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**Studying Local Adaptation in Switchgrass**

Understanding local adaptation in switchgrass could lead to development of higher-yielding varieties.

**The Science**

A switchgrass (*Panicum virgatum* L.) mapping population was developed by crossing two southern lowland and two northern upland ecotypes. This population was planted in 10 field sites in the central United States, ranging from Texas to South Dakota, to study the genetics of local adaptation, or how populations adapt to specific environments. Quantitative trait loci (QTL) mapping of this population showed that most QTL had significant genotype x environment (GxE) effects, but only a limited number of trade-offs for QTL that impact biomass yield. The trade-offs that were observed were either weak or only occurred at a small number of locations.

**The Impact**

A more thorough understanding of local adaptation, or how genetic loci contribute to trait differences across locations, will increase our understanding of evolutionary adaptation. This study showed that most loci that had beneficial effects in some locations did not usually result in a fitness cost – or negatively impact yield – in other locations, and that benefits were typically greater than the costs. The results also suggest that it is possible to combine multiple beneficial alleles in single genotypes, thereby developing high-yielding regionally adapted varieties.

**Summary**

Theory suggests that local adaptation should involve strong fitness trade-offs, where adaptation to one environment will result in a fitness cost in another environment. Previous studies have been limited in various ways, such as in time or environmental range. This study uses a four-grandparent (two southern lowland and two northern upland ecotypes) QTL mapping population of switchgrass, planted across 10 sites ranging from Texas to South Dakota. Analysis indicated that beneficial biomass QTL usually resulted in either no or only slight costs in other locations. This means that multiple beneficial alleles could be combined via traditional plant breeding methods to create high-yielding varieties that are adapted to a wide range of environments.

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**Publications**

D.B. Lowry, *et al.*, “QTL x environment interactions underlie adaptive divergence in switchgrass across a large latitudinal gradient.” *Proceedings of the National Academy of Sciences of the United States of America* (2019). DOI: 10.1073/pnas.1821543116

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<https://www.pnas.org/content/early/2019/06/05/1821543116>