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# The Influence of $GA_3$, Kinetin and Ethylene on Seedling Growth, Nucleic Acids and Protein Content in Sweet Pepper (*Capsicum annuum*)

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## Abstract

A study was made of the influence of $GA_3$, kinetin and ethrel, individually or in combination, on nucleic acids (RNA and DNA), protein and seedling growth in sweet pepper (*Capsicum annuum*) cv. California Wonder. $GA_3$, treatment increased nucleic acids and proteins, markedly, as compared to untreated ones. The nucleic acids and protein content were closely related to the length of the seedlings. Kinetin was equally effective while in rest of the treatments, the nucleic acids content were lower than control and small increase was exhibited in protein content.

## Introduction

Seedlings of most of the species produce ethylene as well as gibberellins. Gibberellins promote elongation of cells and inhibited by ethylene and kinetin (Pearce *et al*., 1991, Sanchez-Bravo *et al*., 1992). It has also been reported that $GA_3$ treatment will reverse the effect of ethylene on elongation (Stewart *et al*., 1974). $GA_3$, treatment of cotton seeds induced synthesis of RNA, DNA and proteins in embyomic axis during period of germination (Khafagy and Mousa, 1982). Similarly $GA_3$ treatment of pea internodes promoted cell elongation, DNA and RNA in the tissue (Degani *et al*., 1970), while DNA, RNA and protein synthesis are essential for $GA_3$ stimulated cell elongation (Broughton, 1969).

Present study was undertaken to see the effect of some of the growth regulators on nucleic acids and protein content in sweet pepper (*Capsicum annuum*) grown as vegetable crop in Saudi Arabia.

## Materials and Methods

Sweet pepper (*Capsicum annuum* cv. California Wonder) seeds were purchased from the market. Seeds were sterilized with 1% hypochlorite solution and germinated in 9 cm plastic petri plates containing two, Whatman No. 1, filter papers. 10 ml distilled water or appropriate test solution (Table 1) was added to the petri plates. Fifteen seeds were transferred to each plate and incubated in dark at $\pm 25^{\circ}C$. Each treatment was replicated three times. After the desired treatment period (10 days in dark), the seedling lengths were measured and harvested. Samples were frozen for subsequent RNA, DNA and protein analysis. For RNA and DNA extraction, the method described by Ogur and Rosen (1950) was followed. Standard orcinal (Munro and Fleck, 1966) and diphenylamine (Burton, 1956) methods were used for estimation of RNA and DNA, respectively. Protein extraction was made following the method of Torres and Tisserat (1980) and estimated by folin phenol reagent method (Lowry *et al*., 1951).

## Results

The results of the present study are depicted in Table 1. It is observed that the growth regulators, used individually or in combination, did not show primitive effect on seedling growth except for $GA_3$ and $GA_3$ + Kinetin which enhanced and the growth, significantly, over control.

DNA and RNA contents increased, as compared to control, significantly, with GA, and kin. and non-significantly with ethrel treatment. Similarly protein content increased significantly with all the three growth regulators used. Combination of these growth regulars affected adversely the RNA content while an increase was observed in DNA for $GA_3$ + Kin and Eth + $GA_3$. The protein content increased over control, in all the combinations used.

## Discussion

In the present study. it is revealed that $GA_3$ treated seedlings contained much more RNA, DNA and protein as compared to untreated ones. It is also observed that content of RNA, DNA and protein are closely related to the length of the seedlings. In many of the previous studies it is indicated that $GA_3$ promoted RNA, DNA and protein in germinating cotton seeds (Khafagy and Mousa, 1982) a cortical tissue of pea internodes (Broughton, 1969; Degani *et al*., 1970). Leaf water soluble protein and nucleic acid contents increased in maize leaves by application $GA_3$ and kinetin (Dogra and Thukral, 1994) similar to present study. However, kinetin in combination with ethrel did not show much effect. The influence of cytokinins RNA and protein synthesis may affect the fluxes of ions a other material across the plasma membrane of leaf ce (Saeed, 1975).

Increase in RNA content by $GA_3$ treatment is supported by previous studies which show that in barley aleurone layer incorporation into salt soluble RNA is enhanced by $GA_3$ and that $GA_3$ enhanced the synthesis of rapidly labeled RNA

Table 1: Effect of $GA_3$, Kinetin and Ethylene (Ethrel) alone or in combination, on growth, nucleic acids and protein content of sweet pepper (*Capsicum annuum*) seedlings. Concentrations of $GA_3$, Kin. and Eth. were 50 mg/L, 10 mg/L and 250 mg/L, respectively

| Experimental solution | Length (cm/seedling) | RNA (Abs/seedling) | DNA (Abs/seedling) | Protein (mg/seedling) |
|---|---|---|---|---|
| Control | 5.8 | 1.542 | 0.163 | 4.17 |
| $GA_3$ | 9.2 | 2.624 | 0.236 | 6.50 |
| Kinetin | 4.5 | 2.000 | 0.203 | 5.66 |
| Ethrel | 1.8 | 1.698 | 0.195 | 5.50 |
| $GA_3$ + Kin. | 7.0 | 0.689 | 0.186 | 5.14 |
| $GA_3$ + Eth. | 2.9 | 0.618 | 0.195 | 6.08 |
| Kin. + Eth. | 2.4 | 0.802 | 0.135 | 5.16 |
| $GA_3$ + Kin + Eth. | 1.8 | 0.653 | 0.133 | 5.93 |

synthesis in barley aleurone layer (Ho and Varner, 1974). Direct evidence of $GA_3$ control of RNA, DNA and protein comes from many sources (Broughton, 1969). It is also reported that DNA synthesis is necessary for elongation of certain plant cells as the inhibition of DNA synthesis also inhibited the shoot elongation induced by $GA_3$ (Nitsan and Lang, 1966). Degani *et al*. (1970) studied that certain fraction of DNA synthesis is pre-requisite for hormone induced elongation or as another possibility, hormone-induced DNA is another manifestation of enhanced growth rather than pre-requisite. Similar mechanism may be operating in the seedlings used in the present study, as a close relationship is observed in length of seedling and nucleic acids and protein content.

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