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TOWARDS IMPROVED CELL CYCLE MANIPULATION AND CHROMOSOME DOUBLING METHODS IN *GOSSYPIUM*

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Abstract

We endeavor to manipulate the cell cycle and mitotic spindle of cotton. Control over these biological features will enhance our ability to produce high quality cytological preparations of chromosomes and to double the number of chromosomes, i.e., induce polyploidy. The ability to routinely produce large numbers of high quality chromosome preparations from plants enables karyotypic germplasm characterization, integrated and comparative genomics, and germplasm utilization. Induction of polyploidy is often among the most crucial steps in germplasm introgression because many interspecific hybrids are otherwise sterile due to meiotic non-homology between the parental chromosomes. Chromosome doubling is also critical to production of doubled haploids, which are completely homozygous and valued for research and breeding. In progression toward these goals, experimental evaluations were made by hydroponically treating seedlings with a variety of antitubulin compounds – amiprophos-methyl, nitrous oxide, a benzamide designated RH-4032, colchicine, and a novel phenylcyclohexene colchicine mimic; followed by visual analysis of root tip morphology and cytological analysis of nuclei and mitotic appearance. Amiprophos-methyl and the phenylcyclohexene seemed to be most effective. We also observed significant effects from topical application of 0.5-2 mM amiprophos-methyl and 25-100 µM phenylcyclohexene, with phenotypes ranging from sectored and misshapen leaves to meristem necrosis, followed by development of thicker and darker leaves. Cytological data and visual observations suggest these compounds cause somatic doubling of the chromosome number in cotton, and that they will provide one or more favorable alternatives to traditional methods based on colchicine, which is highly toxic, light-labile and mutagenic.