

Overview of HRC TASC-funded Project: Developing gene editing technology for American hop cultivars

Hop Research Council Summer meeting
August 5-6, 2026
Bonners Ferry, ID

Oregon State University / USDA-ARS

Chris Willig, Veerendra Sharma, Michele Wiseman, Dave Gent, Steve Strauss

Presented by Chris Willig



Oregon State
University

Talk roadmap

- ▶ Chris Willig - TASC project overview / Agrobacterium strain engineering
- ▶ Veerendra (Veer) Sharma - Research update and future directions

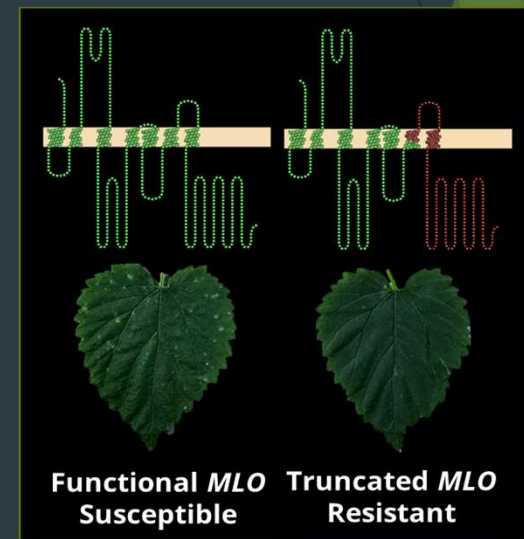
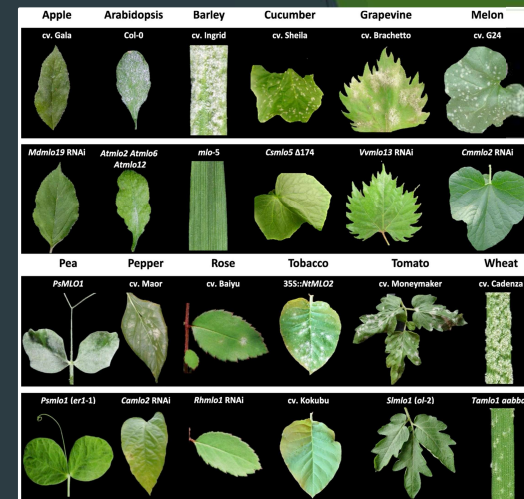
Rationale for the TASC project

- ▶ MRLs set by foreign markets for fungicides used to control hop powdery mildew (HPM) are a potential barrier for US hop exports
- ▶ Increasingly restrictive MRLs could limit variety of fungicide chemistries used to control HPM, making the disease more likely to develop tolerances to these
- ▶ Durable genetics-based resistance to powdery mildew could reduce dependence on fungicides to control
- ▶ Some markets with strict MRL standards are open to gene-edited products—others *moving in* that direction
 - ▶ This project aims to lay groundwork ahead of anticipated changes in global regulatory environment



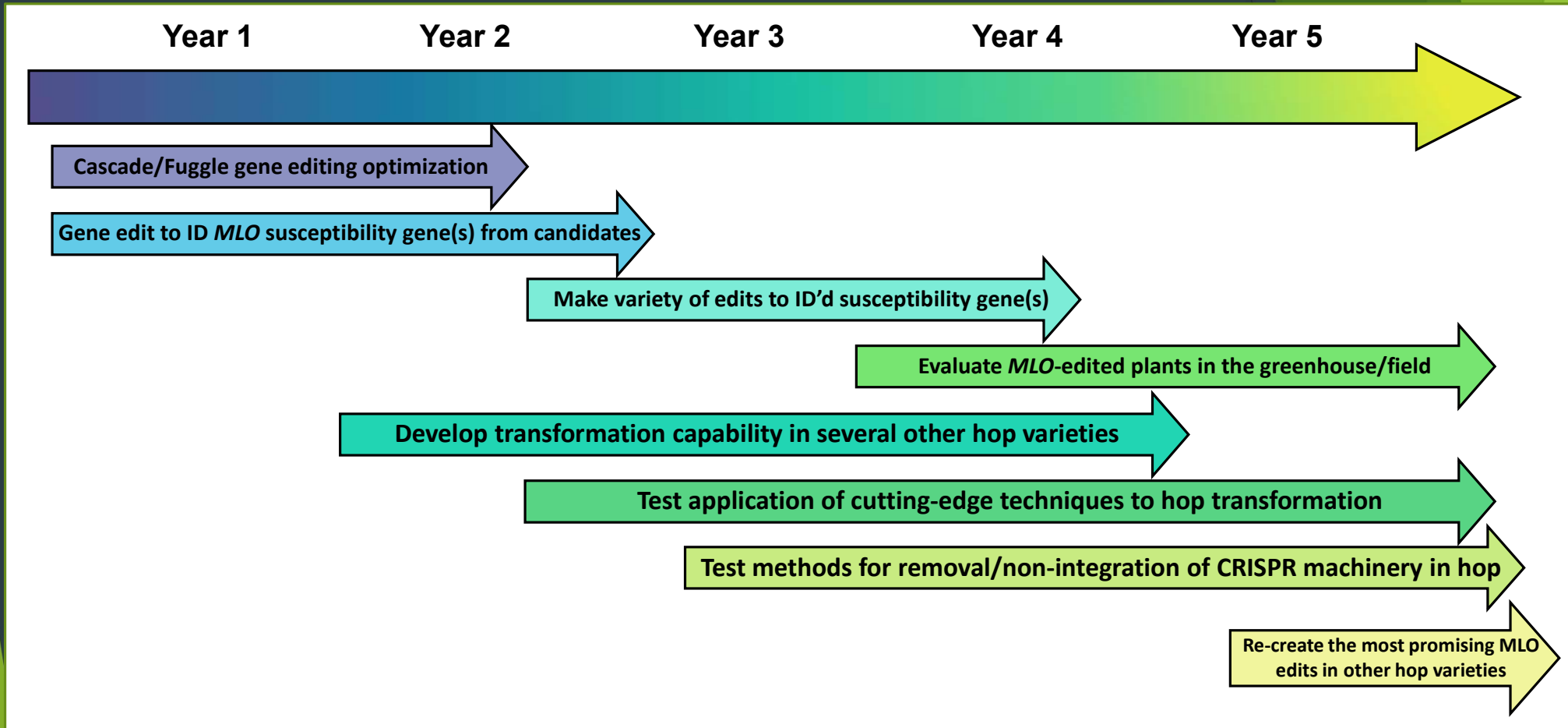
Rationale for the TASC project

- ▶ Variants of *MLO* genes can provide mildew resistance in several crop species
 - ▶ But some variants (not all) can cause yield trade-offs
- ▶ Individual *MLO* gene candidates we are targeting with gene editing were identified by Michele Wiseman
- ▶ Gene editing with CRISPR could allow us to:
 - ▶ Identify genes, and genetic markers associated with HPM susceptibility → supporting conventional hop breeding
 - ▶ Create plants with edited *MLO* variants that can be field-tested for yield viability



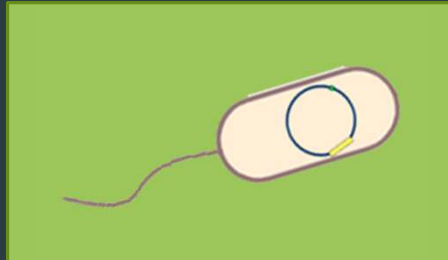
Michele Wiseman

Timeline for TASC project



Agrobacterium strain development

Agrobacterium as a natural genetic engineer

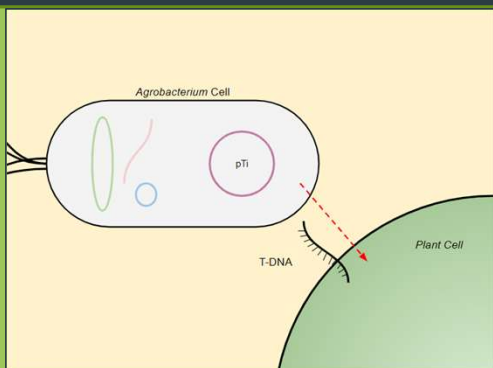


- ▶ In nature, *Agrobacterium* is a plant pathogen that causes “crown gall disease”



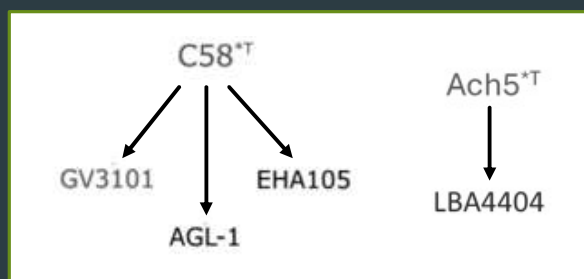
- ▶ *Agrobacterium* transfers a small piece of genetic material into plant cells

- ▶ Researchers have turned some *Agrobacterium* strains into a tool for crop biotechnology



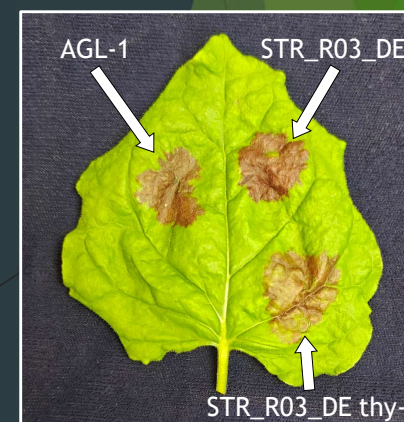
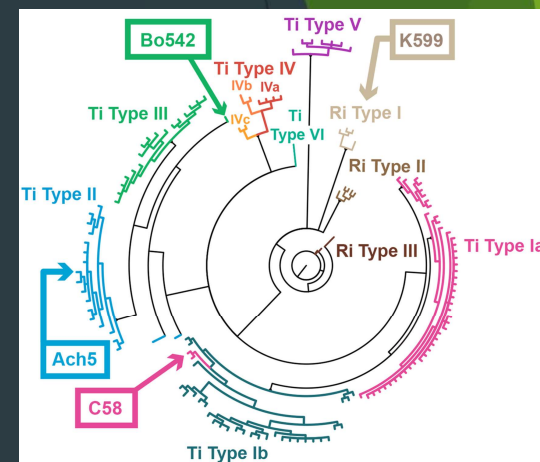
We have developed several new strains that could help to overcome roadblocks in hop and other crops

“Standard” strain toolbox

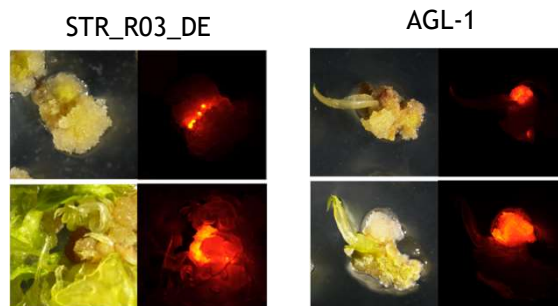
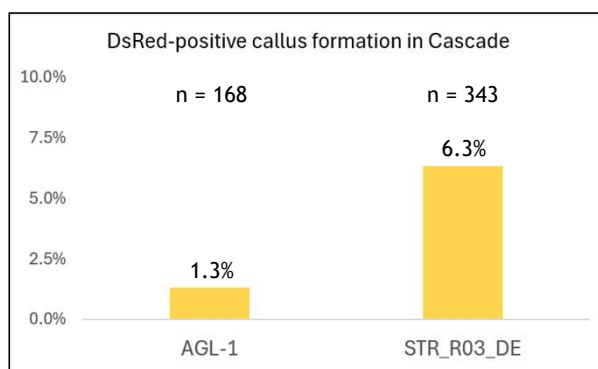
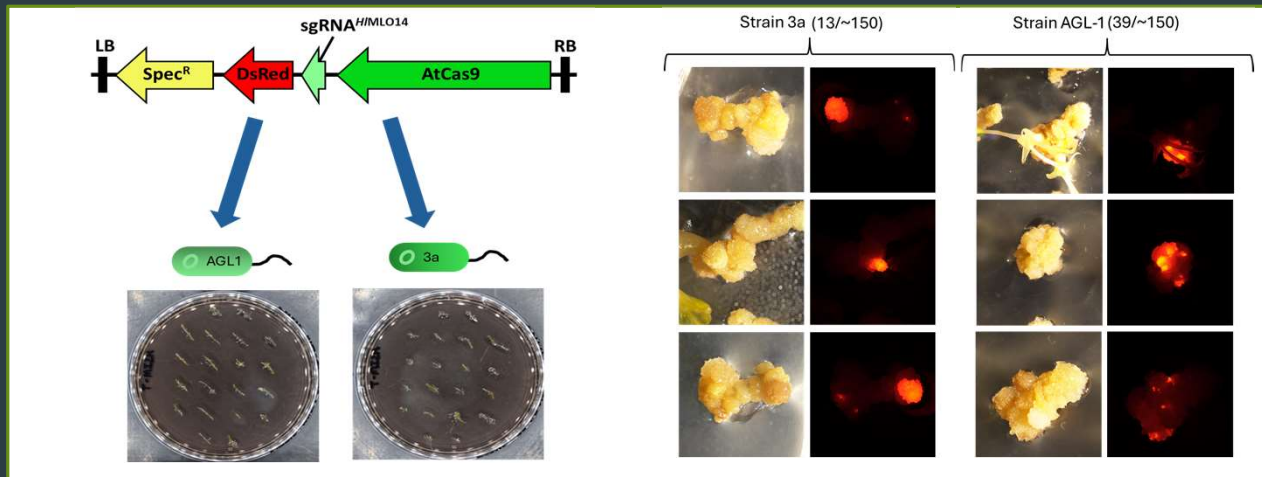


New strains developed by our lab

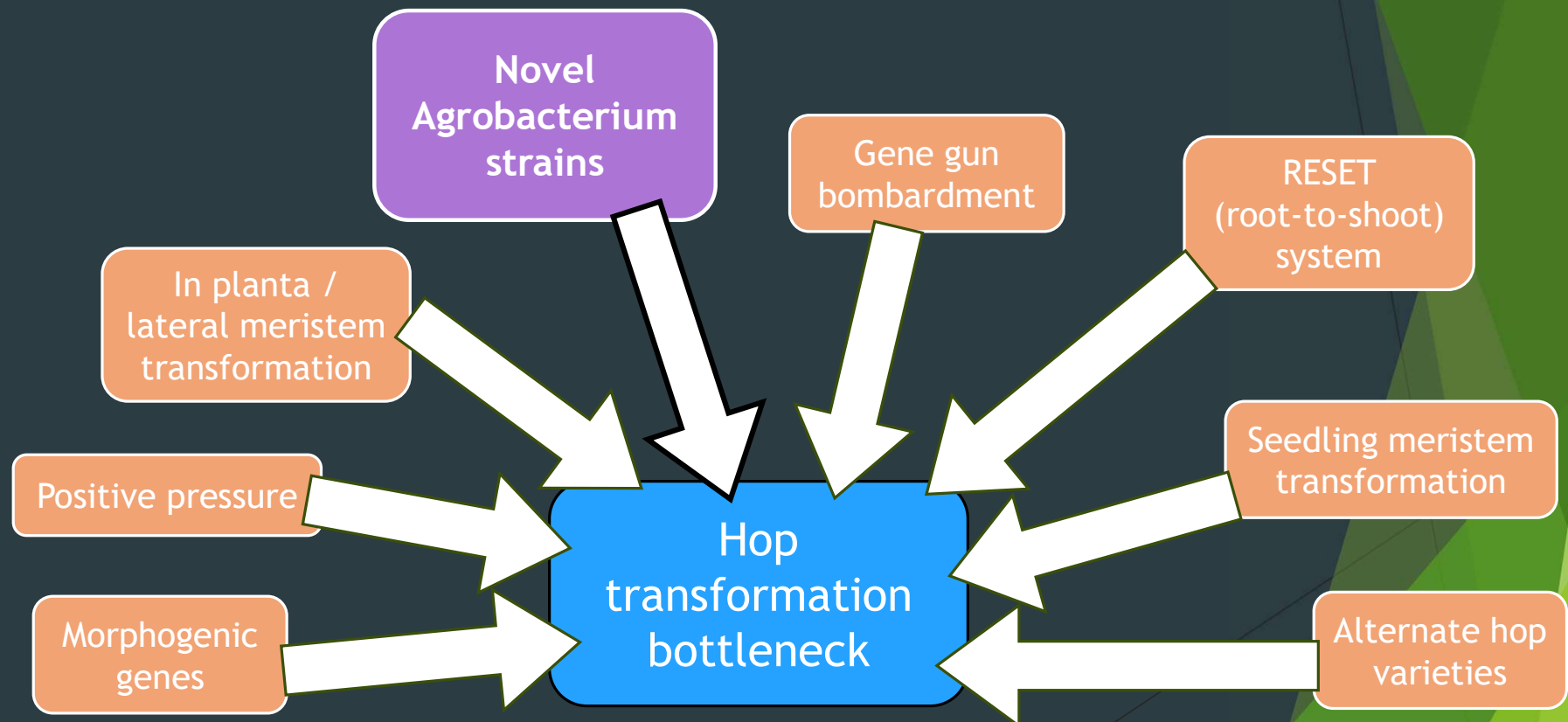
Strain designation	Host plant source	Virulence plasmid type	Chromosomal background / taxonomy
STR_H01_DE	Hop (<i>Humulus lupulus</i>)	Ti Ia	<i>Agrobacterium fabrum</i> (biovar 1)
STR_L01_DE	Pear (<i>Pyrus betulifolia</i>)	Ti Ia	<i>Rhizobium rhizogenes</i> (biovar 2)
STR_R01_DE	Rose (<i>Rosa</i> sp.)	Ti Ia	<i>Rhizobium rhizogenes</i> (biovar 2)
STR_P01_DE	Peach (<i>Prunus persica</i>)	Ti Ia	<i>Rhizobium rhizogenes</i> (biovar 2)
STR_P02_DE	Apricot (<i>Prunus siberica</i>)	Ti Ia	<i>Rhizobium rhizogenes</i> (biovar 2)
STR_P03_DE	Cherry (<i>Prunus avium</i>)	Ti Ia	<i>Agrobacterium radiobacter</i> (biovar 1)
STR_A01_DE	Quaking aspen (<i>Populus tremuloides</i>)	Ti Ib	<i>Agrobacterium tumefaciens</i> (biovar 1)
STR_A02_DE	Cottonwood (<i>Populus</i> sp.)	Ti Ib	<i>Agrobacterium tumefaciens</i> (biovar 1)
STR_G02_DE	Grape (<i>Vitis vinifera</i>)	Ti Ib	<i>Rhizobium rhizogenes</i> (biovar 2)
STR_R02_DE	Rose (<i>Rosa</i> sp.)	Ti Ib	<i>Agrobacterium tumefaciens</i> (biovar 1)
STR_S02_DE	Red raspberry (<i>Rubus idaeus</i> x <i>strigosus</i>)	Ti Ib	<i>Agrobacterium fabrum</i> (biovar 1)
STR_Y01_DE	Yarrow (<i>Achillea</i> sp.)	Ti II	<i>Agrobacterium tumefaciens</i> (biovar 1)
STR_B01_DE	Lilac (<i>Syringa vulgaris</i>)	Ti II	<i>Agrobacterium tumefaciens</i> (biovar 1)
STR_C01_DE	Chrysanthemum (<i>Chrysanthemum</i> sp.)	Ti III	<i>Agrobacterium tumefaciens</i> (biovar 1)
STR_G01_DE	Grape (<i>Vitis vinifera</i>)	Ti IVa	<i>Allorhizobium vitis</i> (biovar 3)
STR_R03_DE	Rose (<i>Rosa</i> sp.)	Ti Ia	<i>Rhizobium rhizogenes</i> (biovar 2)



Some new strains show promise compared to standard transformation tools



This is only one of several approaches we are taking to address hop gene editing efficiency



Hop biotech research group at OSU / USDA-ARS

- Have been working on development of hop biotechnology at OSU since 2021

Strauss Lab



Greg Goralogia
Senior Research Associate



Steve Strauss - PI



Veerendra Sharma
Research Scientist



Cathleen Ma
Senior Research
Technician



Chris Willig
Postdoctoral
Researcher



Eden Todd
Research Technician



Kelly Nerenberg
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Researcher

Gent Lab



Dave Gent - PI



Michele Wiseman
PhD (completed!)



Carly Hartgrave
Undergraduate
Researcher

USDA hop breeding



Kayla Altendorf



John Henning