FL2,4-D, a red clover selected for herbicide resistance to improve broadleaf weed control and to elucidate the molecular mechanism of resistance

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Red clover (*Trifolium pratense* L.) is an important forage legume worldwide, but establishment of red clover can be challenged by competition from broad-leaf weeds. Few herbicides are available for broad-leaf weed control in red clover during establishment. A previous research project developed a population with improved tolerance to 2,4-D and two additional cycles of recurrent selection (a total of 6 cycles) developed a red clover experimental line (FL24D) with good resistance to 2,4-D. Spaced plants of standard red clover cultivars (susceptible to 2,4-D) grown in the field or greenhouse in 2012-13 were killed or severely stunted after application of ½X, 1X or 2X of the recommended 2,4-D application rate, whereas FL24D showed only minor leaf curling and quickly grew out of these symptoms. Broadcast plots seeded in fall 2013 and sprayed with the ½X or 1X rate had similar response as spaced plants with little decrease in total yield relative to the unsprayed treatment. In unsprayed plots, FL24D was the earliest (most non-dormant) of any cultivars and had the highest first harvest yields compared to commercially available cultivars. The University of Florida Forage Breeding program has already released less-dormant cultivars that start growth early in the spring, however FL24D shows much earlier growth than any other known cultivar in the market.

With a current emphasis on commercialization and adoption of transgenic 2,4-D resistant cultivars in soybean and cotton, it is anticipated that an increase in weed resistance to 2,4-D may be expected. However, despite the economic importance of 2,4-D and its use for more than 60 years, remarkably little is known about the underlying genetic architecture or the genetic process by which resistance is acquired in target weeds. Understanding the evolutionary process of herbicide resistance and the molecular mechanism of herbicide-resistant weeds is essential for development of an integrated and sustainable weed management strategy.

Using remnant seed from the cultivar development research, cycle 0 (susceptible) through cycle 6 (resistant), we are studying both the process of acquired resistance and the molecular mechanism involved in such resistance. We will present an update of our work that has the final goal of identifying allele frequency shifts associated with evolution of 2,4-D resistance and the molecular mechanism underlying this resistance.