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Scientific Article

Gladiolus harvest simulation using the phenoglad model for different marketing periods

Simulação da colheita de gladíolos com o modelo phenoglad para diferentes períodos de comercialização

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ABSTRACT - Gladiolus is a species that presents cultivars with flowers of different colors, and these floral stems can be produced using simple and low-cost management practices. Its growth is not widespread in the São Francisco Valley, in Brazil, thus requiring research to guide growers regarding its production and commercialization. The PhenoGlad program was developed to simulate gladiolus production based on temperature data from the previous year. Therefore, the objective of this work was to produce gladioli at different times, assess stem quality, and validate the PhenoGlad model for the region. The experiment was conducted between 2020 and 2021 at the Federal University of Vale do São Francisco, using a complete randomized block design, in a 4×3 factorial arrangement. The treatments consisted of four cultivars (Red Beauty, Jester, T704, and White Friendship) and three harvest peaks (H1: Feast of the Petrolina Patron Saint's Day, August 15, 2020; H2: All Souls' Day, November 2, 2020; and H3: International Women's Day, March 8, 2021). The parameters evaluated were total stem length, rachis length, stem diameter, and postharvest longevity at the R2-R5 stage. The interaction between cultivars and harvest peaks was significant for total stem length and stem diameter. All cultivars grown for H1 performed well and showed a low simulated error compared to field observations, validating the PhenoGlad model. Growing gladiolus in the region is feasible, as the stems meet quality standards and have a suitable shelf life for commercialization.

Keywords: Floriculture. *Gladiolus x grandiflorus* Hort. Commercial quality. Cut Flowers.

RESUMO - O gladíolo é uma espécie que apresenta cultivares com flores coloridas, e essas hastes podem ser produzidas utilizando práticas de manejo simples e de baixo custo. A cultura não é explorada no Vale do São Francisco, demandando pesquisas que orientem os produtores sobre o cultivo e comercialização. O programa PhenoGlad foi criado para simular a produção de gladíolos com base em dados de temperatura do ano anterior. O objetivo do estudo foi produzir gladíolos em diferentes épocas, avaliar a qualidade das hastes e validar o modelo PhenoGlad. O experimento foi conduzido entre 2020 e 2021 na Universidade Federal do Vale do São Francisco, utilizando o delineamento em blocos casualizados completos, em arranjo fatorial 4x3. Os tratamentos foram compostos por quatro cultivares (Red Beauty; Jester; T704; White Friendship) e três picos de colheita (C1: Festa do Dia da Padroeira de Petrolina-PE, 15 de agosto de 2020; C2: Dia de Finados, 2 de novembro de 2020; e C3: Dia Internacional da Mulher, 8 de março de 2021). Os parâmetros avaliados foram comprimento total da haste, comprimento do pendão floral, diâmetro da haste e longevidade pós-colheita no estádio R2-R5. A interação cultivares e picos de colheita foi significativa para comprimento total da haste e diâmetro da haste. Todas as cultivares se cultivadas em C1 tiveram bom desempenho e apresentaram baixo erro em relação com as observações de campo, validando o modelo PhenoGlad. O cultivo de gladíolos na região é viável, pois as hastes atendem aos padrões de qualidade e possuem longevidade para comercialização.

Palavras-chave: Floricultura. *Gladiolus* x *grandiflorus* Hort. Qualidade comercial. Flores de corte.

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INTRODUCTION

The production chain of ornamental plants and flowers in Brazil has been growing in recent years due to the diversity of options available to large and small growers. Floriculture is an important part of Brazilian agribusiness, with an increase of approximately 8% in 2023 compared to the previous year, encompassing the production, wholesale, and retail sectors (IBRAFLOR, 2024).

Gladiolus (*Gladiolus* × *grandiflorus* Hort.), popularly known as Palma-de-Santa-Rita, is among the cut flowers commercialized in the country; it is native to Southern Africa and Mediterranean regions, can produces floral stems of varied colors, and requires a simple and low-cost implementation and management (SCHWAB et al., 2019).

Gladiolus is grown in many tropical and subtropical regions around the world and has proven to be adaptable to different climate conditions. However, it requires ideal humidity conditions for the development of its flower stems to meet the quantitative and qualitative characteristics desired by consumers (LIM, 2014).

The São Francisco Valley is known in Brazil as a hub for horticulture, specifically for national fruit production. This is due to the combination of some factors, including water availability and logistics, which enable high profitability per area and provide good returns for small growers (CARVALHO et al., 2018). These conditions and other soil-climate factors denote the potential of the region for flower production, including gladioli, providing new alternatives that are particularly beneficial for small farms.

The use of plant development simulation software is an alternative for growers to meet market demands and ensure commercialization in different periods, as they can predetermine the entire plant cycle. The PhenoGlad mathematical model was developed by the Federal University of Santa Maria, RS, Brazil, to simulate the entire production cycle of gladioli based on maximum and minimum temperature data from the previous year at the planting location. According to Becker et al. (2020), the program shows the duration of all growth stages (emergence, vegetative, and reproductive) based on temperature variation, enabling growers to implement more precise management practices.

The São Francisco Valley has been shown favorable to produce flowers, such as ornamental sunflower (SILVA et al., 2018; MOURA et al., 2022), and the growth of gladioli in semiarid regions has yielded promising results (SOUSA et al., 2021). However, research providing information on cultivation and marketing practices to guide growers in expanding floriculture in this region is necessary. Therefore, the objective of the present study was to produce gladioli at different times, assess stem quality, and validate the PhenoGlad model for the region.

MATERIAL AND METHODS

A field experiment was conducted between 2020 and 2021 in full sunlight at the Floriculture sector of the Federal University of Vale do São Francisco (UNIVASF), Agricultural Sciences campus, in Petrolina, PE, Brazil (09° 21'S and 40°34'W). The climate of the region was classified as BSh, according to the Köppen classification (ALVARES et al., 2013). Climatic data during the experimental period were recorded by the UNIVASF automatic weather station (Figure 1).

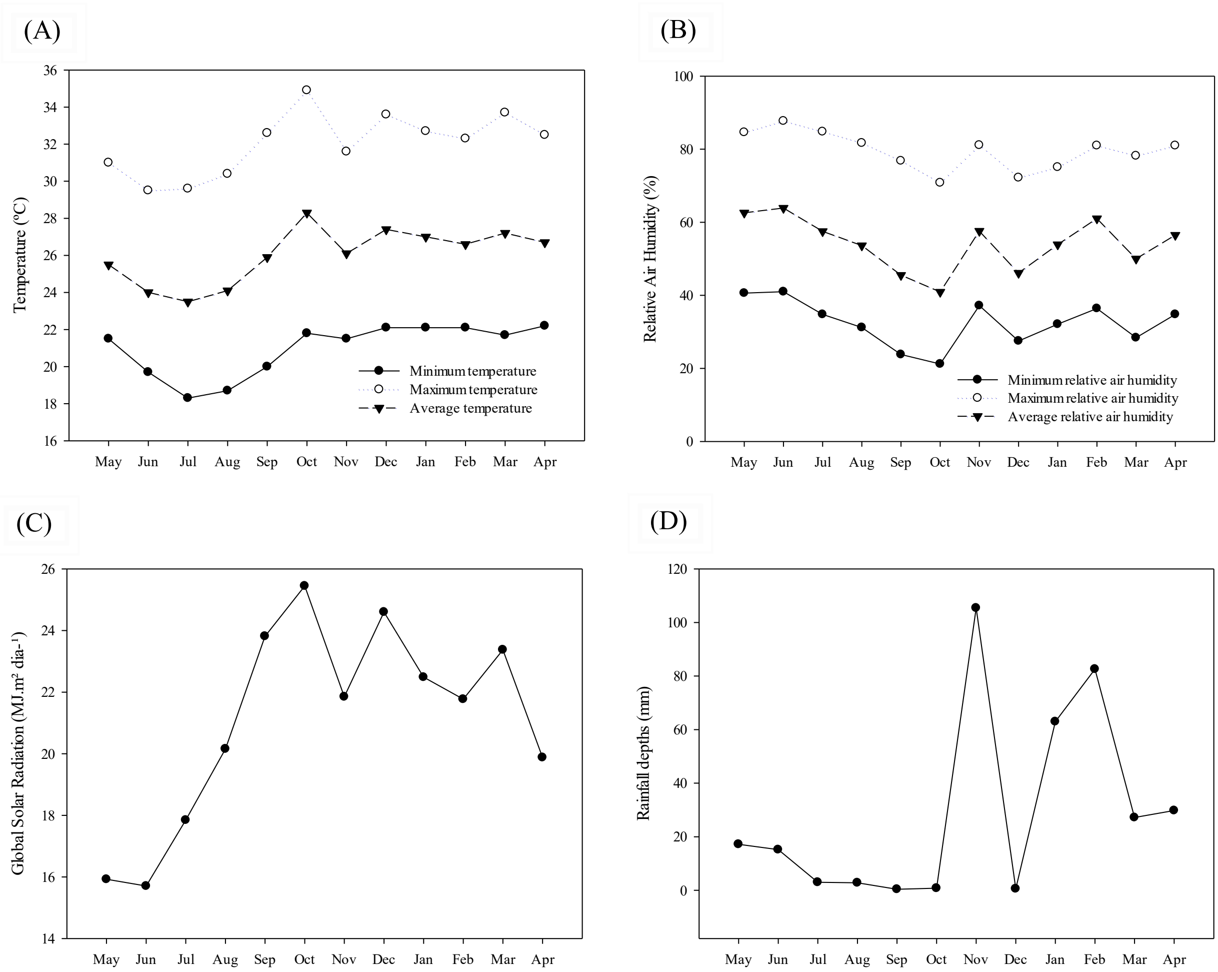


Figure 1. Monthly minimum, maximum, and average air temperatures (A); monthly minimum, maximum, and average relative air humidity (B); global solar radiation (C); and monthly rainfall depths (D) recorded during the experimental period. Petrolina, PE, Brazil, 2020-2021.

The soil fertility of the experimental area was analyzed (Table 1), and corrections were carried out based on the recommendations for growing gladioli described by Schwab et al. (2019). Lime was applied during soil preparation to correct the pH to 5.5.

The experiment was conducted using a complete randomized block design, in a 4×3 factorial arrangement, with four replications and 10 plants per plot. The evaluated factors were: four gladiolus cultivars (Red Beauty, Jester, T704, and White Friendship) (Figure 2) and three harvest peaks: Feast of the Petrolina Patron Saint's Day, August 15, 2020 (H1); All Souls' Day, November 2, 2020 (H2); and International Women's Day, March 8, 2021 (H3).

Table 1. Chemical analysis of the soil of the experimental area (0-20 cm layer) used for growing gladioli.

pH	Ca^{2+}	Mg^{2+}	Na^+	K^+	SB	H+Al	Al^{3+}	AS	OM	P
H_2O	----------	----------	----------	cmolcdm³	----------	----------	----------	%	g kg^{-1}	mg dm^{-3}
5.20	2.12	0.45	0.14	0.22	2.93	1.18	0.00	0	1.10	3.00

SB: sum of exchangeable bases; OM: organic matter; AS: aluminum saturation. Extraction methods: dry extraction method (OM); Mehlich (K and Na); extraction in KCl (Ca, Mg, and Al); extraction with anion exchange resin (P); extraction in calcium acetate (H + Al).

Figure 2. Gladiolus cultivars used in the experiment: Red Beauty (A), Jester (B), T-704 (C), and White Friendship (D).

The PhenoGlad Software was used to meet the established harvest peak dates by simulating planting dates for each cultivar (Table 2), using daily information on minimum and maximum air temperatures in the plantation location. The simulation was conducted up to the R2 harvest stage (recommended for harvesting spikes in the field) and up to the end of the cycle (R6).

Commercial gladiolus corms acquired from growers in the South Region of Brazil were planted in each planting date (Table 2). These corms were vernalized and sized between 14 and 16 cm in circumference. The corms were grown in full sunlight in beds with a height of 0.10 m (including the planting depth), resulting in 5 plants per m^2, with spacing of 0.20 m between plants and 1.00 m between rows. Only one shoot was maintained for each planted corm for experimental control and standardization for PhenoGlad model validation. Water was applied using a drip irrigation system, according to the water demand of the plants to prevent symptoms of soil water deficit. Nitrogen fertilizer (urea 45% N) was applied at a rate equivalent to 350 kg ha^{-1}, when the plants reached the stage of three visible leaves (V3). Weeds were manually uprooted, the soil around the plants was mounded, followed by the addition of mulch (straw) in the beds. Staking was carried out to prevent plant lodging and ensure upright stems, using raffia wires tied to stakes fixed at the ends of the beds. No pests or diseases were observed during the field experiment. Cultural practices followed the recommendations of Schwab et al. (2019) (Figure 3).

Table 2. Planting dates for corms of gladiolus (*Gladiolus* x *grandiflorus* Hort.) cultivars simulated by the PhenoGlad Software.

	Planting dates			
Harvest peaks	Red Beauty	Jester	T-704	White Friendship
H1 - Feast of Petrolina Patron Saint's Day	Jun 1, 2020	Jun 1, 2020	Jun 9, 2020	Jun 9, 2020
H2 - All Souls' Day	Aug 21, 2020	Aug 19, 2020	Aug 24, 2020	Aug 30, 2020
H3 - International Women's Day	Dec 24, 2020	Dec 23, 2020	Dec 31, 2020	Jan 4, 2021

Figure 3. Appearance of *gladiolus* plants (*Gladiolus* x *grandiflorus* Hort.) grown in the field.

Six central plants per replication (24 plants per treatment) were evaluated when their floral stems were at the commercial harvest stage (R2), in which the first three florets at the base of the spike exhibit petal coloration. They were evaluated for the following parameters, according to the criteria of Holambra (2013): total stem length (cm), measured from the base of the plant on the ground to the tip of the stem and classified as class 75 (stem length 75 cm), class 90 (length of 90 cm), or class 110 (length of 110 cm), with stems shorter than 75 cm considered as not meeting the standards; rachis length (cm), corresponding to the distance from the insertion of the first floret to the tip of the stem; and stem diameter (cm), measured bellow the insertion of the first floret using a digital caliper, classified as class 75 (minimum thickness of 0.5 cm), class 90 (minimum thickness of 0.8 cm), or class 110 (minimum thickness of 1.0 cm).

The phenological stage of the cultivars was monitored to assess the longevity of the floral stems, as described by Schwab et al. (2015), from the vegetative to the reproductive phase. The stages considered were: R2 (when the first three buds at the bottom of the spike exhibit corolla coloration) and R5 (when the last floret of the spike shows senescence). The assessments were carried out to determine whether the harvested floral stems reached the predicted longevity, as simulated by the PhenoGlad software.

Validation of the PhenoGlad model

The model's performance in simulating developmental stages was evaluated by comparing field-collected data with the program-simulated data for vegetative stages (VE: emergence; V1: first leaf; and V3: third leaf) and reproductive stages (R1: visible spike; R2: harvest point; and R5: floral stem senescence). The equations used to validate the PhenoGlad mathematical model were Root Mean Square Error (RMSE) (Equation 1) (JANSSEN; HEUBERGER, 1995), BIAS index (Equation 2) (LEITE; ANDRADE, 2002), Pearson correlation coefficient (Equation 3) (WILLMOTT, 1981), and index of agreement (Equation 4) (WILLMOTT, 1981), as follows:

$$RMSE = \left[\frac{\sum(si\text{-}oi)^2}{n}\right]^{0.50} \quad (1)$$

$$BIAS = \frac{(\sum si\text{-}\sum oi)}{\sum oi} \quad (2)$$

$$r = \frac{\sum(oi\text{-}\bar{O})x(Si\text{-}S)}{\sqrt{\sum(Oi\text{-}\bar{O})^2 x \sum(si\text{-}S)^2}} \quad (3)$$

$$W = 1\text{-}\frac{[\sum(si\text{-}oi)^2]}{[\sum(si\text{-}\bar{O})+(oi\text{-}\bar{O})^2]} \quad (4)$$

where: Si is the simulated values; S is the mean of simulated values; Oi is the observed values; $\bar{O}$ is the mean of observed values; and n is the number of observations.

The mean values were subjected to analysis of variance (ANOVA); significant effects were evaluated by comparing treatments using the Tukey's test at a 5% significance level. All statistical analyses followed the recommendations of Ferreira (2018) and were performed using the statistical software SISVAR (FERREIRA, 2019). Graphs were generated using Sigma Plot version 12.0 (SYSTAT SOFTWARE, 2019).

RESULTS AND DISCUSSION

The interaction between factors (cultivars and harvest peaks) was significant for total stem length and stem diameter; no significant interaction was found for rachis length, but the sources of variation had significant effects (Table 3).

Table 3. Analysis of variance for total stem length, rachis length, stem diameter, and postharvest longevity (R2-R5 stages) according to gladiolus cultivars and harvest peaks.

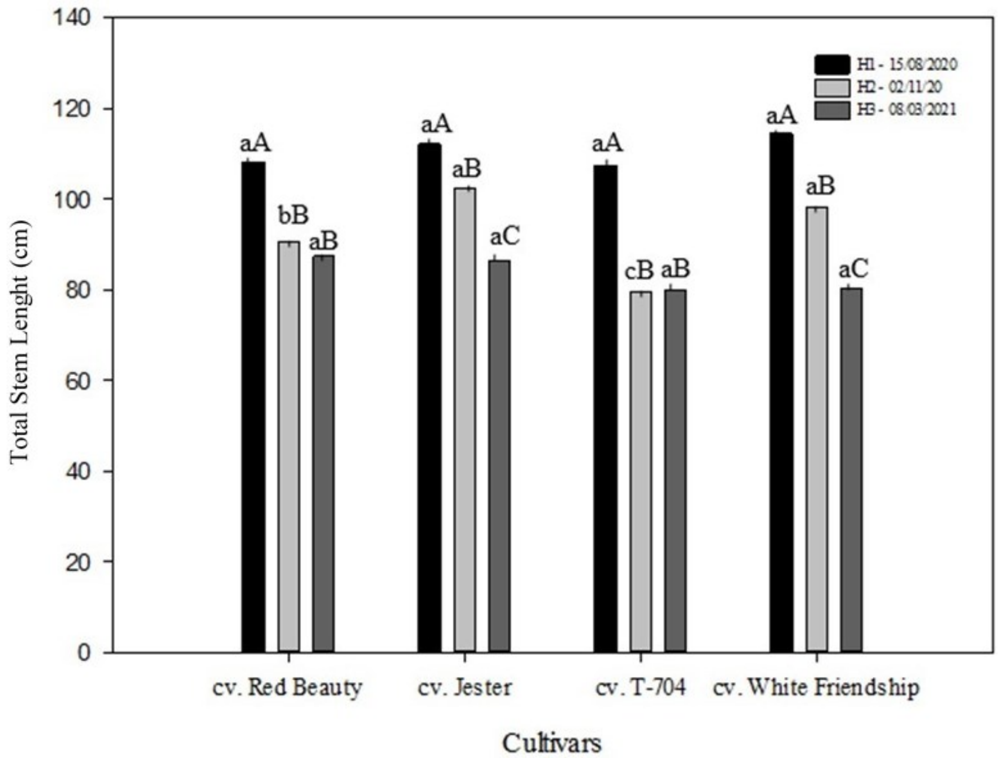
Source of variation	Total stem length (cm)	Rachis length (cm)	Stem diameter (cm)	Longevity (R2-R5 stages) (Days)
Cultivars "F"	22.23**	10.87**	24.66**	52.05**
Red Beauty	95.33 b	40.91 a	8.36 a	11.70 a
Jester	102.07 a	42.75 a	7.75 b	12.42 a
T-704	89.00 c	37.25 b	7.44 c	9.80 b
White Friendship	99.87 a	41.00 a	7.91 b	12.03 a
Harvest peaks "F"	164.73**	76.29**	176.83**	2.25**
H1	110.55 a	46.27 a	8.75 a	11.60 a
H2	92.75 b	37.79 b	7.81 b	11.51a
H3	83.50 c	36.48 b	6.88 c	11.19 a
Cultivars × Harvest peaks	3.448**	0.50 ns	4.58**	0.15 ns
CV%	10.52	14.44	8.36	11.73

Means followed by the same letter in the columns are not significantly different from each other by the Tukey's test at a 5% significance level; ** = significant ($p<0.05$); ns = not significant; CV: coefficient of variation.

The comparison of cultivars within each harvest peak showed no significant difference in total stem length among cultivars for H1 and H3. However, the shortest stem (79.66 cm) was found for the cultivar T-704 in the H2 harvest peak, whereas the others cultivars showed longer stems with no significant differences among them.

The comparison of harvest peaks within each cultivar showed that H2 and H3 had no significant difference in total stem length for Red Beauty and T-704. The results showed a better performance for all cultivars grown in H1 (Figure 4). This may be explained by the more favorable climate conditions for plant development, as the daily minimum and maximum air temperatures ranged from 17.0 to 16.3 °C and 32.0 to 32.6 °C from June to August 2020, respectively.

All cultivars met the minimum stem length criteria established by Holambra (2013) in the three evaluated production cycles. Cultivars in the H1 and H3 treatments were classified into classes 90 and 75, respectively. The cultivar T-704 in the H2 treatment had a mean total stem length (79.66 cm) that classified them into class 75, whereas the other cultivars were classified in class 90, with decreasing means of 102.37 (Jester), 98.33 (White Friendship), and 90.62 cm (Red Beauty). According to Schwab et al. (2015), total stem length is a factor that affects postharvest durability, as longer stems may have basal cuts unable to absorb water, allowing for greater longevity of floral stems.



Lowercase letters compare cultivars within each harvest peak, and uppercase letters compare harvest peaks within each cultivar. Vertical lines represent the standard error of the mean. Bars with the same letters are not significantly different from each other by the Tukey's test at a 5% significance level.

Figure 4. Total stem length (cm) of the gladiolus cultivars Red Beauty, Jester, T-704, and White Friendship in harvest peaks H1 (August 15, 2020), H2 (November 2, 2020), and H3 (March 8, 2021).

Bosco et al. (2021) found similar results for Red Beauty, with total stem lengths ranging from 80 to 103 cm when grown in conventional preparation systems in Santa Catarina, Brazil. A study involving the cultivar Jester grown in pots in semiarid areas showed that stem development was more pronounced when subjected to 70% shading compared to full sunlight conditions, resulting in a plant height of 75 cm (SOUSA et al., 2021).

In regions with climate variations throughout the year, grower should consider the optimal conditions for the growth of the selected cultivar, as soil moisture, air humidity, and water deficit significantly affect productivity. Additionally, high temperatures can affect quantitative and qualitative parameters of developing stems (FERRON et al., 2021).

The results showed that Red Beauty outperformed the other cultivars, showing 0.93 and 0.86 cm in the H1 and H2 treatments, whereas T-704 had the lowest means, with 0.84 and 0.72 cm, respectively. No significant difference was found among cultivars in the last production cycle (H3). Considering the harvest peaks within each cultivar, all cultivars showed larger stem diameters in H1 (Figure 5), whereas Jester showed no significant differences between H2 and H3.

The cultivars showed stem diameters exceeding the minimum of 0.5 cm, according to the reference standards of Holambra (2013). All gladiolus cultivars in H1 were classified into class 90, with diameters >0.8 cm, whereas those in H2 and H3 were classified into class 75. Cruz et al. (2018) and Bosco et al. (2021) reported gladiolus flower stems ranging from 0.7 to 1.0 cm, corroborating the data obtained in the present study, in which gladioli grew entirely in full sunlight.

Stem diameter is connected to stem strength. Wider stems prevent mechanical damage caused by wind during plant development in the field. This variable also affects postharvest longevity, logistics, and material classification. Moreover, a thicker stem diameter leads to increased carbon reserves, extending flowers' shelf life and facilitating their marketing to distant locations (FARIAS et al., 2013; SANTOS et al., 2021).

The results of rachis length showed that the highest mean in H2 was found for the cultivar White Friendship (39.70 cm), although it was not significantly different from Red Beauty and Jester. Jester presented the highest mean (39.93 cm) in H3, not significantly differing from Red Beauty and White Friendship. T-704 had the shortest rachis length in H2 and H3, 34.20 and 32.75 cm, respectively.

All cultivars exhibited stem lengths exceeding the minimum of 40% of the total stem length specified by Holambra (2013) for the rachis length in the three production cycles. Rachis is the portion of the stem that bears the florets responsible for the spike's visual appeal. According to Schwab et al. (2015), a stem with a harmonious proportion between flowers and the rachis tends to attract consumers. Cruz et al. (2018) found similar results to those of the present study for gladiolus cultivars grown only in substrate, resulting in an increase in stem length; however, the combination of substrate and vermicompost (40%) for growing the plants increased stem length from 43 to 51.3 cm, which is desirable for commercialization.

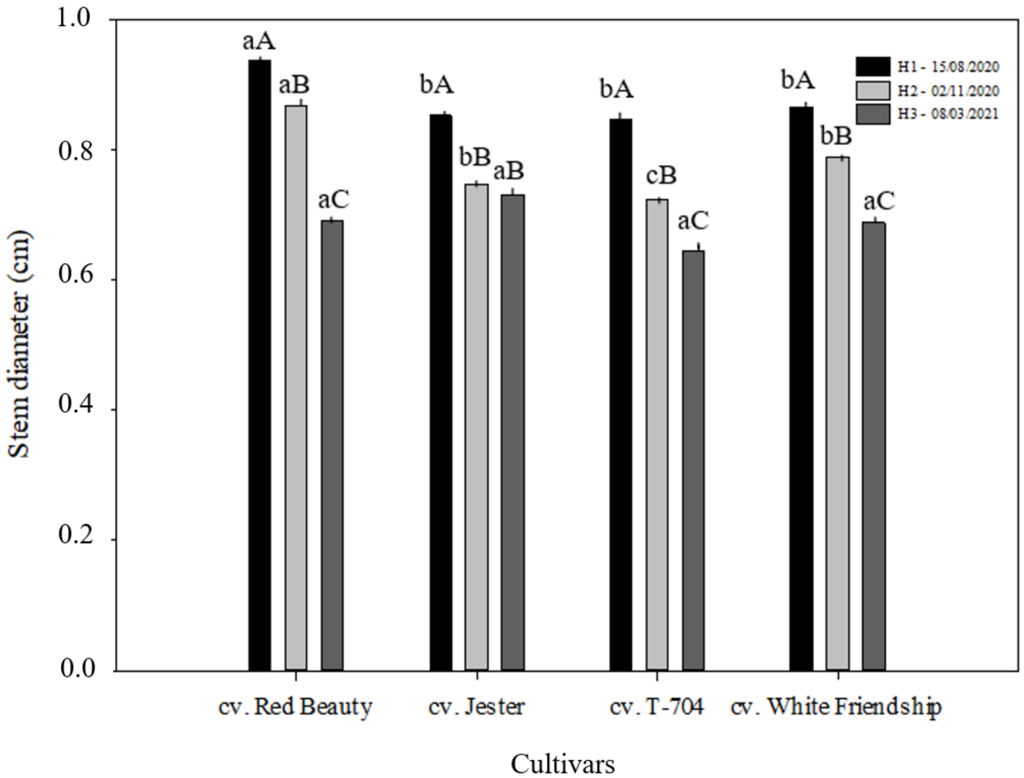


Figure 5. Stem diameter (cm) of the gladiolus cultivars Red Beauty, Jester, T-704, and White Friendship in harvest peaks H1 (August 15, 2020), H2 (November 2, 2020), and H3 (March 8, 2021).

The results showed that the evaluated growth variables can vary among different regions due to the climate conditions of each location, but reinforced that the gladiolus production requires simple management. However, specific management practices may be necessary to achieve better results, as reported by Silva, Souza, and Fonseca (2022), who conducted experiments with gladioli in semiarid regions and found effects of high temperatures and luminosity on quantitative measures (number of leaves and plant height); they recommended the use of substrate combined with soil under shading conditions (70% shading screen with open sides). This management could be an interesting alternative to avoid significant damage to plants, providing an opportunity for further research.

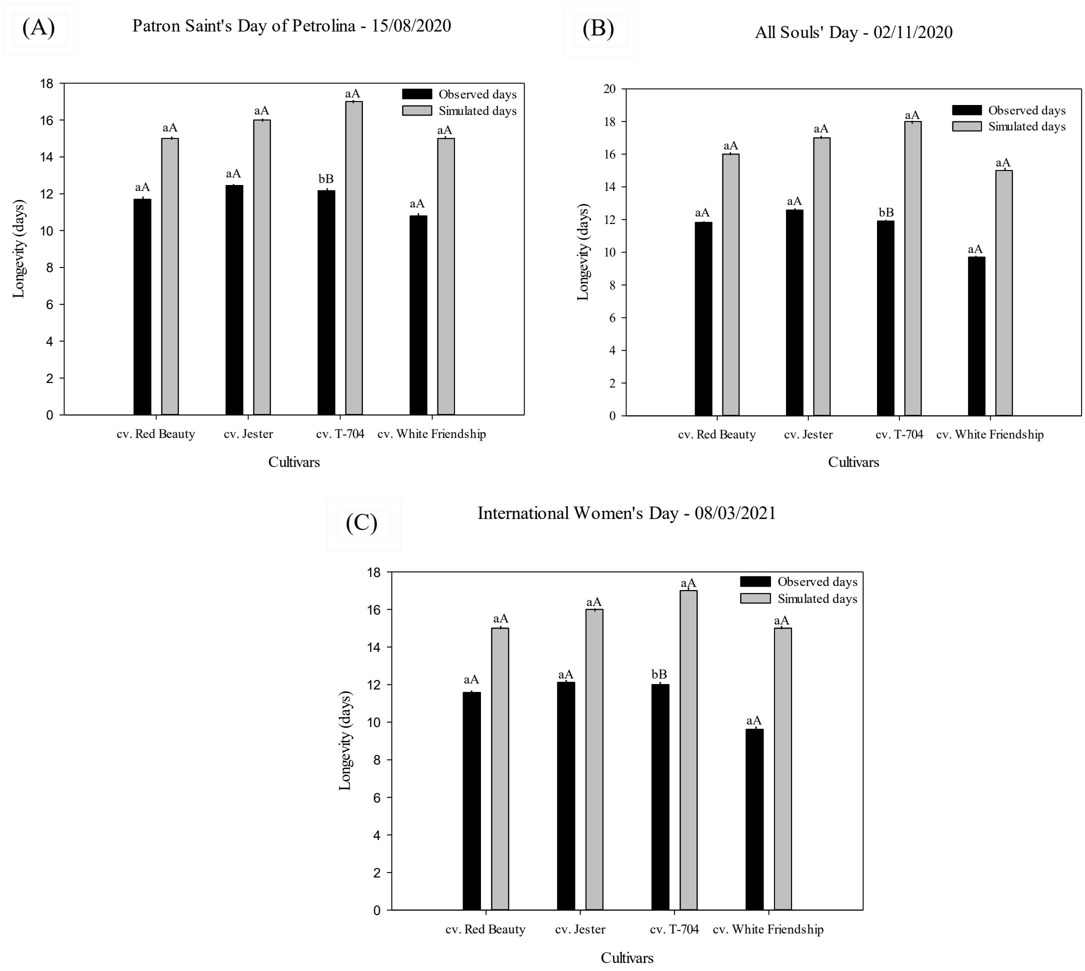
According to the analysis of variance, no significant interaction between cultivars and harvest peaks was found for postharvest longevity of floral stems (Table 3). However, the cultivar factor had a significant effect, as T-704 differed significantly from the other cultivars, showing the shortest postharvest longevity. Although the other cultivars did not differ significantly, Jester achieved over 12 days of longevity, which is significantly interesting when considering the climate conditions during the production cycle.

Fischer et al. (2015) studied cut flowers (roses, gerberas, and chrysanthemums) and found a total postharvest longevity ranging from 7 to 12 days. Considering these criteria, all cultivars, except T-704, showed postharvest longevity suitable for commercial purposes. Additionally, no postharvest interventions were performed in the present study. Thus, the resilience of the evaluated cultivars could be enhanced through postharvest treatments, such renewal of the stem's basal cut or the of preservative solutions.

The comparison of observed data with those simulated by the PhenoGlad model (Figure 6) showed a decrease in the longevity of floral stems harvested in the São Francisco Valley. The cultivar T-704 differed significantly from the other cultivars, showing the shortest postharvest longevity of flower stems in all production cycles: 9.62 to 10.08 days (Figure 6). Plants at the R2 stage are physiologically preparing for senescence; thus, several factors can affect the speed of this process (BECKER; PAULUS; BOSCO, 2023).

Becker, Paulus, and Bosco (2023) reported that the duration of R2 to R5 stage for harvested flower stems differed from that for flowers remaining in the field. Similarly, Bosco et al. (2021) reported that the patterns of floral stems vary according to storage reserves and that each cultivar responded differently when they evaluated the cultivars Red Beauty and White Goddess in a minimal tillage system.

A study involving 12 planting periods for the cultivar Jester in Santa Maria, RS, Brazil, showed a mean duration of 17 days from stage R3 (another point of flower stem harvest) to stage R5 (SCHWAB et al., 2018). Growing flowers during periods of high air temperatures leads to reductions in phenological stages compared to periods of milder temperatures, as well as luminosity and air humidity, impacting the plantation development (BAHUGUNA; JAGADISH, 2015; UHLMANN et al., 2017).



Lowercase letters compare cultivars within each harvest peak, and uppercase letters compare harvest peaks within each cultivar. Vertical lines represent the standard error of the mean. Bars with the same letters are not significantly different from each other by the Tukey's test at a 5% significance level.

Figure 6. Postharvest longevity of flower stems (R2 to R5 stage) of the cultivars Red Beauty, Jester, T-704, and White Friendship in harvest peaks H1 (August 15, 2020) (A), H2 (November 2, 2020) (B), and H3 (March 8, 2021) (C), comparing observed data with those simulated by the PhenoGlad model.

The plantings for the three evaluated cycles were conducted in the same experimental area for the validation of the PhenoGlad mathematical model. According to the RMSE, the vegetative and reproductive phases varied, respectively, from 0.48 to 2.16 days and from 0.74 to 2.84 days for H1; from 0.42 to 1.84 days and 1.02 to 2.43 days for H2; and from 0.84 to 2.53 days and 1.88 to 4.95 days for H3. The RMSE for field-observed data showed that the variation in days compared to simulated data did not compromise the quality of the batch, which presented products suitable for commercialization. The BIAS index was close to zero and the index of agreement was close to one in all phenological phases of the evaluated production cycles (Table 4).

The RMSE, BIAS index, and index of agreement closely matched the values simulated by the PhenoGlad software for gladiolus plant development in the São Francisco Valley. However, additional experiments are needed to confirm these results. The RMSE values were lower than those found in the literature for gladiolus plants grown in the state of Santa Catarina (BONATTO et al., 2023).

Considering the production cycle for the International Women's Day harvest peak, the Jester cultivar showed greater variation in days compared to the simulation, resulting in a more delayed field development than expected. According to Becker, Paulus, and Bosco (2023), this is a critical issue, as it affects the flowering stage of the stems, changing the suitable date for product commercialization.

The model simulations in this study were determined from planting days. However, literature recommends conducting simulations from emergence to ensure greater accuracy. This would reduce errors, as germination is affected by various factors such as soil conditions, air temperature and humidity, and planting depth (BECKER; PAULUS; BOSCO, 2023), which should be considered in subsequent studies.

The production of gladiolus is directly affected by the edaphoclimatic conditions of the planting location. The São Francisco Valley provides favorable conditions for producing floral stems throughout the year and using different cultivars. Furthermore, the use of the PhenoGlad model is highly recommended to assist growers throughout the entire plant cycle.

Table 4. Performance of the Phenoglad model in simulating vegetative and reproductive phases of gladioli of three different cultivars for different harvest peaks, according to Root Mean Square Error (RMSE), BIAS index, and index of agreement (d).

Harvest Peak H1 - Feast of Petrolina Patron Saint's Day (August 15, 2020)						
Cultivars	RMSE - Vegetative	BIAS	d	RMSE - Reproductive	BIAS	d
Red Beauty	2.16	0.05	1.00	2.84	0.04	1.00
Jester	0.49	0.01	1.00	0.74	0.01	1.00
White Friendship	1.08	0.02	1.00	1.45	0.02	1.00
T-704	0.48	0.00	1.00	1.45	0.02	1.00
Harvest Peak H2 - All Souls' Day (November 2, 2020)						
Cultivars	RMSE - Vegetative	BIAS	d	RMSE - Reproductive	BIAS	d
Red Beauty	0.96	0.01	1.00	1.02	0.01	1.00
Jester	1.75	0.03	1.00	1.25	0.01	1.00
White Friendship	0.22	0.00	1.00	1.57	0.01	1.00
T-704	1.84	0.03	1.00	2.43	0.02	1.00
Harvest Peak H3 - International Women's Day (March 8, 2021)						
Cultivars	RMSE - Vegetative	BIAS	d	RMSE - Reproductive	BIAS	d
Red Beauty	0.91	0.21	1.00	4.95	0.20	1.00
Jester	2.53	0.45	1.00	1.88	0.08	1.00
White Friendship	0.84	0.08	1.00	2.20	0.09	1.00
T-704	1.74	0.27	1.00	2.19	0.09	1.00

CONCLUSION

The gladiolus cultivars White Friendship, Red Beauty, Jester, and T-704 meet the minimum quantitative measurement criteria established by Veiling Holambra. The production cycle intended for harvesting for the Feast of Petrolina Patron Saint's Day had more favorable climate conditions for the development of these cultivars.

The duration of gladiolus cycle in the São Francisco Valley showed a close similarity in days to that simulated by the PhenoGlad software. The postharvest longevity of flower stems could meet local commercial standards, offering new alternatives for diversification and income generation for producers.

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