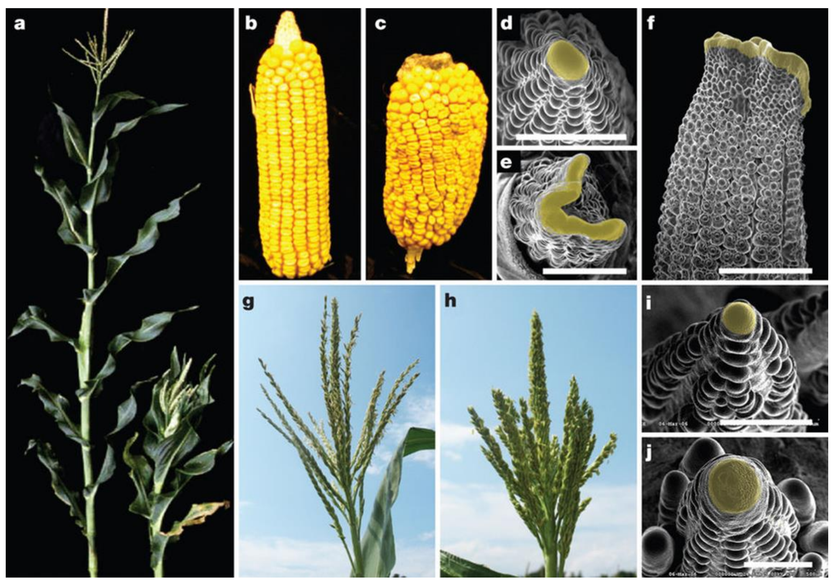
# The *lateral suppressor1* (*las1*) mutant inhibits axillary meristem initiation and shows a complex genetic interaction with the meristem maintenance mutant *compact plant2* (*ct2*) in maize

Stephanie Sage; Norman Best; Paula McSteen
*Division of Biological Sciences, University of Missouri, Columbia, MO 65211*

## Abstract

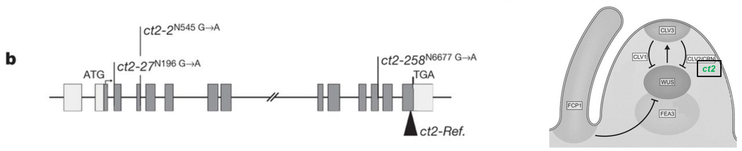
*Zea mays* (maize) develops in growing points called meristems that form and divide new cells. The lateral suppressor1 (*las1*) mutant is defective in axillary meristem initiation and encodes a GRAS transcription factor. This novel *las1* mutant produces barren stalks and fails to develop female inflorescences for reproduction. The *compact plant2* (*ct2*) mutant is a semi-dwarf with a fasciated ear phenotype and increased spikelet density in male inflorescences. The *ct2* gene regulates the maintenance of the shoot apical meristem (SAM) and acts in the clavata pathway. Producing *las1*; *ct2* double mutant will enable us to test how the *las1* gene, which is responsible for axillary meristem initiation, is affected by altering meristem maintenance. Data was collected for ear number, tassel length, branch number, and plant height for quantitative analysis and statistical comparison. The *ct2* mutant partially suppresses the barren stalk *las1* phenotype, suggesting that *las1* is also involved in maintenance of axillary meristems. However, the *las1* mutant suppresses the *ct2* mutant's increase in tassel branch number. This indicates that *las1* is involved in the initiation and/or maintenance of axillary meristems during reproductive development. These results indicate a developmentally specific complex genetic interaction between initiation and maintenance to control axillary meristem development. The *fasciated ear4* (*fea4*) gene is also involved in meristem maintenance and encodes a bZIP transcription factor. A double mutant analysis with *fea4* and las1 is being analyzed and will further confirm the *las1* involvement in the meristem maintenance pathway. In summary, these results provide evidence that *las1* functions in axillary meristem maintenance in as well as initiation in a developmentally specific manner.

## *ct2* functions in meristem maintenance




Bommert, et al., 2013

The *compact plant2* (ct2) *is a* semi-dwarf plant with a fasciated ear phenotype. This mutant displays increased spikelet density. The *ct2-Ref allele* has expressivity in B73 and regulates SAM size.

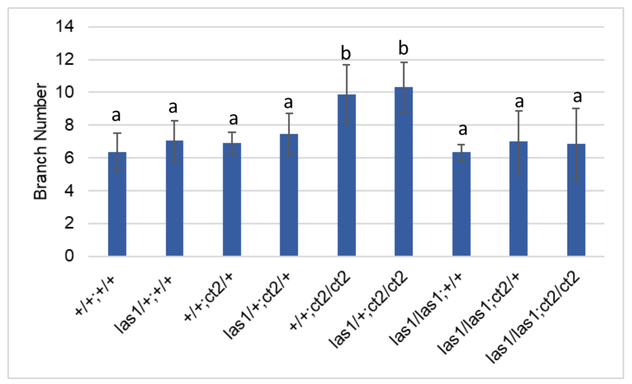






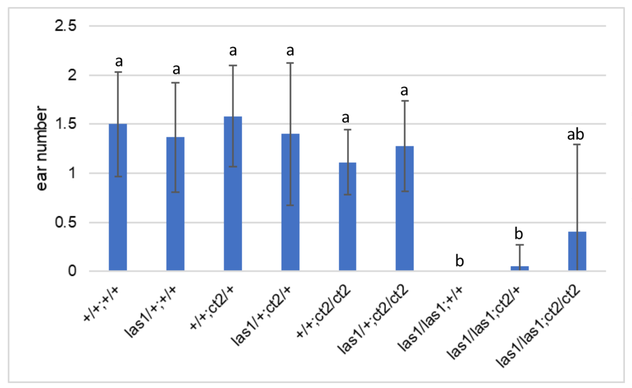
modified from Somssich, 2016

## *las1*;*ct2* double mutants indicate that *las1* functions in vegetative but not reproductive axillary meristem maintenance




*P* < 0.01

- *ct2* had a significant increase in tassel branch number
- *las1* epistatic to *ct2* for tassel branch number
- *las1* suppresses *ct2* induced tassel branch number

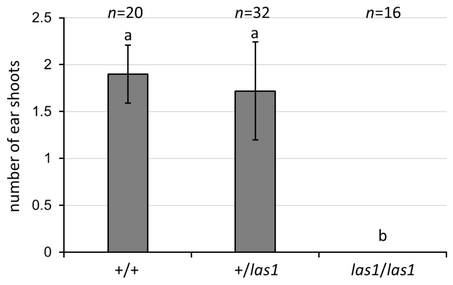



*P* < 0.01

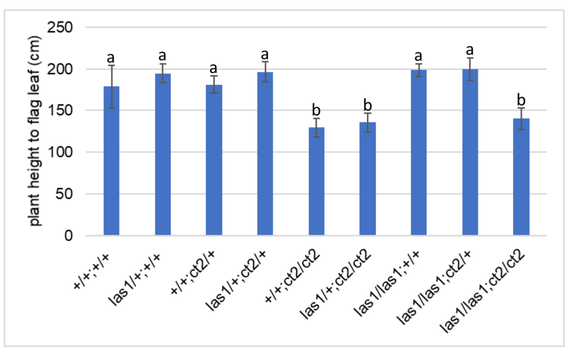
- 1 plant of *las1/las1;ct2 /+* had 1 ear
- 1 plant of *las1/las1;ct2 /ct1* had 2 ears

## *las1* functions in axillary meristem initiation

The *lateral suppressor*1 (*las1*) is a novel mutant which fails to produce ears compared to its WT sibling

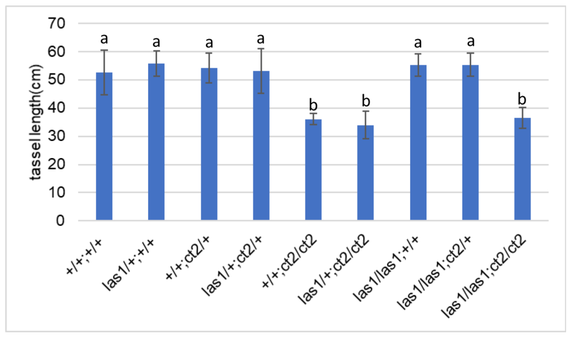



## *las1*;*ct2* double mutants resemble *ct2* in plant and tassel height




*P* < 0.01

- *ct2* is shorter than all other allelic combinations
- No het effect
- Any genotype with homozygous *ct2* looks like *ct2*



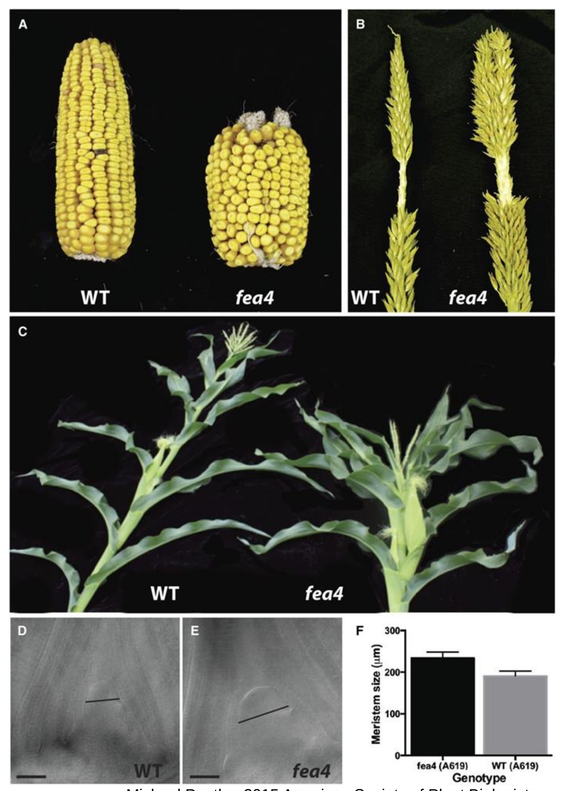

*P* < 0.01

- *las1* fails to suppress *ct2* phenotype
- *las1* is similar to the WT phenotype
- Data might imply there is no interaction

## Future directions

Repeat *las1*;*ct2* double mutant analysis this summer
- Analyze branch length

Continue with the *fasciated ear4* (*fea4)* double mutant analysis
- Genotype *fea4* with the RsaI genetic marker
- Compare with *las1* and *ct2*
- Graph the collected data
- Finish quantitative analysis to compare statistically




Michael Pautler, 2015 American Society of Plant Biologists

## Acknowledgements

I thank Dr. Paula McSteen, the principal investigator of this lab, where I preformed this project and Dr. Norman Best for mentoring me though the research. I thank the rest of the McSteen lab for support: Katy Guthrie, Micha Matthes, Janlo Robil, Clair Neighbors, Conner Norwald, Paige Spencer, Zoey Darnell and Leo Koeingsfeld.

This project is supported by NSF GRANT #IOS-1546873

## Conclusion

The *las1* mutant displays complex interactions in meristem initiation and maintenance with *ct2*. The *las1* mutant fails to produce ears which indicates it functions in initiation during normal development. The *ct2* mutant is responsible for maintenance displayed in ear fasciation and increased spikelet density compared to the normal WT. The *las1*;*ct2* plants resemble the *ct2* mutants in tassel length and plant height to flag leaf. Moreover, the *ct2* mutants suppress *las1* in axillary meristems indicating *las1* is also involved in the meristem maintenance pathway.

Bommert, Peter, et al. "The Maize Gα Gene COMPACT PLANT2 Functions in CLAVATA Signalling to Control Shoot Meristem Size." *Nature News*, Nature Publishing Group, 11 Sept. 2013, www.nature.com/articles/nature12583.
Greb, Thomas, et al. "Molecular Analysis of the LATERAL SUPPRESSOR Gene in Arabidopsis Reveals a Conserved Control Mechanism for Axillary Meristem Formation." *Genes & Development*, Cold Spring Harbor Lab, 1 Jan. 1970, genesdev.cshlp.org/content/17/9/1175.short.
Pautler, Michael, et al. "FASCIATED EAR4 Encodes a BZIP Transcription Factor That Regulates Shoot Meristem Size in Maize." *Plant Cell*, American Society of Plant Biologists, 1 Jan. 2015, www.plantcell.org/content/27/1/104?utm_source=TrendMD&utm_medium=cpc&utm_campaign=Plant_Cell_TrendMD_0.
Somssich, Marc, et al. "CLAVATA-WUSCHEL Signaling in the Shoot Meristem." *Development*, Oxford University Press for The Company of Biologists Limited, 15 Sept. 2016, dev.biologists.org/content/143/18/3238?utm_source=TrendMD&utm_medium=cpc&utm_campaign=Development_TrendMD_1.