tillers had their tips removed; however, the leaves in the stems were kept aiming to protect the meristems and avoid damages.

During the planting, the stems were harvested, transported, sectioned and sowed within two days. They were directly placed in double rows in the furrows using the technique known as 'foot with the tip', where the thicker part of one stem faces the thinner part of a parallel stem. Each stem was sectioned with an average length of 40 cm, and their tips were removed to avoid apical dominance. Stems were covered with soil after being placed within the furrows. The treatments (genotypes) were arranged in a randomized block design with eight replicates each (n=8), totalling 32 experimental units. Individual plots were 24 m^2 (4 x 6 m), and the sampling area of each plot was 15 m^2 (3 x 5 m).

The experimental area was irrigated using a drip system, with approximately 95% of water distribution uniformity. The irrigation aimed to supply water to restore 100% of the actual crop evapotranspiration (ETc), and it was calculated based on the standardized Penman-Monteith method FAO/56. The reference evapotranspiration (ET0) was calculated daily and used to estimate the actual crop evapotranspiration, considering the following Kc values: 0.40 for the first 10 days of the growing cycle; 0.80 for the interval between the 11^{th} and 50^{th} days, and 1.0 over the 51^{st} day (Allen, Pereira, Raes,& Smith, 1998). The sum of the reference evapotranspiration (ET_0) and the average daily blade irrigation during the experimental period were 174 and 0.20 mm, respectively.

Field sprouting evaluations were performed at 20, 40, 60 and 90 days after planting. For this evaluation, 5 rows of 3-m length (15 m of row total) were sampled within each plot. As a criterion for successful sprouting, elephantgrass shootings on the soil with more than 5 cm height were counted. It was counted the number of plant shootings along each marked row, and, if there was a distance >20 cm between two plant shootings, this was counted as a sprouting failure within the row. The sprouting percentage was calculated using the following equation: (%) Sprouting percentage on soil-planted lines = 100 - [(∑ F/∑ B) *100]. In which: ∑ F = Sum of failures (no sprouting in a planted line of the soil > 20 cm distance between plants); ∑ B = Sum of successful sprouting (successful sprouting in a planted line of the soil < 20 cm distance between plants).

The measurements of tillering growth and other morphological traits were performed within a delimited area of the plot 0.5 m^2 (1 x 0.5 m), at 20, 41, 55, 75 and 90 days after planting. All tillers in the sampling area (0.5 m^2) were marked in each evaluation using different colour markers. Responses evaluated were the number of tillers m^{-1}; the percentage of tiller appearance [(new tillers in the evaluation x 100) /total number of tillers in the first evaluation]; tillers mortality rate [(total number of dead tillers in the evaluation x 100)/total number of tillers in previous evaluation], equations were proposed by Pessoa et al. (2016). The stability index of tiller populations was calculated (percentage of survival/percentage of tillers appearance), as proposed by Bahmani, Thom, Matthew, Hooper, and Lemaire (2003).

The morphological characterization of the tillers was always performed in the same two plants selected within the marked area of each plot (0.5 m^2). Plant height (cm), plant growth rate (cm day^{-1}), stem length (cm), stem elongation rate (cm day^{-1}), stem diameter (mm), and number of expanded leaves were measured. Plant height was measured using a metric tape and was based on the average of four measurements per plot. The height of the plants was recorded based on the distance between the soil and the inflection of the highest leaf.

At 90 days after planting, all plots were completely harvested (5-cm stubble height). This material was weighed to estimate the total biomass, herbage accumulation rate and to evaluate the leaf and stem biomass ratio of the swards. Two tillers were randomly selected from the harvested biomass, leaf blades were removed, and the stems were fractionated in equal parts (base, middle and apex). These fractions of the stem were taken to a forced-air circulation oven, dried at 55°C until constant weight, ground in a Wiley mill (1-mm sieve). Non-structural carbohydrates were extracted from these stems using the anthrone method (Bezerra Neto & Barreto, 2011), and were analysed in a spectrophotometer (620 nm) using glucose as the standard control. Dry matter (DM) concentration was accessed by drying the material in an oven at 105°C until constant weight.

The statistical analyses were carried out using the statistical software SPSS 23 IBM®. Before the analysis of variance (ANOVA), normality (Shapiro-Wilk and Kolmogorov-Smirnov) and homoscedasticity (Levene)

tests were performed to evaluate data distribution. Means were compared at the significance level of 5% ($p < 0.05$) using the Tukey HSD test. For variables that showed non-homogeneous variance in the Levene's test ($p < 0.05$), their means were compared by the Games-Howell test ($p < 0.05$). Regression models were tested for the relationship between plant growth variables and days after planting, models were chosen according to R^2 and best-fit relationship. Principal components analysis (PCA) was performed using the Microsoft Excel add on XLSTAT.

Results and discussion

Tall genotypes (Elephant B and IRI 381) showed greater field sprouting rates ($p < 0.05$) (Table 2), ranging between 95-99%, while Mott and Taiwan A- 146 2.37 had sprouting rates of 88 to 90%, respectively. The greatest difference was between Elephant B compared to Mott, approximately >10%. All genotypes showed best-fit quadratic models in the relationship between field sprouting rate and days after planting (Figure 1a). At approximately two months after being planted, the genotypes tended to cease or stabilize their field sprouting.

Tall genotypes Elephant B and IRI 381 showed a much lower average number of tillers 31 and 32 per linear m^{-1} than Taiwan A-146 2.37 and Mott, 56 and 41 linear m^{-1}, respectively ($p < 0.05$) (Table 2). The number of tillers per linear m of row increased in the first two months of growth in all elephantgrass genotypes and were noticed to stabilize after the evaluation performed at 55 days after planting (Figure 1b). All genotypes showed best-fit quadratic functions in their relationships between the number of tillers per linear mof row and days after planting (Figure 1b). There was no effect of genotype on tiller mortality ($p > 0.05$), which was considered very low <1%. Taiwan A-146 2.37 showed greater stability index, mostly associated with its greater number of tillers per linear mof row (Table 2) ($p < 0.05$).

Table 2. Productive and morphological traits of elephant grass genotypes harvested at 90 days after establishment planting.

Variable	Elephantgrass genotypes						
	Mott	Taiwan A-146 2.37	Elephant B	IRI 381	SE	Levene's test p-value	ANOVA p-value
Sprouting rate on soil	88.8 c	90.7 c	99.0 a	96.4 b	0.88	0.03*	p < 0.0001
Number of tillers per linear (m^{-1})	41.7 b	56.6 a	31.0 c	32.2 c	2.11	0.44	p < 0.0001
Tillers stability index	2.30 b	5.05 a	1.70 b	1.61 b	0.31	0.04*	p < 0.0001
Stem length (cm)	86.8 b	89.8 b	108.5 a	108.4 a	2.29	0.20	p < 0.0001
Stem elongation rate (cm day^{-1})	0.97 b	1.01 b	1.20 a	1.21 a	0.02	0.55	p < 0.0001
Plant height (cm)	160 b	166 b	238 a	241 a	8.24	0.05	p < 0.0001
Stem diameter (mm)	15.0 c	15.8 bc	19.2 a	17.0 b	0.33	0.19	p < 0.0001
Forage mass (t DM ha^{-1})	5.46 b	5.08 b	9.80 a	8.45 a	0.45	0.14	p < 0.0001
Forage accumulation (kg DM $ha^{-1}day^{-1}$)	60.7 b	56.5 b	109 a	93.9 a	5.02	0.15	p < 0.0001
DM concentration (g kg^{-1})	225 c	239 bc	253 ab	267 a	3.57	0.47	p < 0.0001
Stems mass (t DM ha^{-1})	3.10 b	3.77 b	7.16 a	6.46 a	0.36	0.05	p < 0.0001
Leaves mass (t DM ha^{-1})	2.36 a	1.30 b	2.66 a	1.97 a	0.15	0.04*	p < 0.003
Leaf / stem ratio	0.77 a	0.34 b	0.38 b	0.31 b	0.04	0.004*	p < 0.0001
Number of expanded leaves	9.06 a	6.62 b	5.19 b	5.12 b	0.35	0.93	p < 0.0001

Means with different lowercase letters in the row differed in the Tukey HSD test ($p \leq 0.05$).*Variables that showed non-equal variance (Levene's test $p < 0.05$), means with different lowercase letters in the row differed in the Games-Howell post-hoc test ($p \leq 0.05$).DM= dry matter; SE = Standard error (n=8).

Plant height, stem length, stem elongation rate, and stem diameter were superior in tall genotypes ($p < 0.05$) (Table 2). Elephant B and IRI 381 average plants heights, 238 and 241 cm at 90 days, respectively, were taller than Mott and Taiwan A-146 2.37, 160 and 166 cm, respectively. Elephant B and IRI 381 had a stem length of 108 cm on average, which was greater than Mott and Taiwan A-146 2.37, average 88.28 cm. Elephant B had the largest stem diameter average of 19.2 mm ($p < 0.05$). All genotypes had best-fit linear functions in the relationship between plant height and days after planting (Figure 2a), while stem length showed best-fit quadratic functions (Figure 2b). Stem diameter displayed best-fit with a logarithmic regression in the function of the days after planting. A large increase in diameter was noticed in the first 20 days of growth in all genotypes, followed by slow-steady increase up to 90 days, when the last measurement was taken (Figure 2c).

Forage accumulation, forage accumulation rate, dry matter concentration and stem biomass were superior in tall genotypes ($p < 0.05$) (Table 2), at 90 days establishment period. Taiwan A- 146 2.37 showed the lowest leaf biomass of 1.30 t DM ha^{-1} ($p < 0.05$), while Mott did not differ from the tall genotypes ($p > 0.05$). The leaf/stem ratio and the number of expanded leaves were superior in Mott ($p < 0.05$) (Table 2). Forage biomass accumulation in Elephant B and IRI 381 were 9.8 and 8.4 t DM ha^{-1}, respectively, while Mott and Taiwan A-

146 2.37 had 5.4 and 5.1 t DM ha^{-1}. The PCA analysis showed that the dwarf genotypes were more nearly similar to each other (F1 68.6% axis) (Figure 3) and were more uniform in terms of their sward structure. Dwarf genotypes were characterized by a greater number of tillers; however, it did not reflect in greater or comparable forage accumulation compared with the tall genotypes.

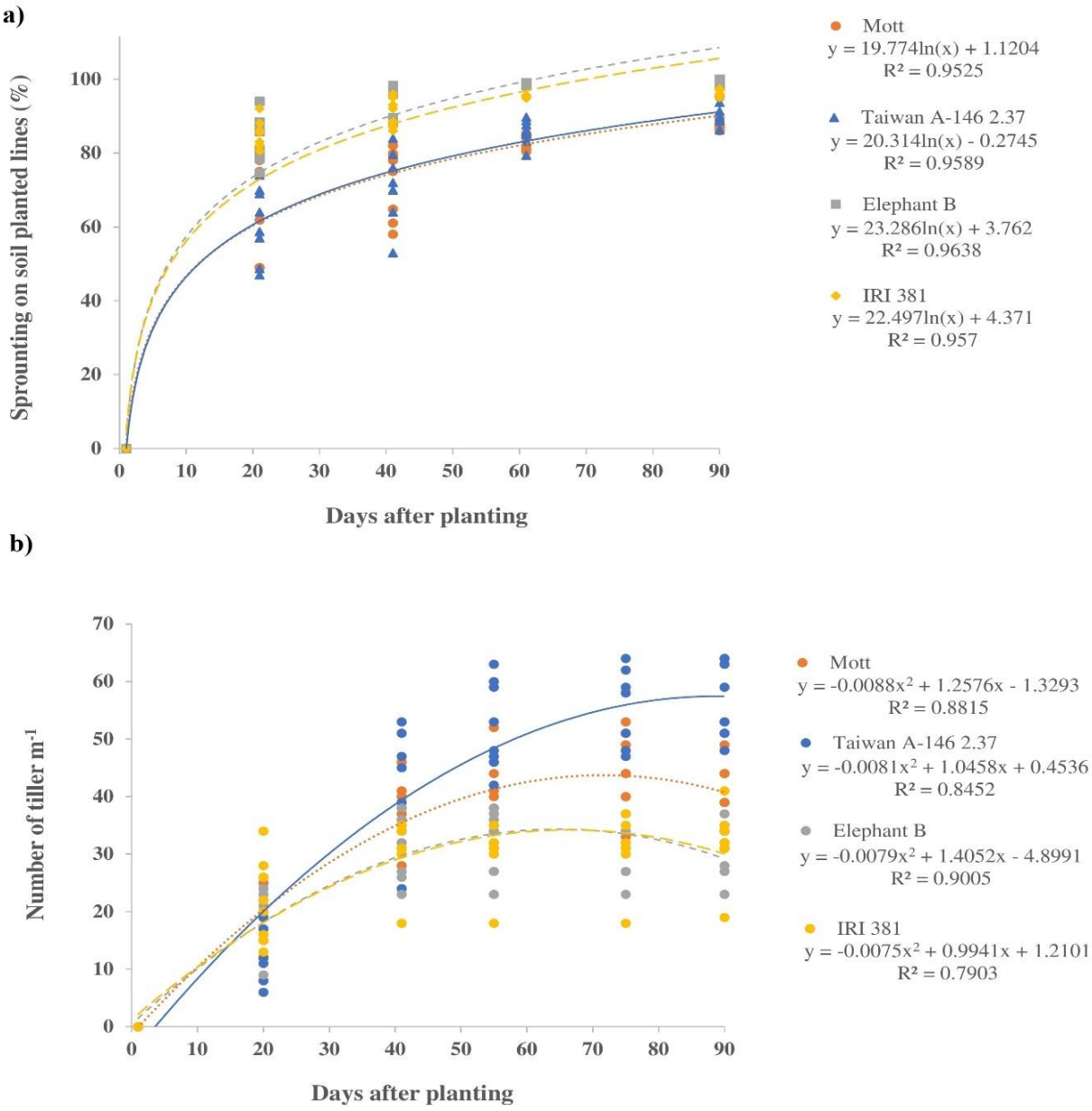

Figure 1. Sprouting rate on soil (a) and number of tillers (linear m^{-1}) (b) of the elephantgrass genotypes evaluated at 20, 40, 60 and 90 days after planting. Significance level in the regressions ($p < 0.05$).

Elephantgrass genotypes harvested at 90 days showed differences in NSC concentration only at the base of the stems ($p < 0.05$) (Figure 4). Mott showed greater concentration of NSC at the base of the stem compared with Taiwan A-146 2.37 ($p < 0.05$), while Elephant B and IRI 381 showed intermediate concentration. Comparing the genotypes, there were no differences ($p > 0.05$) in NSC concentration in the middle of the stem nor at their apex (Figure 4). In all genotypes a pattern was observed with NSC concentration decreasing from the base of the stem to the apex ($p < 0.05$); the middle part, in general, showed intermediate values (Figure 4).

Although the dwarf genotypes showed a slightly lesser percentage of field sprouting (<10%) than tall-sized genotypes, they were considered to have comparable establishment efficiency, as their sprouting rate was around 90%, which is noticeably good under field conditions. This satisfactory result observed in all genotypes was linked to the quality of the stems planted, especially their concentration of NSC that ranged between 10 to 16%, as well as their number of preserved meristems (Table 1). Despite the known importance of the NSC

in supplying the energy required by the meristems for shooting and growth (Mullet, 2017; Benot et al., 2019), there is no consensus of what is the optimal level of NSC in planted stems of elephantgrass. Our findings suggest that concentrations above 10% of NSC should provide satisfactory levels of field sprouting, once environmental and nutritional conditions are adequate.

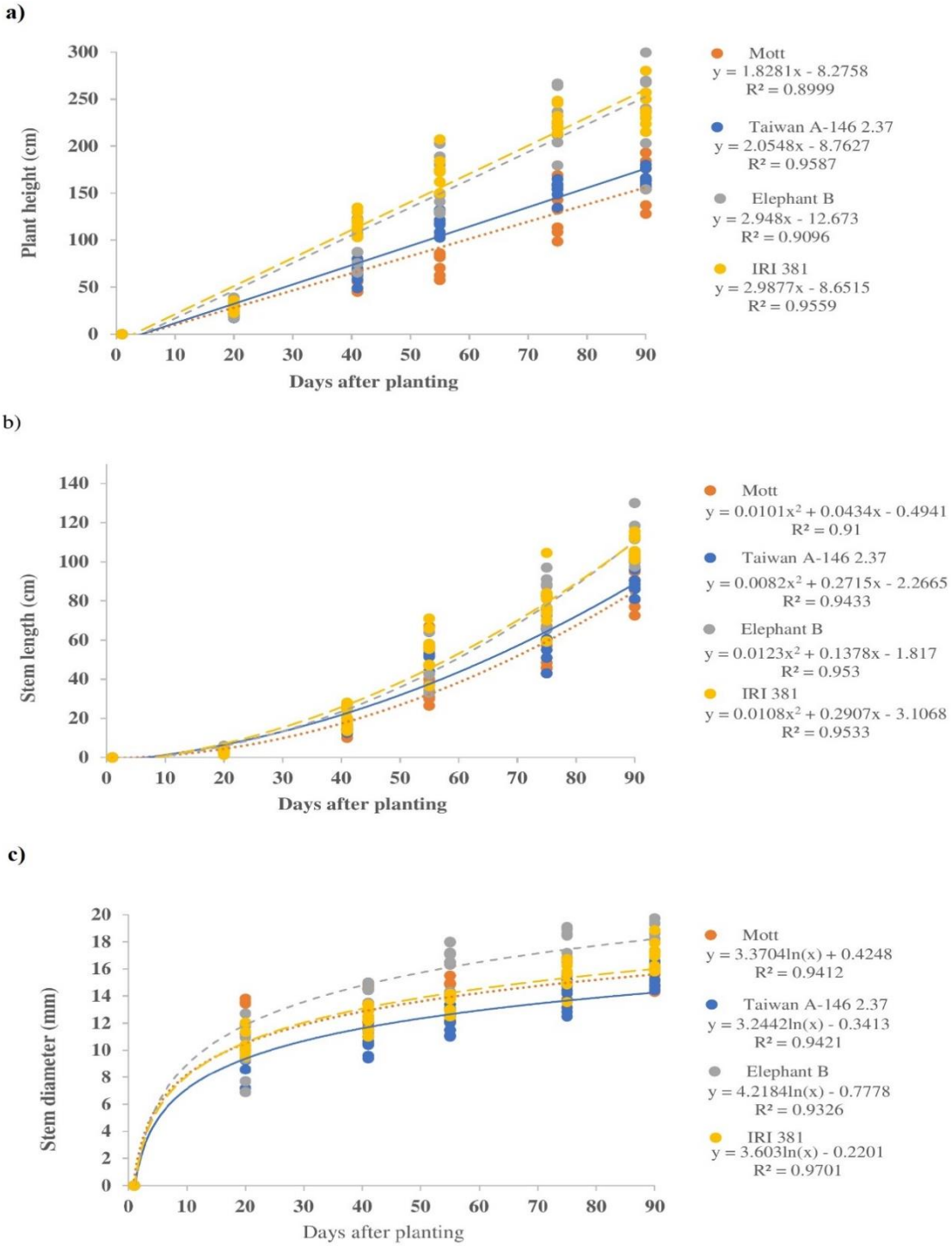

Figure 2. Dynamics of stem growth: plant height (a); stem length (b); stem diameter (c) in elephantgrass genotypes evaluated at 20, 41, 55, 75 and 90 days after planting. Significance level in the regressions ($p < 0.05$).

Another factor that might have contributed for the comparable field sprouting and establishment rate between different elephantgrass genotypes observed in this trial, was that the genotypes were planted following the technique of foot with the tip, aiming to cover the whole length of the furrow rows. As the number of meristems per tiller was comparable between the genotypes, however, dwarf genotypes were short in terms of tillers length, probably the number of meristems were greater in the rows planted with the dwarfs,

especially Mott. A greater number of meristems in the rows, possibly increased the chances of successful sprouting in the dwarf plants, or at least, reduce the impact of possible failures when compared to the tall size genotypes. Even though, in the literature, it can be found that dwarf elephantgrass generally display lower efficiency in establishing than tall genotypes (Woodard et al., 1986; Silva et al., 2009; Fukagawa & Ishii, 2018).

It has been suggested to avoid using old stems for planting, especially those from plants that already flowered or produced too many aerial tillers. Nevertheless, Kozloski, Perottoni, and Sanchez (2005) reported that the concentration of NSC in elephantgrass tends to increase with the advance of the plant age. Budiman et al. (2011) also observed greater concentrations of NSC (200 to 236 $g.kg^{-1}$) in the stems during the reproductive phase compared to vegetative (157 to 176 $g.kg^{-1}$), in different elephantgrass genotypes. The recommendation to avoid stems from plants that have already flowered possibly takes into account the depletion of NSC that might occur after the flowering stage, as allocation of NSC to the rhizomes and roots can occur (Purdy et al., 2015). Concerning stems from elephantgrass that already produced many aerial tillers, this may be because they already lost many of their potential meristems.

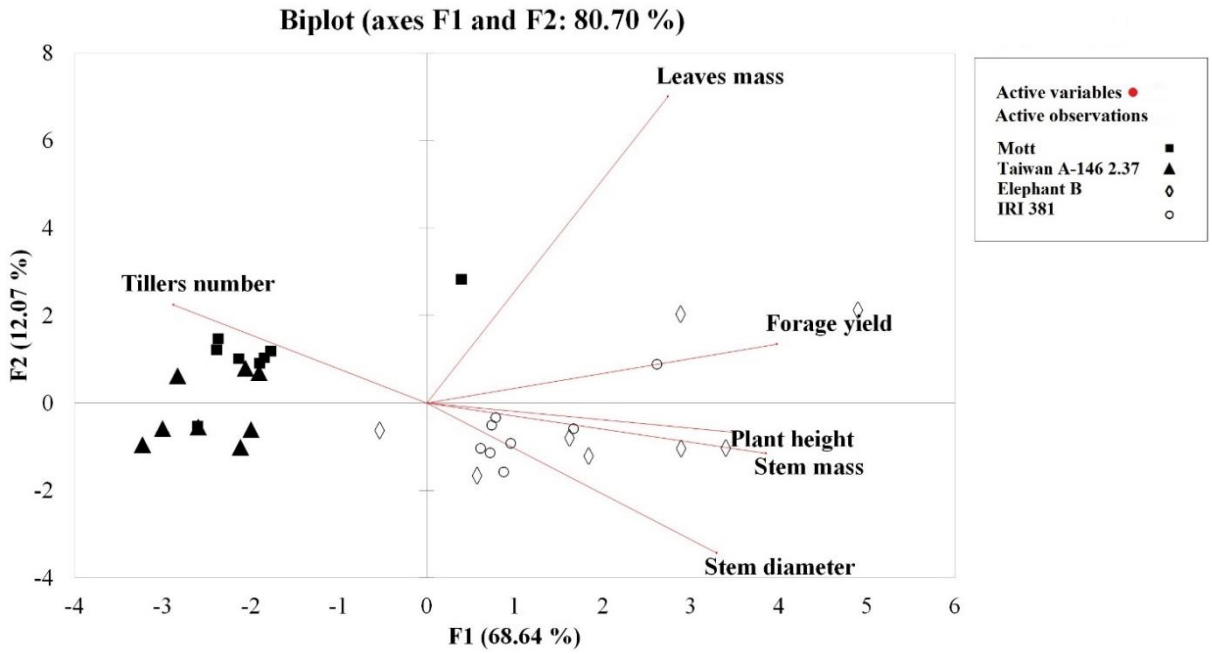

Figure 3. Principal component analysis of the relationship between forage yield, number of tillers, leaves mass, stem mass and plant height for different types of elephant grass genotypes under 90 days establishment period.

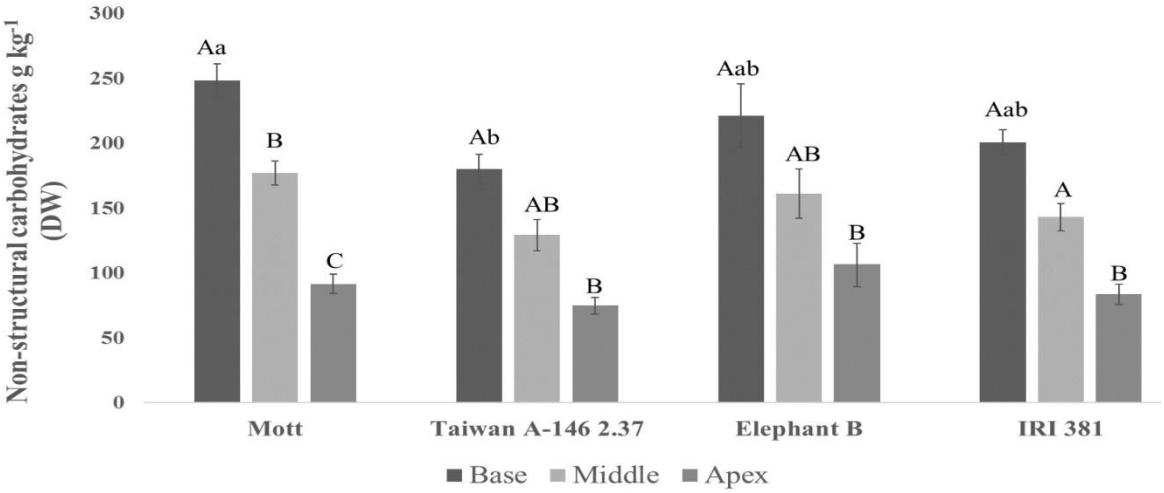

Figure 4. Non-structural total carbohydrates ($g\ kg^{-1}$) of the stem fractions from different elephant grass genotypes harvested at 90 days after planting. SE= Standard error. Means with different uppercase letters within each genotype, and lowercase between genotypes were significantly different in the Tukey HSD test ($p < 0.05$).

During the planting of elephantgrass, it must be considered that NSC are in elevated concentrations at the base of the stem (Figure 4). Knoll and Anderson (2012) reported greater shoot and root production in the early growth of elephantgrass stems originated from the base compared to the apex of the stems. In most of the grass species, NSC are stored at the base of the stems (Martínez-Vilalta et al., 2016). The base of the stem is also thicker, and thickness is associated with the greater NSC concentration (Silva et al., 2009). In our trial, NSC ranged between 180 and 248 g kg^{-1} at the base of the stems, a greater range than that found in the middle and apex. It was also superior compared with the average found in the whole stems of the parental material, that ranged between 103 and 164 g kg^{-1} (Table 1). As the parental stems were not analyzed in sections (base, middle, apex), comparisons could not be made.

The superior number of tillers sprouted on soil with dwarf genotypes was associated with their more proximal stem nodes, consequently, a superior number of meristems per planted area compared with the tall-sized genotypes with longer internodes. Silva et al. (2009) compared the tillering rate of different elephantgrass genotypes and also reported that Taiwan A-146 2.37 showed superior tillering. In our trial, Taiwan A-146 2.37 showed a higher stability index, which was associated with its greater number of tillers, as tillers mortality was low in all genotypes. However, greater tillering did not lead to comparable or greater biomass accumulation compared with tall genotypes, which produced more biomass. As the focus of this study was exclusively evaluating how these genotypes established in their first 90 days, herbage accumulation data were considered a mere consequence of the genetic potential of each genotype. The period of 90 days was given to provide enough time for plants to build up their root system and NSC reserves.

Superior forage biomass accumulation noticed in Elephant B and IRI 381 genotypes were associated with their genetic potential to produce longer, heavier and thicker stems (Table 2). In elephantgrass plantings, stem thickness is directly associated with greater dry matter yields (Oliveira et al., 2013). Despite the fact that tall genotypes showed a smaller number of tillers, their tillers were robust and heavier. Additionally, DM concentration in tall genotypes tended to be greater, especially compared with Mott. In terms of establishment, all genotypes showed satisfactory results, and differences in biomass accumulation in the first 90 days of growth were considered a mere consequence of the genetical potential of each genotype.

Conclusion

Different elephantgrass genotypes showed variation in their growth dynamics during the establishment phase of 90 days, however, they have comparable efficiency. All genotypes showed adequate traits for satisfactory establishment, mostly associated with a combination of non-structural carbohydrate concentrations >10% and preserved meristems in their parental material. Dwarf genotypes, despite being known to display lower efficiency to establish than tall size elephantgrass, showed a similar efficiency in this present trial, this might be linked with a greater number of meristems per planted row. The period of two months was considered enough for the elephantgrass plantings to establish; however, it is highly recommended to allow recently planted swards to build up their root system and NSC reserves before subjecting them to frequent defoliation.

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