PHOTOSYNTHESIS AND TRANSLOCATION OF SUGARS IN COTTON PLANTS SUBJECT TO DROUGHT STRESS AFTER MEPIQUAT CHLORIDE APPLICATIONS

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Abstract

In the tropical regions of the world, cotton plants often produce excessive vegetative growth. Tall plants with dense foliage reduce insecticide coverage, interfere with mechanical harvesting operations and promote boll rot. The use of the plant growth regulator Mepiquat Chloride (MC) is a common and necessary practice in commercial cotton production to prevent excessive growth. Since MC is applied during the vegetative phase of development, cotton crops often experience periods of water stress after the application.

This study was designed to research leaf water potential, carbon assimilation, translocation of sugars and chlorophyll content of plants exposed to drought after an application of 42g of MC ha^{-1} at bloom. The study was conducted at the Research Center of the Institute Agronomico do Parana, Londrina, Brazil, using cultivar IAC-20. Treatments were water stress and non-stress, each split into sub-plots with and without MC. Water stress treatments were imposed after the application of MC by covering plots with a movable rain-out shelter. The upper-most fully developed leaf of several plants were selected for the determination of leaf water potential. The same leaves were used for determination of chlorophyll and sugar content. Two disks were collected from one half of each selected leaf at 700, 1100, 1500 1800 and 700 h of the following day for determination of reducing and soluble sugars. Photosynthesis was measured with a portable chamber (LI-6200) from the undisturbed half of the selected leaf at the times listed above. Carbon translocation was calculated from the difference between carbon fixation and levels of sugars measured in the disks.

Water stress crops consistently resulted in lower leaf water potential readings. Although differences were not significant, MC treated leaves tended to exhibit a higher water potential value than non-treated plots. Twenty-one days after imposing the water stress treatments, significant differences in chlorophyll content were detected. Total chlorophyll content was higher in non-stress plots than in stress plots. MC applications increased the chlorophyll "a" and "b" of treated leaves. This is consistent with reports in the literature and with the general observation that MC treated leaves turn dark green in color. No significant differences in initial levels of starch accumulation were detected. However, 13 days later the level of starch in stress plots were significantly reduced. Differences in starch accumulation due to MC applications were not statistically significant. Water stress significantly increased levels of reducing sugar in leaves. MC treatments did not significantly influence levels of reducing sugars in plants. Under water stress conditions, plots treated with MC maintained a higher level of carbon assimilation than non-treated plots. The data on translocation of sugars showed no statistical differences among MC treatments. However, water stress significantly reduced the translocation of sugars.

The study demonstrated that cotton plants exposed to water stress are not adversely affected by applications of the plant growth regulator Mepiquat Chloride.

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