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# OKRA TRANSPLANT GROWTH AS AFFECTED BY THE EXOGENOUS PLANT GROWTH REGULATOR BENZYLAMINOPURINE

## CRESCIMENTO DE MUDAS DE QUIABO EM RESPOSTA À APLICAÇÃO DE BAP

Cláudia Lopes Prins[1*]; Brunno de Oliveira Almeida[2]; Letícia Borges da Costa[3]; Lia Mara da Silva Gomes[4]

[1] Horticulture Department – Vegetable Crops, Center of Agricultural Science and Technology, North Fluminense State University, RJ, Brazil, CEP 28013-602. * prins@uenf.br; [2] Instituto Capixaba de Pesquisa, Assistência Técnica e Extensão Rural, ES, Brazil, CEP 29052-010. E-mail: almeida.brunnodeoliveira@gmail.com; [3] Horticulture Department – Vegetable Crops, Center of Agricultural Science and Technology, North Fluminense State University, RJ, Brazil, CEP 28013-602. koborgesleticia@gmail.com; [4] Horticulture Department – Vegetable Crops, Center of Agricultural Science and Technology, North Fluminense State University, RJ, Brazil, CEP 28013-602. Liamara32@gmail.com

## INTRODUCTION

Okra (*Abelmoschus esculentus*) plants are grown in tropical regions during summer when they are exposed to high temperatures and dry periods. Although okra is considered a resistant plant, its growth is negatively affected by reduced water availability a common scenario in tropical lands (KUSVURAN, 2012). The initial period of plant development is important for future production and practices which allow plants to grow under severe conditions at this stage are needed. Plant growth regulators (PGRs) could confer stress protection to plants, improving their tolerance (UPRETI; SHARMA, 2016).

Cytokinins or similar products can influence development (O'BRIEN; BENKOVÁ 2013) and increase plant tolerance to cold (ZWAK et al. 2016), heat (JERSPERSEN; HUANG 2015) and drought (KUPPU et al. 2013) when applied to transplants. Positive effects are reported for okra grown under nutritional deficiency and treated with commercial products containing cytokinins (PAPENFUS et al. 2013).

This work aimed to evaluate BAP, a synthetic cytokinin, with respect to okra transplant growth.

## MATERIAL AND METHODS

The experiment was carried out in a protected environment. Okra seeds, Santa Cruz 47 cultivar, were sowed in 200 mL pots fulfilled with commercial substrate for transplant production. The experimental design was completely randomized with four repetitions (n=4) and each repetition was composed of six pots. A BAP solution was prepared dissolving BAP (0.2 g) in alcohol (100 mL) and deionized water (100 mL), from this standard solution a 5 ppm solution was obtained and applied to plants. At 30 days after sowing the treatment has started.

Treatment 1 (BAP-shoot) consisted of BAP applications on shoot, treatment 2 (BAP-substrate) consisted of BAP application on substrate and treatment 3 (CONTROL) no BAP application. Each plant received 5 mL of a 5 ppm BAP solution. For control it was applied to plants the same volume of a water and alcohol solution. It was realized three applications in an interval of four days. Four days after the last application the plants were harvested. Before harvesting, it was evaluated the greenness of leaves

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(SPAD). After harvest plant was separated into leaves and stems and then weighted (fresh matter). Following, foliar area was analyzed (foliar meter, Licor, model LI-3100). Leaves and stems were dried at 65°C until constant weight. For root dry mass determination roots were washed in current water and dried at 65°C.

The data were submitted to Variance Analysis and Tukey test (5%) when treatments showed significant effects.

## RESULTS AND DISCUSSION

Leaves fresh weight and root to shoot ratios were affected by BAP applications in aerial part. BAP application on substrate results in increased leaf Fe concentrations. The other variables were not affected by treatments.

Fresh mass of leaves from plants whose received BAP on aerial part was higher than that treatments with BAP on substrate and do not differ from control (Fig.1). For root to shoot ratio, plants treated with BAP on shoot showed an average of 0.16, this is 11% lower than those values observed for the others (Fig.2). Although it was not reported statistical difference for leaves and stem dry mass, which sum generates root to shoo ratio, it was verified that plants treated with BAP on shoot presented total dry mass 11.79% higher than control plants, while plants which received BAP on substrate this increase was 16.24% (Fig. 3).

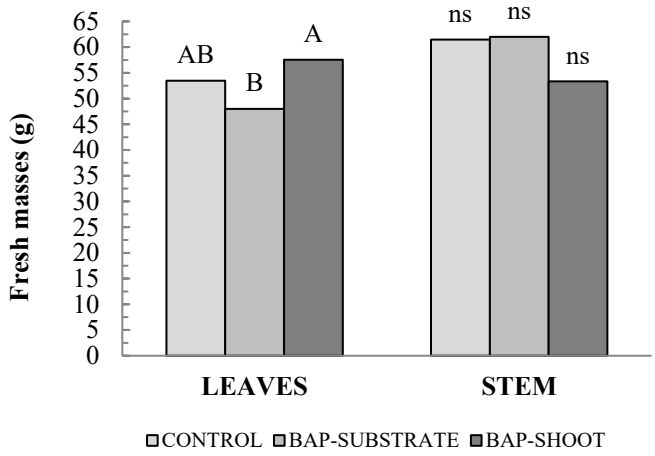


**FIGURE 1** - Okra (*Abelmoschus esculentus*) leaves and stem fresh masses (g) in response to BAP applications. The same capital letter upon column groups means no statistical difference among treatments (Tukey, 5%).

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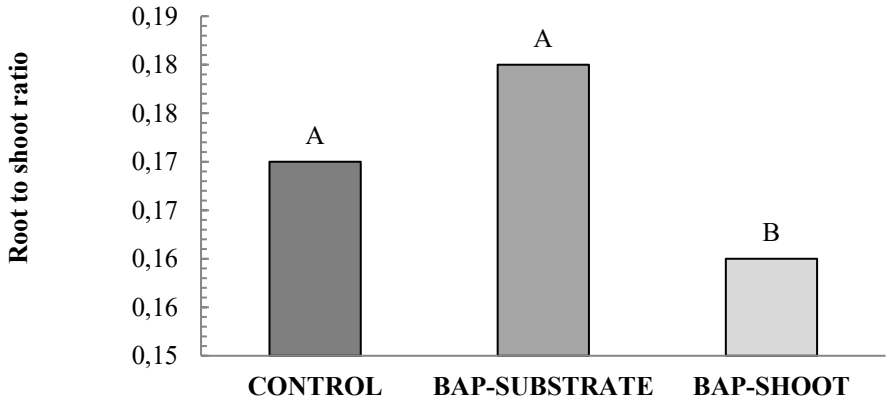


**FIGURE 2** - Okra (*Abelmoschus esculentus*) root to shoot ratio in response to BAP applications. The same capital letter upon column means no statistical difference among treatments (Tukey, 5%).

Plants that had received BAP on shoot showed a 14.82% increase in leaves dry mass compared to the others. This result was accompanied by stem dry mass reduction which in BAP shoot was 10.91% lower than in others (TABLE 1). Such result indicates assimilate partition alteration toward leaves at the expense of stem dry mass accumulation. The SPAD index was also evaluated. For this variable there was no treatment effect showing 39.46±1.27 in average. Foliar areas were not affected by treatments with 2158.35 $cm^2$ in average.

**TABLE 1** - Okra (*Abelmoschus esculentus*) leaves, stem and root dry masses (g) in response to BAP applications.

| TRANSPLANT ORGANS | TREATAMENTS | | |
|---|---|---|---|
| | CONTROL | BAP-SUBSTRATE | BAP-SHOOT |
| LEAVES | 6.53 $^{ns}$ | 6.28 $^{ns}$ | 7.30 $^{ns}$ |
| STEM | 5.50 $^{ns}$ | 5.60 $^{ns}$ | 4.95 $^{ns}$ |
| ROOTS | 2.10 $^{ns}$ | 2.18 $^{ns}$ | 1.97 $^{ns}$ |

The same capital letter upon column groups means no statistical difference among treatments (Tukey, 5%). ns – no significant.

Okra plants are responsive to PGRs. Plant growth and fruit production are influenced by gibberelin ($GA_3$), ethylene (etephon), auxin (Indol acetic acid - IAA), and cytokinin (benzylaminopurine - BAP). $GA_3$ application increased leaf number per plant, fruit number and length, raised seed number per fruit, and plant height. Moreover, seeds showed both higher protein content and percentage of germination (AYYUB et al. 2013). Fresh and dry fruit weights increased in response to Etephon and IAA applications and sowing date (DILRUBA et al. 2009), indicating the influence of age on okra response to PGRs.

Cytokinin is a plant hormone that promotes senescence delay and sink enhancement in the organs it is applied to (PRAJAPATI et al. 2015) leading to an increase in plant growth (ROITCH; EHENB, 2000). Our results show that BAP applications on okra transplant shoots increased fresh mass.

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Our data do not indicate morphological effects, which could be related to treatment duration. Cytokinin control on morphogenesis is linked to cell cycling as observed in tobacco (WERNER et al. 2001), but this variable was not evaluated in the present study.

BAP applications on substrate neither affected root growth nor root to shoot ratios (Table 1). Werner et al. (2001) observed that low cytokinin favored root growth in tobacco. This negative effect of cytokinin on root growth could explain our results when the PGR was applied in the substrate.

## CONCLUSIONS

We conclude BAP application, as evaluated in this work, affected young okra plant growth When applied to shoot, BAP promoted growth by enhancing fresh mass and led to reduced root to shoot ratios.

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