CO-OVEREXPRESSION OF OSSIZI AND AVP1 IN COTTON SUBSTANTIALLY IMPROVES COTTON GROWTH AND DEVELOPMENT UNDER MULTIPLE-STRESS CONDITIONS Nardana Esmaeili Jennifer Smith Hong Zhang Department of Biological Sciences, Texas Tech University Lubbock, Texas John Burke Paxton Payton United States Department of Agriculture Cropping Systems Research Laboratory Lubbock, TX

Abstract

Environmental stresses such as salt, drought, and heat cause significant losses in crop production. Our laboratories employ genetic engineering to modify gene expression of selected genes to improve plant performance under environmental stress conditions. Previous studies by our group have shown that the overexpression of the rice gene *OsSIZ1*, a SUMO E3 ligase, resulted in improved heat- and drought-tolerance in cotton. In separated experiments, overexpression of an Arabidopsis vacuolar pyrophosphatase gene, *AVP1*, improved salt- and drought-tolerance in transgenic plants. We hypothesized that co-overexpression of *OsSIZ1* and *AVP1* in cotton would simultaneously confer higher heat-, drought-, and salt-tolerance in transgenic cotton and thus reduce loss in fiber yield under stressful growing environments. We introduced both *AVP1* and *OsSIZ1* into cotton and conducted preliminary experiments to test the performance of the *AVP1/OsSIZ1*-co-overexpressing cotton plants in laboratory and field conditions. We observed that improved photosynthetic rates were achieved under combined salt and drought stresses, as well as under combined heat and drought stresses. Furthermore, field-grown transgenic cotton plants performed better in rain-fed plots when compared to non-transgenic plants.