FLOWERING, INFLORESCENCE AND NUMBER OF PODS IN BEAN CULTIVARS NAPOLI POWDER AND CONTENT IRRIGATED

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ABSTRACT: The flowering stage, directly influences the satisfactory yield of the crop, because the number of pods per plant depends on the number of open flowers, which, in turn, is very susceptible to climatic and management factors. The objective of this study was to evaluate the effect of different water replenishments on the number of flowers per inflorescence and on the number of pods in the bean cultivars Napoli and Contender. The study was conducted at the Universidade Estadual de Goiás, Câmpus Ipameri, beans were planted in May 2015, and the experimental design of randomized blocks was analyzed in a 5x2 sub-divided plots scheme, in three blocks. The plots were constituted of the irrigation levels determined by the water replenishment (RH) corresponding to 25; 50; 75; 100 and 125% of the evaporation of the Pichet evaporimeter, the subplots the pod bean, Napoli and Contender. The number of flowers per inflorescence, the color of the flowers, the average length of the inflorescences and the number of pods per inflorescence were determined. The cultivar Contender showed earlier flowering than the Napoli, regardless of the applied water depth. The period for pod formation was 8 and 14 for Contender and Napoli, respectively, but the highest number of pods was observed in the Napoli variety.

KEYWORDS: cycle, flowering age, revenge of flowers.

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FLORAÇÃO, INFLORESCENCIA E NÚMERO DE VAGENS NAS CULTIVARES DE FEIJÃO VAGEM NAPOLI E CONTENDER IRRIGADO

RESUMO: O estádio de floração, influência diretamente no rendimento satisfatório da cultura, pois o número de vagens por planta depende do número de flores abertas, o qual, por sua vez, é muito susceptível aos fatores climáticos e de manejo. O objetivo deste estudo foi avaliar o efeito de diferentes reposições hídricas no número de flores por inflorescência e no número de vagens nas cultivares de feijão vagem Napoli e Contender. Conduziu-se o estudo na Universidade Estadual de Goiás, Câmpus Ipameri, os feijões foram semeados em maio de 2015, sendo adotado o delineamento experimental de blocos casualizados analisados em esquema de parcelas subsubdivididas 5x2, em três blocos. As parcelas foram constituídas dos níveis de irrigação determinadas pela reposição hídrica (RH) correspondente a 25; 50; 75; 100 e 125% da evaporação do evaporímetro de Pichet, as subparcelas as cultivares de feijão vagem, Napoli e Contender. Determinaram-se o número de flores por inflorescência, a cor das flores, o comprimento médio das inflorescências e o número de vagens por inflorescências. A cultivar Contender apresentou florescimento mais precoce que a Napoli, independente da lâmina de água aplicada. E o período para formação de vagens foi de 8 e 14 dias para as cultivares Contender e Napoli, respectivamente, porém o maior número de vagens e o período de florescimento foram observados na variedade Napoli.

PALAVRAS-CHAVE: ciclo, idade de floração, vingamento de flores.

INTRODUCTION

The common bean and the bean pod, belong to a species (*Phaseolus vulgaris* L.) being introduced to the crop for more than seven thousand years in two centers of origin, Mesoamerica (Mexico and Central America), and the Andean Region (KAPLAN, 1981). As the main differences between us is that teh second is used as a vegetable from which immature, tender and low-fiber pods are consumed within which they grow as seeds (FILGUEIRA, 2008).

It is characterized by being an autogamous species, with hermaphrodite flowers, where cleistogamia occurs, that is, stigma pollination occurs before the flower bud is opened. Since the floral morphology favors self-pollination, because the anthers, protected by the petals, are on the same level as the stigma. When the anthers dehiscence occurs, the pollen grains fall directly on the stigma. Despite the high degree of autogamy, cross fertilization may occur,

mainly due to the action of insects. Most authors report less than 1% cross-pollination, but there are reports of up to 11% (PEIXOTO & CARDOSO, 2016).

Establish a pattern for the flowering period of the bean, attributing importance and ease of handling, from the point of view of physiology and plant breeding. For during the flowering stage, a series of physiological phenomena occur, influenced by environmental factors, that can result in a higher or lower yield of the crop (SILVEIRA et al., 1980). The flowers may be white, yellow, cream, pink or purple (VAZ, 2014).

The flowers are distributed in cluster type inflorescence. In the cultivars of determined growth they are located at the end of the stems. Cultures of undetermined growth show flowering from the base to the apex of the plant. For the great period of flowering, which can be over two months, it is common observed in the same plant from anthesis flowers to well-developed pods, and then the harvest is done in order to avoid pods passing from the commercialization point (PEIXOTO & CARDOSO, 2016).

It also influences the final yield, which is directly influenced by the number of pods per plant, the number of grains per pod and the weight of the grains. Since the number of pods per plant is the factor that is most influenced to the environment interaction. Being directly dependent on the number of open flowers, which, in turn, is very susceptible to climatic factors (SILVEIRA et al., 1980).

In the study developed by Mariot (1976) it is described that the percentage of revenge of flowers of the cultivar 'Porrilio Sintético' significantly reduced with the age of flowering. Silveira et al. (1980) report that there is still no satisfactory explanation for the high fall of common bean flowers, nor for the increase of this fall with the age of flowering. Smith & Pryor (1962) mention that flower fall may be due to the high temperature at flowering time. And Laing & Zuluaga (1977) describe the fall of flowers due to deficiency in the supply of photoassimilates during the flowering period.

Against the foregoing, the objective of this study was to evaluate the effect of different water replenishments on the number of flowers per inflorescence and on the number of pods in the bean cultivars Napoli and Contender.

MATERIAL AND METHODS

The experiment was carried out under field conditions, at the State University of Goiás - UEG, Ipameri Campus with 17º43 'south latitude and 48º22' west longitude and 800 m altitude.

The climate of the region according to the classification of Köppen is defined as Tropical Humid (AW), constant of high temperatures with rains in the summer and dry in the winter.

They were performed as planning and coverage fertilizers, performed according to the suggestion of Peixoto et al. (2002), using 600 kg ha^{-1} of the formulated 4-30-16 without planting 15 to 20 days after sowing 150 kg ha^{-1} of urea.

The experiment was installed in a randomized block design, in a 5 x 2 subdivided plot scheme with three replicates. As plots were constituted of irrigation levels, which was determined by water replenishment corresponding to 25; 50; 75; 100 and 125% of the evaporation of the Piche evaporator, as subplots was 2 pod bean cultivars (Contender and Napoli).

The drip irrigation system was used, using a dripping tube with emitter spacing of 0.20 m and a flow rate of approximately 2.4 L h^{-1}.

Evaporation data, the basic service for the application of the long-term operations of the vital crop culture, obtained from a Piche Evaporimeter, installed in the experimental area. The amount of water to be applied was determined by the need to replace passive evapotranspiration losses of the crop (ETc), the following equation was obtained:

$$ETc = [ETo \times Kc] \quad (1)$$

At where:

ETo is the reference evapotranspiration (mm day^{-1}); Kc is the cultivation coefficient, proposed by Stone & Silva (1999) for common bean.

The inflorescences and pods will be evaluated following the following methodologies:

Number of flowers per inflorescence: obtained through the average of ten inflorescences sampled per plot.

Color of flowers: will be obtained when the flowers are open, is attributed the following graduation: white; yellow and purple.

Number of pods per inflorescences: the number of pods formed in ten inflorescences sampled per plot.

After the emergence of the first flower, the percentage of flowers and pods was determined weekly and distribution studies, new reproductive structures were carried out until a complete formation of the plants of two bean pod cultivars.

RESULTS AND DISCUSSION

In the development of the work the coloration observed for the cultivars under analysis were respectively purple color for the Cultivar Contender and white color for the cultivar Napoli, as can be observed in Figure 1 and Figure 2.

At Figure 3 shows the percentages of flowers and pods per pod bean plant of the cultivars Contender and Napoli, under the effect of irrigation slides and evaluation period. It is noticed that the period of flowering varied according to the applied water depth, as well as by the cultivar. The cultivar Contender began flowering 38 days after sowing (DAS) and emitted flowers up to 66 DAS, remaining with flowers for 28 days, except for the 100% evaporation slide of the Piche evaporimeter. The cultivar Napoli remained florida for 42 days, that is up to 80 DAS and independent of the applied water blade.

It is also noted that the greatest revenge of pods occurred for the cultivar Napoli, regardless of the applied water depth. However, for both cultivars, the slide of 100% Figure 1G and 1H) of the evaporation of the Piche evapoimeter was superior to the others, indicating that both the excess and the water deficit influence the revenge of flowers, and consequently, of pods of the bean pod.

The cultivar Napoli presented in this total leaf of 14.11 pods per plant at 87 DAS, the cultivar Contender presented in this date average of only 6.22 pods, production, close to that found by Oliveira (2015).

Which found for the first cultivar 14.67 pods per plant, which represented one of the best genotypes in the study environment and in relation to this evaluated characteristic. These values of average number of pods per plant were within the averages found by Pinto et al. (2001); Peixoto et al. (1997) and Vidal et al. (2007), in crops in the states of Minas Gerais and Goiás.

According to Peixoto et al. (2001), the vegetative cycle is an important phenological characteristic for the bean pod, because the earlier the cultivar, the greater the number of options the family farmer will have in scheduling successive crops in the same area and is therefore an important feature to be observed in the Selection of cultivars for production.

CONCLUSION

Checked that the cultivar Contender presented earlier flowering than the Napoli, regardless of the applied water depth. And the period for pod formation was 8 and 14 days for the cultivars Contender and Napoli, respectively, but the highest number of pods was observed in the Napoli variety.

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Figure 1. Cultivar Contender bean blossom.

Figure 2. Cultivar Napoli bean blossom.

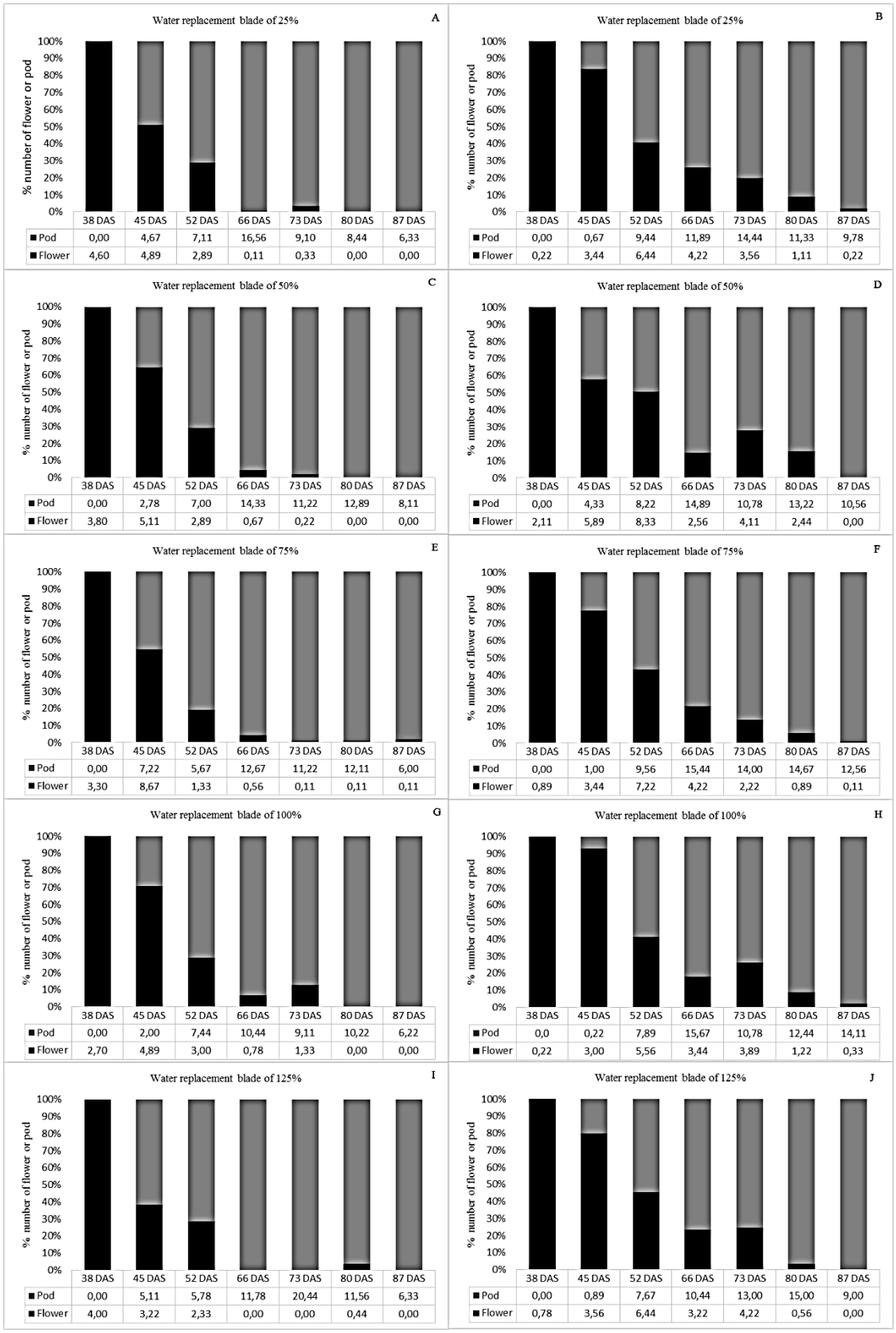

Figure 3. Quantitative flower and pod pods of Contender cultivar (A, C, E, G and I) and Napoli (B, D, F, H and J) cultivated under the effect of irrigation blades indicated as evaporation of evaporimeter Of Piche, during the reproductive period, given in days after sowing (DAS).