Palmer Amaranth from the North Carolina Coastal Plain: More Cause for Concern with the Herbicide Toolbox. D.J. Mahoney*, D.L. Jordan, A.T. Hare, N.R. Burgos, K.M. Jennings, R.G. Leon, and M.C. Vann.

Palmer amaranth (*Amaranthus palmeri* S. Wats.) is one the most problematic weeds in the United States. It is a highly competitive weed with immense fecundity and has the ability to replenish the soil-seed bank in one generation. Palmer amaranth is an obligate cross-pollinator, possesses a high amount of genetic variation and its pollen has been shown to move significant distances. Along with immense herbicide selection pressure, these characteristics have led to Palmer amaranth populations resistant to several mechanisms of action (MOA) with some populations expressing multiple resistance. In North Carolina (NC), resistance to acetolactate synthase (ALS) and 5-enolpyruvylshikimate-3-phosphate (EPSP) synthase inhibitors is widespread and suspicion of resistance to protoporphyrinogen oxidase (PPO) inhibitors within Palmer amaranth exists. Greenhouse research was completed to determine the presence and distribution of Palmer amaranth population from the NC Coastal Plain expressing possible resistance to multiple MOA. In fall 2016, 110 Palmer amaranth populations were collected from fields predominantly in the NC Coastal Plain, the state's primary peanut producing region. Following inflorescences being dried, threshed, and cleaned, seeds were sown into cellular trays thinned to one plant cell^{-1}. When plants reached the 2- to 4-leaf stage, they were treated with glufosinate (451 g ai ha^{-1}), glyphosate (840 g ae ha^{-1}), fomesafen (280 g ai ha^{-1}), mesotrione (105 g ai ha^{-1}) or thifensulfuron-methyl (17.5 g ai ha^{-1}) in separate experiments (two per herbicide). Plant injury was estimated visually (0 to 100%) and mortality was recorded 3 wks after application.

Only 4 populations had no survivors following application of thifensulfuron-methyl. Of the other populations with survivors (< 90% injury), 69 had survival frequencies of 1 – 30%, 35 with 31 – 70%, and the remaining 2 with 71 – 80%. Following glyphosate, only 1 population was completely controlled with 9 populations having survival frequencies in the 1 – 30% range. Higher survival frequencies were more common with glyphosate as 38 and 62 populations had survival frequencies of 31 – 70% and 71 – 100%, respectively. Survival following mesotrione was less frequent with 68 populations being completely controlled. While 41 populations had survival frequencies of 1 – 10%, 37 fell below 5% survival rate with the 1 population having 17% survival. Fomesafen controlled 106 of the populations completely with the remaining 4 falling in the 1 – 10% survival frequency. All populations were completely controlled following glufosinate application. In total, none of the tested populations were completely controlled by all herbicides and only 3 survived only one MOA. Within the other 107 populations, 65, 40, and 2 populations had survivors to 2, 3, and 4 MOA, respectively. These data suggest that Palmer amaranth resistant to EPSP synthase and ALS inhibitors remains commonplace throughout the NC Coastal Plain. There is now greater cause for concern with populations which have individuals surviving PPO- and 4-hydroxyphenylpyruval dioxygenase inhibitors. While glufosinate currently remains active on these populations,

extra caution should be taken to ensure proper application timing as decreased efficacy of this herbicide would be detrimental for many row crop systems in North Carolina.