Research Article

Production of *Ornithogalum* spp. floral stems as a function of bulb mass[1]

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ABSTRACT

Among ornamental species, *Ornithogalum* spp. has a high commercial potential, and bulb size is a determining factor for production success. This study aimed to evaluate the influence of bulb mass on the production and quality of floral stems. The experiment was conducted in a completely randomized design, with four bulb mass classes (234-109.9, 109.8-49.9, 49.8-22.7, and 22.6-14.9 g) and six replications. The following variables were evaluated: days to emergence, number of leaves, onset of the reproductive phase, days to harvest (cycle), peduncle diameter, stem height, inflorescence diameter, diameter of the standardized stem at 70 cm, stem fresh mass, and number of stems per plant. Bulbs with mass greater than 109.9 g promoted a higher number of stems per plant, earlier flowering, and floral stems with greater fresh mass and vigor, whereas bulbs with lower mass did not exhibit flowering. Bulbs of greater mass are more suitable for the commercial production of *Ornithogalum* spp., since they result in floral stems with superior morphophysiological characteristics and greater market value.

KEYWORDS: Floriculture, bulbous plant, ornamental plant.

RESUMO

Produção de hastes florais de *Ornithogalum* spp. em função da massa do bulbo

Dentre as espécies ornamentais, *Ornithogalum* spp. apresenta elevado potencial comercial, sendo o tamanho do bulbo um fator determinante para o sucesso produtivo. Objetivou-se avaliar a influência da massa do bulbo na produção e qualidade de hastes florais. O experimento foi conduzido em delineamento inteiramente casualizado, com quatro classes de bulbos (234-109,9; 109,8-49,9; 49,8-22,7; e 22,6-14,9 g) e seis repetições. Foram avaliadas as variáveis dias para emergência, número de folhas, início da fase reprodutiva, dias para colheita (ciclo), diâmetro do pedúnculo, altura da haste, diâmetro da inflorescência, diâmetro da haste padronizada com 70 cm, peso da haste e número de hastes por planta. Os bulbos com massa superior a 109,9 g promoveram maior número de hastes por planta, florescimento mais precoce e hastes florais de maior peso e vigor, enquanto os bulbos com menor massa não apresentaram florescimento. Bulbos com maior massa são mais indicados para a produção comercial de *Ornithogalum* spp., pois resultam em hastes florais com melhores características morfofisiológicas e maior valor de mercado.

PALAVRAS-CHAVES: Floricultura, planta bulbosa, planta ornamental.

INTRODUCTION

Within the Brazilian agribusiness sector, floriculture has gained prominence as a segment characterized by high profitability per cultivated area, operating in the market through the production of seeds, potted flowers, and cut flowers of a wide variety of forms and species (Junqueira & Peetz 2017).

Over the last decade, from 2014 to 2023, the floriculture sector in Brazil showed a steady growth, with an average annual increase of approximately 10 %, reaching $ 3.1 million in 2017, which expanded to $ 3.8 million in 2022 and 2023, with the domestic market accounting for $ 2.5 million (Ibraflor 2024).

Cut flowers can contribute significantly to this growth, particularly due to the expanding production carried out by small farmers (Alves et al. 2025).

Belonging to the Hyacinthaceae family, *Ornithogalum* spp. is a bulbous, monocotyledonous, herbaceous plant native to southern Africa and the

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Mediterranean region (Demirelma 2020). The leaves present linear to obovate shape, measuring between 0.50 and 1.50 cm in width and 15 to 70 cm in length, with dark green coloration. They are basal, the floral stems may reach up to 1.5 m in height, and the species does not present leaves with high commercial value (Carneiro et al. 2012). The main *Ornithogalum* spp. propagation method is vegetative, through its bulbs; therefore, it is through them that growers establish the crop (Öztürk 2023).

Bulb size is a crucial characteristic that directly influences the potential yield per plant. The use of larger bulbs, due to their greater nutrient reserves, results in a significant increase in the number of floral stems per plant (Kapczyńska 2014). However, it should be emphasized that the relationship between bulb size and plant vigor is not simple, and varies according to the genotype; therefore, basic research focused on individual species must be conducted to obtain bulbs of better quality for a specific use (Le Nard & De Hertogh 2002).

Considering the aforementioned information, this study aimed to characterize the most suitable bulb mass for production and for obtaining superior *Ornithogalum* spp. plants and floral stems.

MATERIAL AND METHODS

Planting was carried out at the experimental area of the Universidade do Estado de Mato Grosso, in Cáceres, Mato Grosso state, Brazil (16º4'1"S, 57º41'12"W and altitude of 126 m), in September 2024. The climate of the region, according to the Köppen classification, is tropical Savanna Aw, with mean annual temperature of 28.8 ºC. The temperature and rainfall conditions observed during the experiment are presented in Figure 1.

The soil of the experimental area is classified as concretionary Petric Plinthosol, dystrophic (FAO 1994, Santos et al. 2025), and is composed of 565 g kg^{-1} of sand, 95.5 g kg^{-1} of silt, and 337.5 g kg^{-1} of clay, with the following chemical characteristics: pH (H_2O) = 6.80; P = 8.75 mg dm^{-3}; K = 0.33 $cmol_c$ dm^{-3}; Ca = 4.32 $cmol_c$ dm^{-3}; Mg = 0.94 $cmol_c$ dm^{-3}; Al = 0.00 $cmol_c$ dm^{-3}; and organic matter = 18.41 g dm^{-3}.

A total of 72 bulbs were used, which were previously weighed and distributed in a histogram, and classified into mass classes as follows: C1 = 234.0-109.9 g; C2 = 190.8-49.9 g; C3 = 49.8-22.7 g; and C4 = 22.6-14.9 g, in descending order of bulb mass.

The experimental design was completely randomized, with four treatments corresponding to bulb mass, and six replications, containing three plants per replication, totaling 72 bulbs.

Field planting was carried out in a bed of 1.20 m wide, in planting holes, with the bulbs arranged in three rows at a spacing of 40 × 40 cm. Pre-planting fertilization consisted of 50 g m^{-2} of NPK (5-20-20), and topdressing fertilization with 50 g m^{-2} of urea was applied at the beginning of the reproductive phase and at the emission of the floral stem.

The evaluated parameters were: days for bulb emergence; number of leaves, with the total number of fully expanded leaves recorded; onset of the reproductive phase, defined by floral stem emission; days to harvest, with stems presenting three open flowers; peduncle diameter, measured at the base of the entire stem; stem height; inflorescence diameter; diameter of the standardized stem at 70 cm; stem fresh mass; and number of stems per plant.

Data analysis was performed using the Sisvar software, and differences among treatments were tested by the Scott-Knott test at 5 % of probability.

RESULTS AND DISCUSSION

Days to emergence and number of leaves did not show significant differences among the evaluated treatments, whereas the onset of the reproductive phase and harvest showed significant differences.

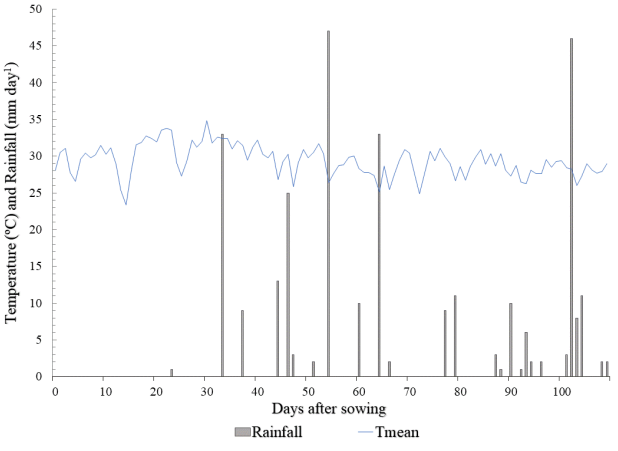

Figure 1. Air temperature and rainfall during the cultivation period - Sep. 2024 (Cáceres, Mato Grosso state, Brazil).

Bulbs of class 4 (22.6-14.9 g) did not reach the reproductive phase during the evaluation period, which lasted 110 days; therefore, several variables were not recorded for this class (Table 1).

Akand et al. (2016) reported that larger bulbs tend to emerge more slowly, which may be related to the natural dormancy of larger bulbs, as they contain greater reserves and may require a longer period for metabolic activation. According to Bufler (2001), dormancy represents an important factor in the storage capacity of the bulb, and can be described as the absence of leaf sprouting growth, characterized by the elongation of the sheath and the leaf blade. However, under the *Ornithogalum* spp. cultivation conditions, this behavior was not observed during bulb emergence.

The mean number of leaves ranged from 7 to 8.5, indicating a relatively constant vegetative vigor. Even the smaller bulbs of class 4 (22.6-14.9 g) produced leaves, but not flowers, demonstrating that leaf production per plant does not necessarily ensure flowering. In a study with *Narcissus poeticus* L., bulb size appeared to determine the plant growth dynamics and mainly influenced the final plant parameters, especially during the reproductive phase (Slezák et al. 2020).

Regarding the onset of the reproductive phase, bulbs of classes 1, 2, and 3 began stem emission at 49, 63, and 66 days after planting, respectively, whereas plants originating from the smallest bulbs of class 4 did not enter the reproductive phase. For the variable days to harvest, despite the variation from 62 to 76 days, all classes that reached flowering did not show significant differences for this parameter, except for class 4, whose bulbs did not produce floral stems.

Little attention has been given to the role of bulb size in the growth and development of *Ornithogalum* spp. Kapczyńska (2014), evaluating cultivars of *Lachenalia* (Cape hyacinth), concluded that larger bulbs resulted in earlier flowering and higher quality flowers.

Data presented in Table 2 indicate significant differences among treatments for several morphophysiological variables related to floral stem development. For the variable peduncle diameter, there was a statistically significant difference among treatments, with the highest value observed in class 3, with stems reaching 0.72 cm in diameter. This greater diameter may be related to a higher allocation of resources to the structural formation of the floral stem in this class.

The classes with greater bulb mass, classes 1 and 2, presented statistically lower values (0.50 and 0.47 cm, respectively), suggesting a possible limitation in the redistribution of reserves for peduncle formation. Bulbs of class 4 did not show

Table 1. Development and reproductive cycle of *Ornithogalum* spp. bulbs.

Bulb mass (g)	Emergence (days)	Number of leaves	Onset of the reproductive phase (days)	Harvest (days)
C1 (234-109.9)	17.16 a*	8.50 a	49.66 a	76.83 a
C2 (109.8-49.9)	15.66 a	7.66 a	63.16 a	69.20 a
C3 (49.8-22.7)	19.50 a	7.00 a	66.33 a	62.50 a
C4 (22.6-14.9)	15.83 a	8.00 a	0.00 b	0.00 b
CV (%)	21.81	24.15	28.61	33.35
Standard deviation	3.71	1.88	12.81	17.62

* Means followed by the same letter within the column do not differ from each other by the Scott-Knott test at 5 % of probability.

Table 2. Quality of floral stems of *Ornithogalum* spp.

Bulb mass (g)	Peduncle diameter (cm)	Stem height (cm)	Inflorescence diameter (cm)	Stem diameter with cut at 70 cm	Stem fresh mass (g)	Number of stems per plant
C1 (234-109.9)	0.50 b*	84.33 b	8.00 b	1.11 a	77.80 a	2.50 a
C2 (109.8-49.9)	0.47 b	85.00 b	9.33 a	1.03 a	67.07 b	1.16 b
C3 (49.8-22.7)	0.72 a	90.00 a	8.16 b	1.00 a	61.14 b	1.00 b
C4 (22.6-4.9)	0.00 c	0.00 c	0.00 c	0.00 b	0.00 c	0.00 c
CV (%)	19.06	5.29	14.10	19.71	18.41	48.23
Standard deviation	0.08	3.45	0.89	0.17	9.48	0.56

* Means followed by the same letter within the column do not differ from each other by the Scott-Knott test at 5 % of probability.

development of floral structures. The stem diameters of bulbs from class 3 showed results similar to those obtained by Streck et al. (2025), who observed that *Ornithogalum* stem diameters ranged from 0.7 to 0.8 cm.

Plants originating from class 3 bulbs showed a greater stem height, when compared with the other classes, exhibiting a statistically significant difference. Plants from bulbs of classes 1 and 2 presented lower and statistically similar stem heights: 84.33 and 85.00 cm, respectively.

A greater inflorescence diameter was observed in bulbs of class 2, showing a statistically significant difference, if compared with the other classes. This result indicates that plants originating from class 2 bulbs exhibited larger inflorescences, which is a desirable trait for commercialization. According to Carneiro et al. (2012), the *Ornithogalum* bulbs size influences flower size, flowering time, and flowering yield.

There was no statistical difference among bulb classes for the variable diameter of the standardized stem at 70 cm. All values were similar, ranging from 1.00 to 1.11 cm, except for class 4, in which the plants did not produce floral stems. This indicates that this characteristic may be less influenced by initial bulb mass under the experimental conditions. Menegaes et al. (2017), working with cut chrysanthemum, reported that stem diameter is directly related to plant architecture and to the stem rigidity required to support the weight of the inflorescences.

The highest stem fresh mass (77.80 g) was recorded in the treatment with class 1 bulbs, which was significantly higher than the others. This result is consistent with the greater reserve supply in larger bulbs, which favors a more robust vegetative development. Values decreased with the reduction in bulb mass and were null in the group with the smallest mass. Kapczyńska (2014) recommends the use of large bulbs in the cultivation of *Lachenalia* hybrids, as they produce inflorescences of better quality than small bulbs.

For the variable number of stems per plant, there was a significant difference among treatments. Bulbs from class 1 showed the highest mean number of stems per plant (2.50), suggesting that reserve accumulation favors both flowering and multiple emission of floral structures. Plants from class 2 and 3 bulbs showed reduced emission (1.16 and 1.00, respectively), and plants from class 4 bulbs did not emit stems.

In many geophytes, bulb size plays an important role in determining flowering competence, and may affect factors related to harvest quality, such as inflorescence size and number of flowers produced per plant (Lyons et al. 2018). *Allium moly* bulbs size at planting determines stem quality, inflorescence quality, and the total yield of daughter bulbs, in terms of number and mass (Laskowska et al. 2013).

In the case of *Ornithogalum* spp., bulb mass influenced stem fresh mass, and this parameter is a strong indicator of flower quality and durability.

CONCLUSIONS

1. Bulbs of *Ornithogalum* spp. with masses above 109.9 g are the most suitable for high quality flowers, strong vegetative vigor, and adequate stem height;
2. Intermediate mass ranges (49.8-109.8 g) may also be used, although they are associated with a reduction in reproductive performance.

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