IMPACT OF CORN POPULATION, IRRIGATION, AND HAIL INJURY ON PALMER AMARANTH.

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A crop is most vulnerable to defoliation as it approaches maximum leaf area. For corn, this growth stage often coincides with one of the seasonal peaks of hail activity throughout most corn growing regions in North America. In 2005, while executing a long-term experiment to measure the dose response relationship of irrigation and corn grain yield, the leaf area index (LAI) of the corn was significantly reduced by a hail storm. This occurred again in 2006 at approximately the same stage of growth. Replicated studies of natural hail injury and the resulting weed flushes are rare. Therefore, our objectives were redirected to study these effects. Corn had a preemergence application of isoxaflutole, atrazine, s-metolachlor and 2,4-D at 0.05, 1, 1.9, and 1 lbs a^{-1} followed by two or more postemergence applications of glyphosate at 0.75 lbs a^{-1} to maintain weed-free conditions at canopy closure. The six irrigation treatments, replicated four times, were 100, 84, 71, 55, 42, and 30% of what locally-derived models predicted for non-rate limited irrigation. Corn populations for each treatment were 9,500, 22,000, 24,500, 27,000, 29,500, and 32,000 plants $acre^{-1}$, increasing as irrigation level increased. No hail injury occurred in 2004 or 2007 so these years are used for comparisons. Palmer amaranth biomass samples were taken at corn harvest. In 2005, hail injury reduced the LAI to the same level in all but the highest corn populations. In 2005 and 2006, all but the highest corn population had statistically significant reductions in LAI. Reductions in LAI correlated well with reductions in corn yield. In 2005, hail opened up the canopy and produced a dramatic flush of Palmer amaranth. At the lowest level of corn population and irrigation inputs, Palmer amaranth biomass (PABM) at corn harvest was twice that seen in the two highest corn populations. This was predicted by the equation: Pounds of PABM a^{-1} = 945 (corn yield in bu a^{-1}) -7.76 (corn yield bu a^{-1}) ^{2} +.029 (corn yield in bu a^{-1}) ^{3} - 18883 (LAI) + 3249 (LAI) ^{2} -184 (LAI) ^{3}, with an R^2 of 0.87.

In 2006, regardless of irrigation level or corn population, hail-induced increases in PABM were consistently high across all levels of treatment. Perhaps hail in the previous year increased the amount of weed seed dropped and elevated weed pressure, which might have buffered the effects of differences in canopy damage. Although differences between treatments were difficult to measure, the relationship among corn grain yield, LAI, and PABM clearly showed a curvilinear trend at higher levels of each factor. This trend was predicted by the equation: Pounds of PABM a^{-1} = 3129 (LAI) -531 $(LAI)^2$ -871 (inches of irrigation) +49.6 (inches of irrigation) ^{2} with an R^2 of 0.78. Corn injury was severe enough to remove corn grain yield as a predictor of PABM. In 2007, PABM was 4- to 15-fold less than in 2005 or 2006. Even under these much more competitive conditions, similar trends in PABM were seen with increasing levels of inputs. More than 4-fold reduction in PABM was seen with increasing corn populations and irrigation.

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