



CHIVES IN RESPONSE TO CONJUGATE PLANTING OF TILLERS

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ABSTRACT

The Creole chives (*Allium schoenoprasum*) is the most common cultivar in Piauí. Recognized for its high preference by the local consumer, being highlighted by the color, aroma, palatability and high tillering. This attribute favors vegetative multiplication, stimulating, for sure, over time, internal competition leading to the formation of tillers with reduced capacity to react to environmental stress. As a consequence, market gardeners tend to decompress the clump leaving only one plant, for fear of losing vigor. Aiming to clarify these issues an experiment was installed in the experimental area of the Department of Plant Science / UFPI, whose treatments consisted of a 4 x 2 + 1 factorial, the first factor being the number of tillers, the second the condition (separated or conjugated) and control treatment (one plant per pit). The design was randomized blocks, with 8 repetitions with plots consisting of a 3 liter pot, according to the treatment. The substrate consisted of the mixture of soil/manure and chemical fertilization. Harvesting was carried out in the 9th week after planting, with the evaluation of the parameters, height, number of leaves and tillers per clump, root length; fresh mass of the tiller; fresh mass of the whole plant and root. Only the height was impaired with the use of 5 tillers. Most parameters received the favorable influence of density and conjugate planting, except for the mass of the tiller and root. Thus, it is possible to opt for the use of conjugate tillers at the maximum density of 4 tillers, when the objective is to plant more than one per pit.

KEYWORDS: *Allium schoenoprasum* L., pot cultivation, planting density, cultivation method.

REAÇÃO DA CEBOLINHA AO PLANTIO CONJUGADO DE PERFILHOS

RESUMO

A cebolinha (*Allium schoenoprasum*) Caipira é a cultivar mais comum no Piauí. Reconhecida por apresentar elevada preferência pelo consumidor local, sendo destacada pela cor, aroma, palatabilidade e elevado perfilhamento. Este atributo favorece a multiplicação vegetativa, estimulando, por certo, com o passar do tempo, uma competição interna ensejando a formação de perfilhos com reduzida capacidade de reagir ao estresse ambiental. Como consequência, os horticultores costumam fazer a descompactação da touceira deixando apenas uma planta, pelo receio da perda de vigor. Visando esclarecer tais questões um experimento foi

implantado na área experimental do Departamento de Fitotecnia/UFPI, cujos tratamentos consistiram de um fatorial 4 x 2 +1, sendo o primeiro fator o número de perfilhos, o segundo a condição (separados ou conjugados) e tratamento testemunha (01 planta/cova). O delineamento foi blocos casualizados, com 8 repetições com parcelas constituídas de um vaso de 3 litros, consoante o tratamento. O substrato constou da mistura terriço/esterco e adubação química. A colheita foi realizada na 9ª semana do plantio, com a avaliação dos parâmetros, altura, número de folhas e perfilhos por touceira, comprimento da raiz; massa fresca do perfilho; massa fresca da planta inteira e da raiz. Apenas a altura foi prejudicada com o uso de 5 perfilhos. A maioria dos parâmetros recebeu a influência favorável da densidade e do plantio conjugado, salvo, quanto à massa do perfilho e da raiz. Assim, é possível optar pelo uso dos perfilhos conjugados na densidade máxima de 4 perfilhos, quando o objetivo for plantar mais de um por cova.

PALAVRAS-CHAVE: *Allium schoenoprasum* L., cultivo em vaso, densidade de plantio, método de cultivo.

INTRODUCTION

Chives (*Allium schoenoprasum*) belong to the Alliaceae family, among which the most common cultivars are Todo Ano and Caipira. In this botanical species, the plants resemble onions, but are characterized by intense tillering, in most cultivars, forming a clump (FILGUEIRA, 2008).

Chives are an Alliaceae, whose cylindrical, entire, basal leaves are characteristics that provide less surface contact for microorganism adherence on its leaves (CARVALHO *et al.*, 2019).

The Caipira cultivar is more common in the Northeast and is recognized for its high preference by the local consumer, being highlighted by him for the properties of light green color, thin leaves, high palatability, aroma and the lack of seeds on the market.

For the producer, it is the cultivar with the smallest size (around 30 cm), greater precocity and intense level of tillering. Cultivated with nutrient solution, this cultivar presented an average height of 20cm, average weight around 12.00 g and over three tillers per clump (BELFORT *et al.*, 2006). However, depending on the age of the plant, it is possible to find more than 20 tillers per clump, reasons used to explain the intense reduction in the average weight of them, over time.

The propagation process in chives involves the production of seedlings through seeds, being more commonly carried out through tillers removed from the division of clumps, deserving special care in the choice and preparation (PINHEIRO *et al.*, 2020; BELFORT *et al.*, 2021a).

Regarding the harvest period, in research carried out with chives "Todo Ano" propagated by tillers, it was found that the growth of the plant expressed by height, root depth, fresh mass of the shoot and the whole plant is described by a curve second degree whose range of greatest performance is between the 8th and 10th weeks after planting (BELFORT *et al.*, 2021b).

In circumstances where harvesting is done by cutting the top of the pseudostem, regrowth almost always occurs, often used for new cuts (FILGUEIRA, 2008), however, causing successive loss of plant vitality, although a crop can continue for several years. A reasonable range of market gardeners prefer to uproot the whole plant, an operation that favors conservation, guaranteeing the product, presentation and better market quotation, which justifies the renewal of the crop.

The use of tillers incorporates significant reasons for being undoubtedly faster, with production available for marketing in a time frame almost always around 60 days after planting (BELFORT *et al.*, 2021a; BELFORT *et al.*, 2022a), in addition to better preserving during long distance transport. When stored outdoors, tillers withstand 15 days until planted, achieving survival rates above 90% (BELFORT *et al.*, 2021a).

The dynamics of market gardeners, especially in community projects, often requires, when renewing beds, the removal of all plants, raising doubts about how to ensure the quality of propagation material, given the inhospitable conditions in the northeast summer, characterized by high temperatures and low relative humidity.

Regarding the renewal of beds, whatever the motivation leads in some way to trauma in the shoot or root system, in view of the market gardeners' belief in cutting the aerial part of the plant before planting or uprooting the clump and separating the tillers, with the theoretical assumption of hastening sprouting and avoiding dehydration of the propagation material. In contrast, several manifestations have become known (CARVALHO; MARCUZZO, 2021; BELFORT *et al.*, 2022b), however, the need for more detailed clarification remains.

In the "Caipira cultivar", the intense tillering causes many market gardeners to renew through various forms, including removing tillers for new planting. Others decompress the clump, removing excess tillers, keeping one or two per pit. In any case, they admit it is safer to separate them from the clump, imagining that keeping them conjugated will harm the tillers.

The aim was, therefore, to assess the need to separate the tillers from the clump when planting the "Caipira cultivar", while also evaluating the possible effect of biological competition exerted by varying planting density.

MATERIAL AND METHODS

This study was carried out in the city of Teresina, capital of Piauí, with the geographic coordinates: Latitude -5.08921; Longitude: -42.8016 5° 5' 21" South, 42° 48' 6" West). The climate is characterized by high temperatures for most of the year, and the presence of two well-defined seasons, one dry, extending through the winter and spring months, and another rainy, corresponding to the summer and autumn period. The average temperature is 26°C, while annual rainfall totals 1365 mm (GUITARRA, 2023). The experiment was conducted in the rainy period, from December to March, when the temperature is milder.

Tillers of the Caipira cultivar under cultivation at the Department of Plant Science (CCA/UFPI) with an average weight ranging between 2 and 3g, were selected for use in the experiment. The treatments consisted of a 4 x 2 + 1 factorial, where the first factor was the number of tillers and the second the condition of the tillers (separated or conjugated) and a window treatment, one plant per pit. The design was randomized blocks, with 8 replicates, with the plots corresponding to a pot according to the treatment. The pots used had a capacity of 3 liters and the substrate composed of the soil manure mixture in the proportion of 2/1 supplemented with 5g of the 4-14-8 formula per liter of mixture.

In coverage the plants received the application of nitrogen in the form of Ammonium Sulfate and Potassium Chloride, in the order of 20 and 10g respectively, diluted in 2 liters of water, in two weekly applications of 10ml, the first at 20 days after planting.

The harvest of the experiment was carried out in the 9th week after planting, when the following parameters were evaluated: height, number of leaves per clump, number of tillers per clump, root depth, fresh mass of clump, tiller and root.

After tabulation, the data were submitted to analysis of variance using the statistical program ASSISTAT® Version 7.7 (SILVA; AZEVEDO, 2016) and the means were compared using the Tukey test at 5%.

RESULTS AND DISCUSSION

The experiment was harvested in the ninth week after planting and the analysis of variance revealed statistical differences for all parameters, showing interaction only for the plant height variable (Table 1).

Plant survival

The survival rate related to field establishment after planting can be considered close to 100%, expressing a characteristic of the species, so much so that Belfort *et al.* (2022b) evaluating the reaction of chives "Todo Ano" to mechanical damage performed in a phase prior to transplanting, attest that pruning does not affect survival. Pruning the aerial part causes a traumatic effect. The trauma is hardly relevant when the affected organ is the root.

Biometric Parameters

Plant height was influenced only under the condition of conjugated tillers, at the planting density of 5 plants, revealing that the operation can be adopted regardless of whether the tillers are separated or not, as long as the clump contains a maximum of four units. In any case, the "Caipira" chives at the time of harvest presented a height greater than 30 cm, considering that this is the cultivar with the smallest size and highest level of tillering, although greater than the results obtained by Zárata *et al.* (2010) with the chives "Todo Ano" and Belfort *et al.* (2021b) with this same cultivar.

According to findings by Oliveira *et al.* (2019) height is influenced by environmental conditions, particularly regarding direct exposure to the sun. In this environment, when compared to the conditions of using a shade screen, the height was 24.61% lower; however, the behavior of the plant in conjugated planting at a density of five tillers is difficult to explain in the present experiment.

TABLE 1 - Height of Caipira chives according to density with planting of separate or conjugated tillers. Teresina/PI, UFPI, 2020.

Planting density	Nature of planting	
	Height (cm)	
	Not conjugated	Conjugated
02	41.18 aA	41.68aA
03	44.75 aA	44.93aA
04	47.18 aA	47.06aA
05	44.18 aA	31.50bB
CV (%)	12.72	

Means followed by the same lowercase letter in the column and uppercase letter in the line do not differ from each other at the 5% probability level, by Tukey's Test.

Regarding the number of leaves, the exceptional tillering capacity contributes to increasing the number of leaves, where each tiller almost always presents between 3 and 5 leaves (Table 2). At the same time, there is a tendency for increased tillering when planting is done with conjugated tillers (Table 2).

TABLE 2 - Number of leaves, number of tillers, root length, fresh mass of tiller, plant and root of Caipira chives according to density with planting of separate or conjugated tillers. Teresina/PI, UFPI, 2020.

Number of leaves			
Density	Averages	Tiller Situation	Averages
02 tillers	11.56 d	Separate	19.68 b
03 tillers	18.81 c		
04 tillers	24.25 b		
05 tillers	29.75 a	Conjugated	22.50 a
Control	8.75		
CV (%)	20.38		
Number of tillers			
02 tillers	3.12 d	Separate	5.48 b
03 tillers	5.25 c		
04 tillers	6.87 b		
05 tillers	8.18 a	Conjugated	6.25 a
Control	2.37		
CV (%)	24.34		
Root length			
02 tillers	7.43 a	Separate	7.67 a
03 tillers	7.84 a		
04 tillers	8.06 a		
05 tillers	8.06 a	Conjugated	8.03 a
Control	6.06		
CV (%)	29.43		
Fresh mass of tiller			
02 tillers	5.47 a	Separate	5.60 a
03 tillers	5.81 a		
04 tillers	5.89 a		
05 tillers	5.47 a	Conjugated	5.73 a
Control	6.22		
CV (%)	36.94		
Fresh mass of whole plant			
02 tillers	16.76 c	Separate	29.43 b
03 tillers	29.33 b		
04 tillers	39.44 a		
05 tillers	43.80 a	Conjugated	35.26 a
Control	13.01		
CV (%)	32.43		
Fresh mass of root			
02 tillers	1.67 c	Separate	2.75 b
03 tillers	2.93 b		

04 tillers	3.46 b		3.59 a
05 tillers	4.62 a	Conjugated	
Control	1.08		
CV (%)	31.41		

Means followed by the same lowercase letter in the column and uppercase letter in the line do not differ from each other at the 5% probability level, by Tukey's Test.

It is reasonable to suppose that intraplant competition increases, given the change in hormonal balance, stimulating the differentiation of buds that will form new plants, with an increase in clump size. For Rabinowitch and Brewster (1990), observed in onions, the population pressure resulting from the increased planting density could stimulate the acceleration of the bulbing process.

Chive tillers originate from lateral buds and their growth is subordinate to endogenous and exogenous influences, such as hormones and environmental factors, including cold and drought, as observed by Wakchaure *et al.* (2018). Borges *et al.* (2019), working with chives "Todo Ano" in consortium, did not verify an effect on this parameter, obtaining between 8 and 9 tillers per plant.

On the other hand, root length was not influenced by the treatment. Regardless of conjugated use, reaching a depth compatible with plant height, reaching values close to those obtained in chives "Todo Ano" by Belfort *et al.* (2022b) and with the hybrid "Natsu Saku", according to Machado and Belfort (2007).

The fresh mass of the tiller was not influenced by planting density, nor by the situation of the tillers being conjugated or not, something that authorizes planting indistinctly at the densities tested. Observations about the crop point to a reduction in the mass of tillers with the lengthening of the cycle, outside the time frame defined as the harvest point, making them increasingly thin and, consequently, lighter.

Regarding the fresh mass of the whole plant, also identified as clump, the values changed up to the number of 4 tillers, demonstrating that planting at a density of up to 4 plants dispenses with their separation, in addition to the operability of the practice and the tendency of better response with them conjugated. This difference allowed an increase of approximately 20% in weight gain in plants obtained from conjugated tillers, encouraging the practice, considering the intense tillering in the cultivar, behavior that not infrequently stimulates decompaction of the clump.

It is reasonable to assume that eliminating the operationalization of the practice will allow real gains, by reducing the cost spreadsheet, in addition to the natural productivity gains, especially since the root in chives in general recovers very well from occasional damage (BELFORT *et al.*, 2022b).

In this species, with the increase in the vegetative cycle there is a corresponding increase in the capacity for temporary storage of photoassimilates in the leaf sheaths (ZÁRATE *et al.*, 2003). In onions, the bulb development phase occurs when the plant stops leaf formation, the leaf growth rate decreases and the leaf sheaths of the bulb swell to form the storage tissue (OLIVEIRA, 2011).

The fresh mass of the root system increased up to planting with three tillers, and it was also demonstrated that the clump is better endowed with the conjugated tillers, a finding that helps explain the results obtained with the fresh mass of the clump. Although this organ did not receive influence from the treatments regarding depth, it seemed to be denser, which justifies the variation in fresh mass. The use of conjugated tillers implies an increase of approximately 30%. A denser root system

allows not only an increase in the capacity to absorb water and nutrients, but also in water balance (SANTOS *et al.*, 2020).

The root system in plants of the Alliaceae family is fasciculated and superficial, so its performance can be decisive in controlling water deficit and, consequently, minimizing losses, as highlighted by Machado and Belfort (2007). The capacity of plants in the family, especially chives, regarding root system recovery is well known. In the case of these species, as the leaf sheath accumulates reserves in the pseudobulb, as stated by Belfort *et al.* (2022b), it allows us to project that establishing a connection with this property helps to justify decompacting the clump, without the practice being able to cause any level of damage.

CONCLUSION

The negative reaction of the plant to conjugated planting occurred in the height variable, especially at the density of five plants per pit. Most organs received the influence of density and planting of conjugated tillers, with better results for number of leaves, tillers per clump and fresh mass of the whole plant, with no influence on fresh mass of the tiller and root. It is noted, therefore, in Caipira chives, that it is unnecessary to separate the tillers when planting up to four per pit.

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