

# Management Strategies for Head Smut caused by *Tilletia maclaganii* on Switchgrass (*Panicum virgatum* L.)

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Clyde Yan





# Objectives

1. Conduct a field survey to investigate the extent of head smut in Ontario switchgrass fields
2. Examine various cultivars in the greenhouse for resistance to head smut
3. Investigate the effectiveness of various seed treatments at preventing head smut establishment on seeds
4. Examine various cultivars and mixed species in the field to assess cultivar resistance and to determine the impact of growing switchgrass with smut-tolerant species (big bluestem) on biomass and the spread and development of head smut

# Objective 1: Field Survey

▶ 15 switchgrass field surveyed

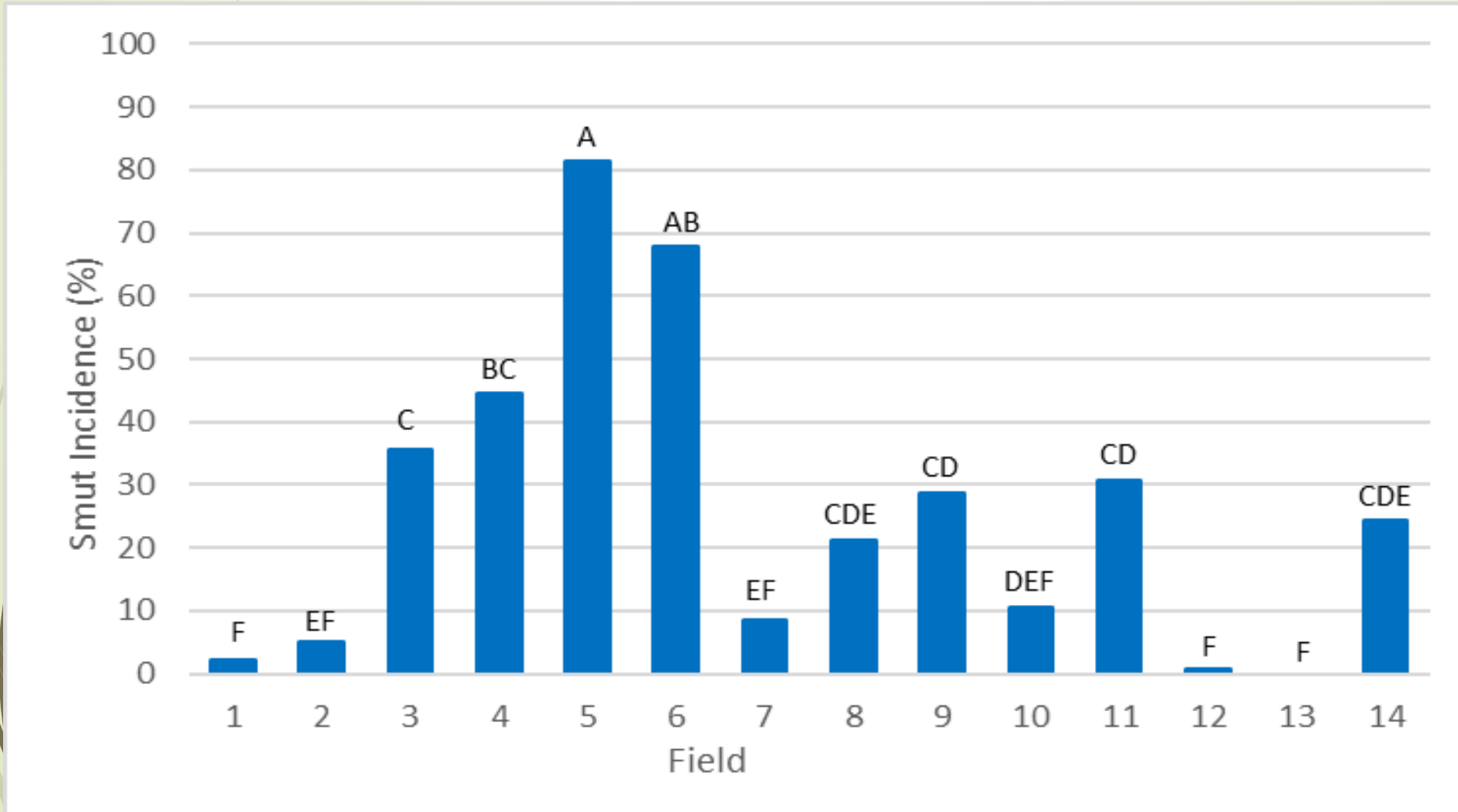
Field No.	Year Surveyed	County	Acres	Year Planted	Age
1	2019, 2021	Halton	17	2015	5
2	2019, 2020, 2021	Halton	26	2015	5
3	2019, 2021	Halton	9	2013	7
4	2019, 2021	Halton	17	2012	8
5	2019, 2020, 2021	Halton	15	2010	10
6	2019, 2020	Halton	35	2009	11
7	2019, 2020, 2021	Halton	35	2014	6
8	2019, 2020, 2021	Halton	15	2013	7
9	2019, 2020, 2021	Grey	7	2010	10
10	2019, 2020, 2021	Grey		2012	8
11	2019, 2020, 2021	Grey	5	2009	11
12	2019, 2020	Clinton	44	2016	4
13	2019, 2020	Clinton	8	2017	3
14	2019, 2020	Perth	10	2011	9
15	2020, 2021			2017	3



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# Objective 1: Field Survey

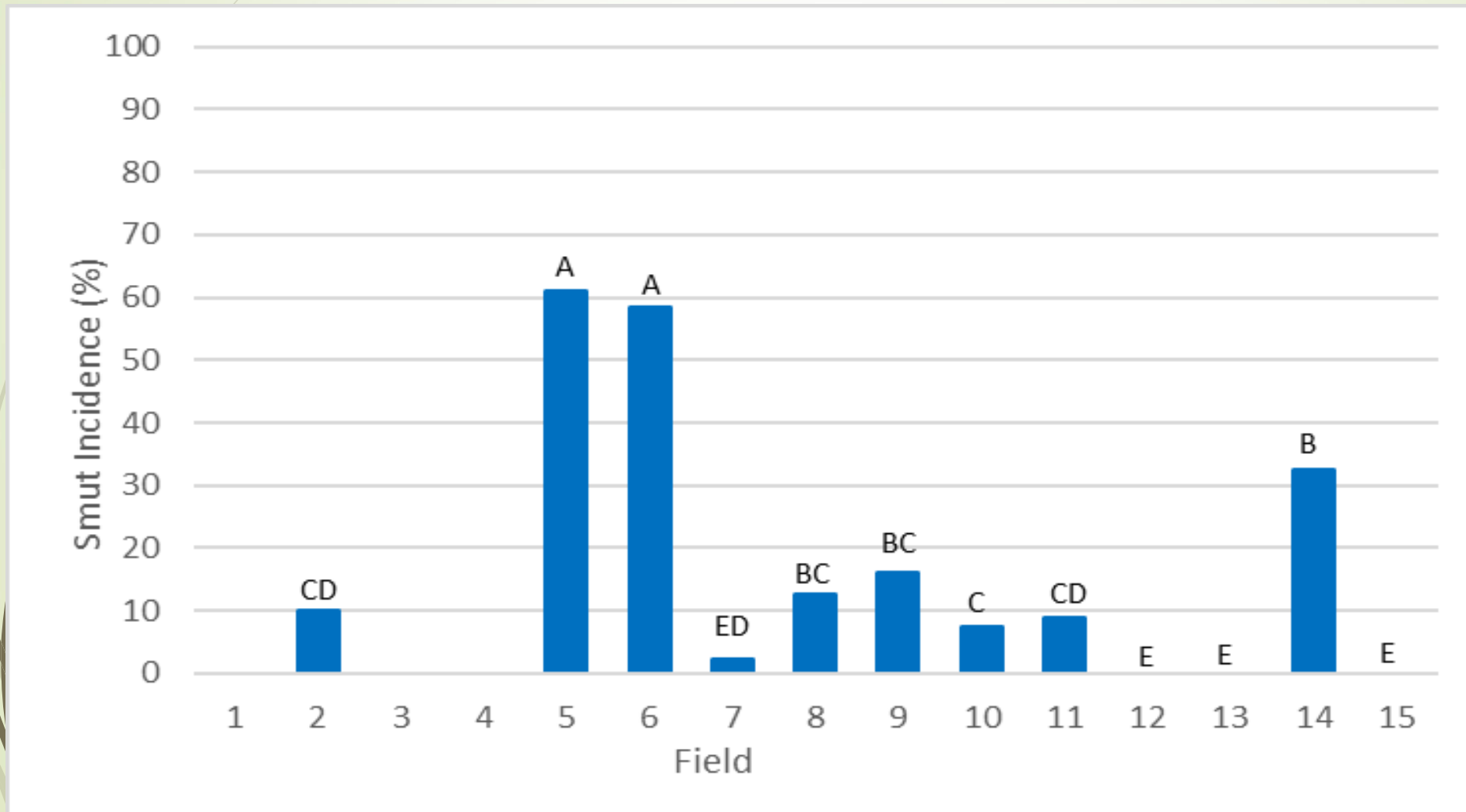
## 2019 Head Smut Incidence



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# Objective 1: Field Survey

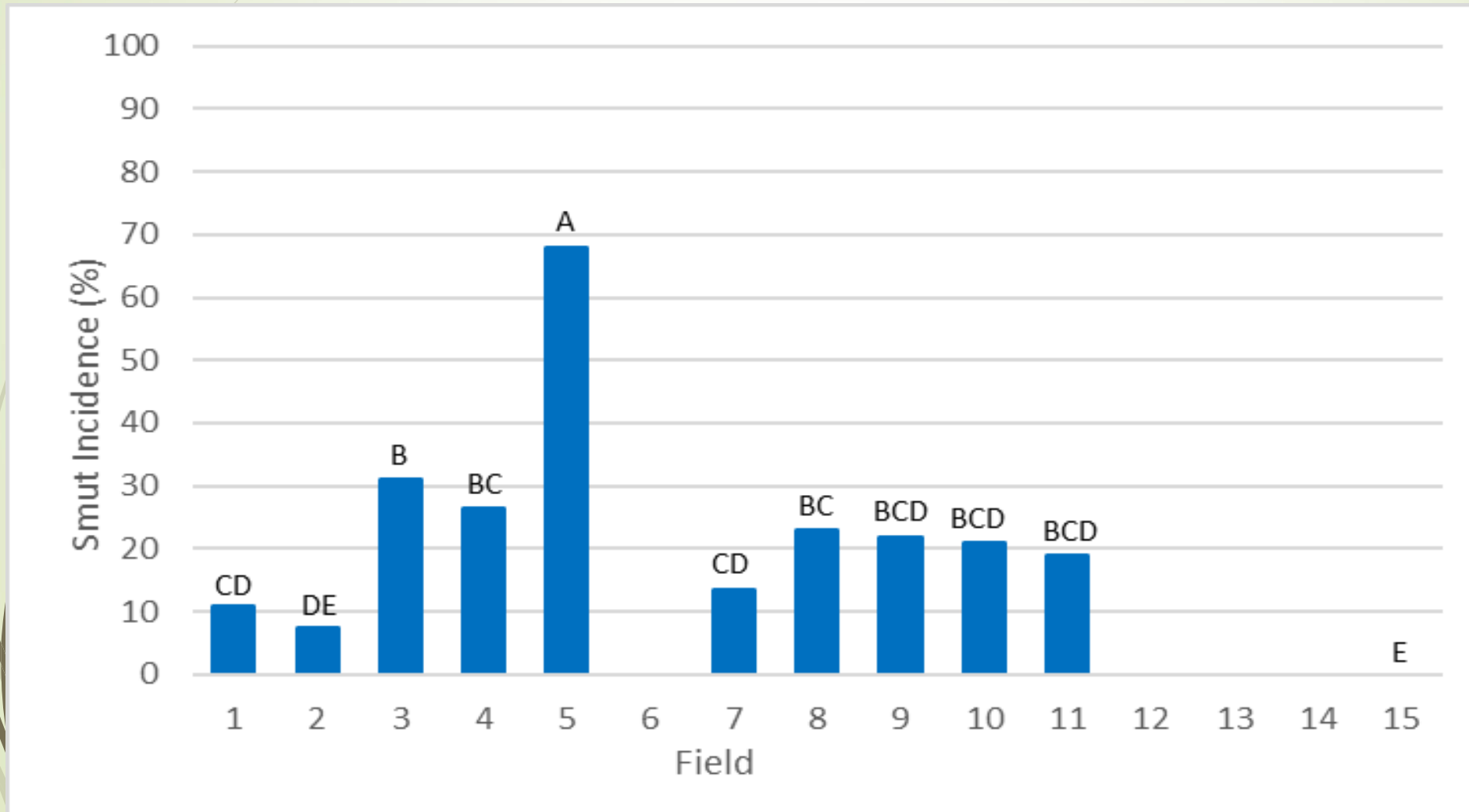
## 2020 Head Smut Incidence



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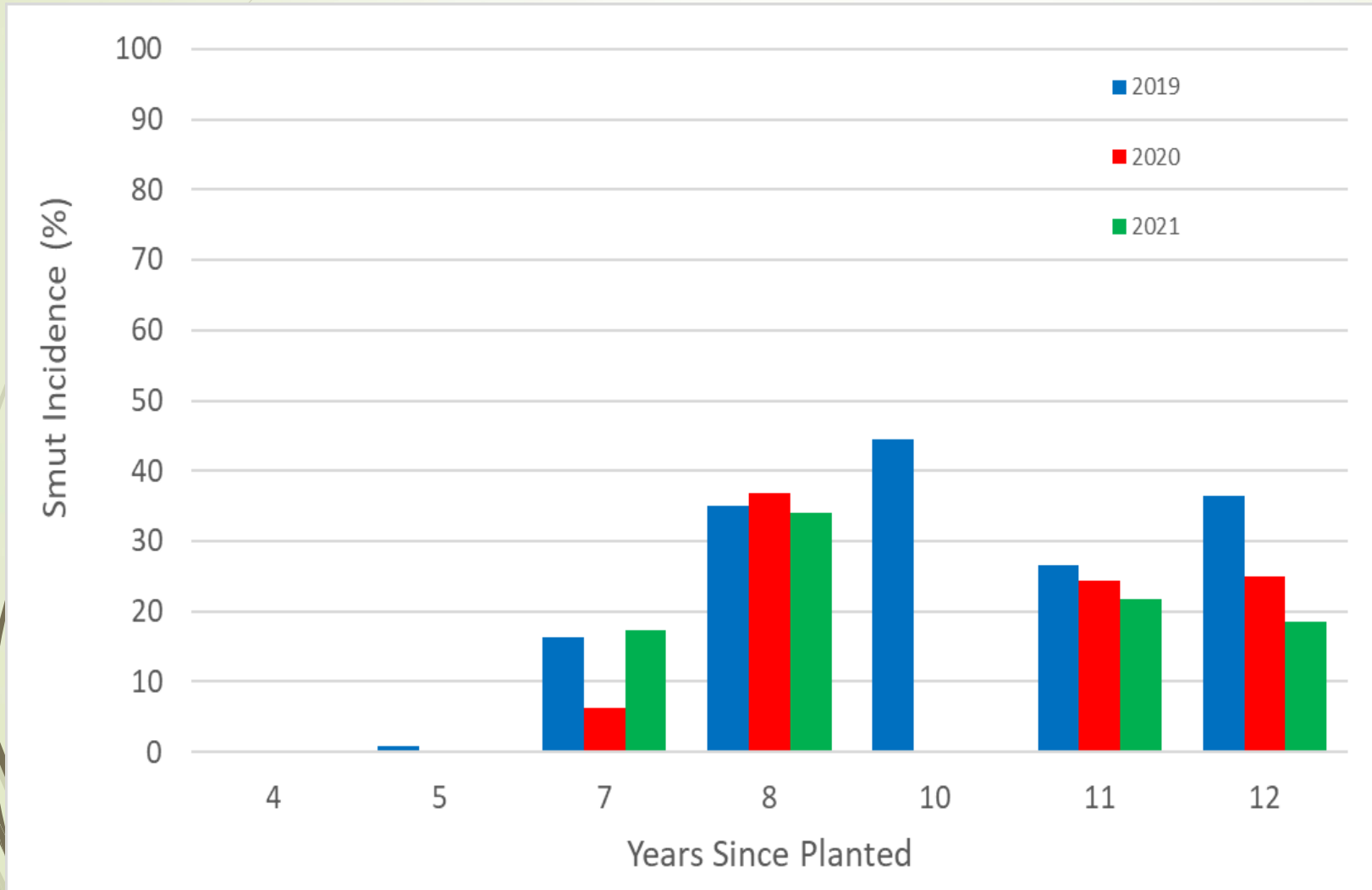
# Objective 1: Field Survey

## 2021 Head Smut Incidence



# Objective 1: Field Survey

## 2019 Head Smut Incidence (by age)



Year	Age	Field
2017	2	13, 15
2016	3	12
2014	5	2, 3, 7
2013	6	1, 5, 8
2011	8	4
2010	9	9, 14
2009	10	6, 10, 11

P-value = 0.0002



# Objective 1 Summary

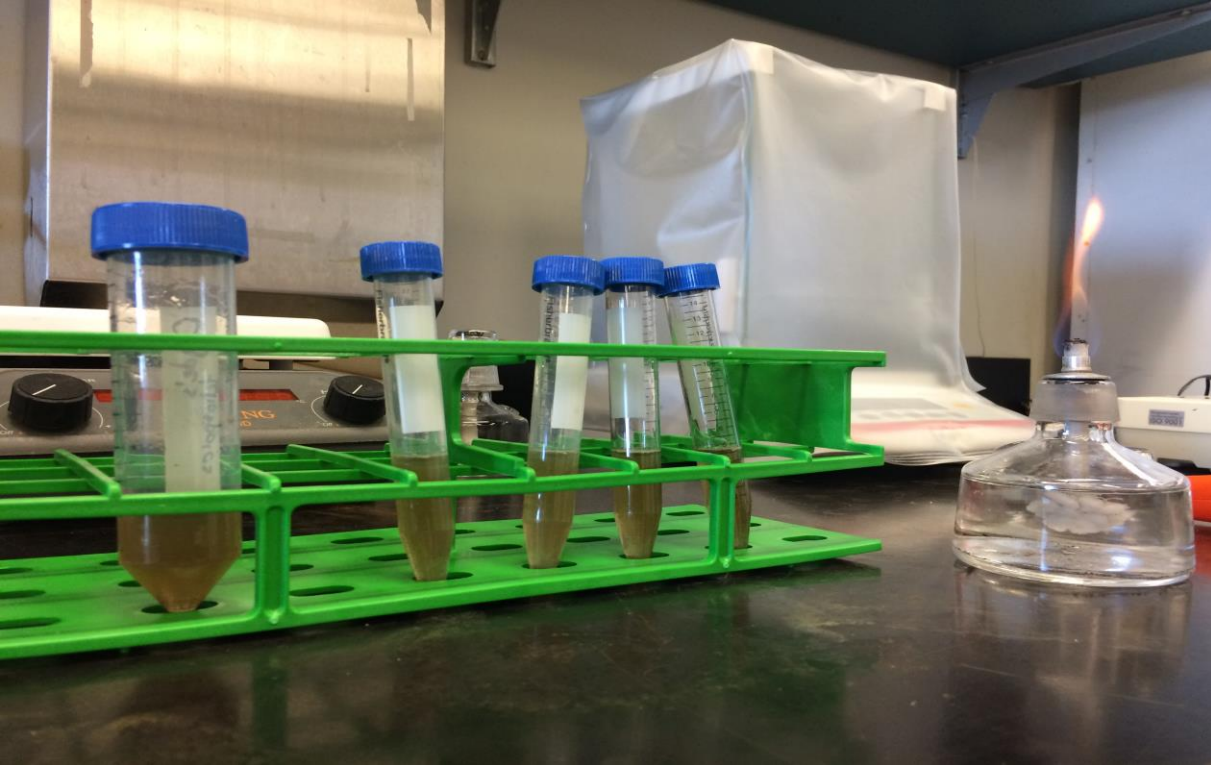
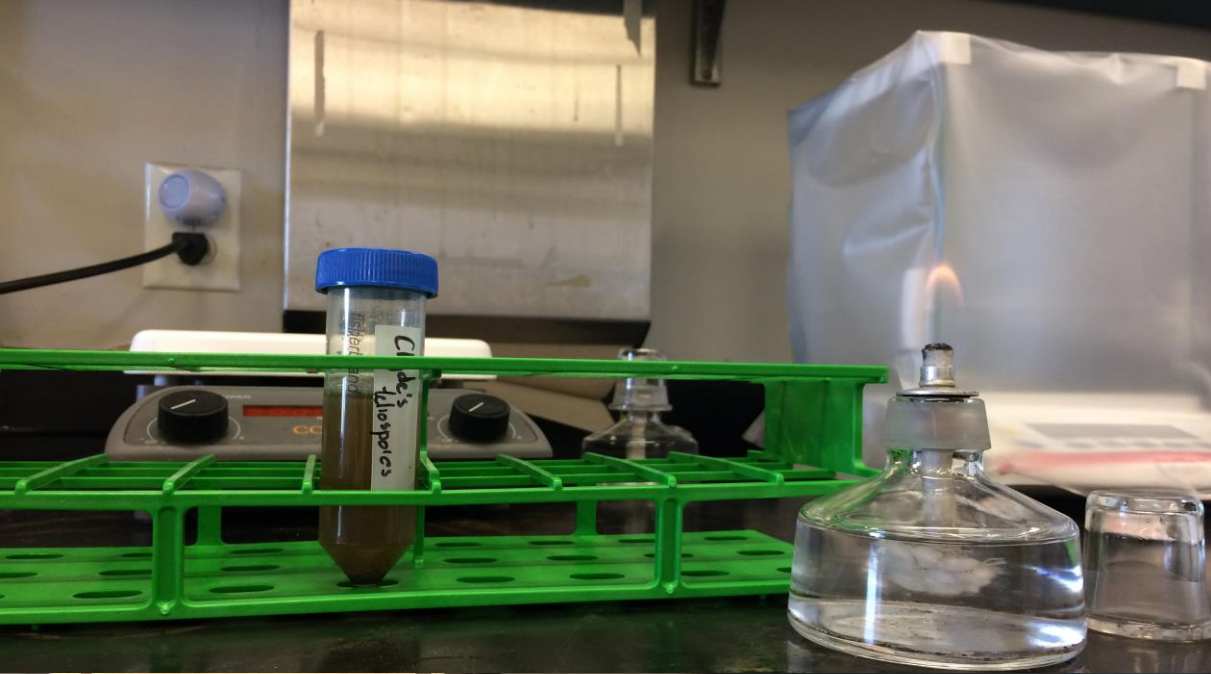
- More than half of the fields surveyed in 2019 and 2021 have greater than 20% smut incidence
  - Less than half in 2020
- Smut incidence greater than 50% observed in 2 fields in 2019 and 2020, 1 field in 2021
- Age of field correlated to smut incidence
  - Takes 4-5 years to start seeing head smut
  - Smut incidence increases until ~8 years before declining

## Objective 2: Cultivar Trial

- Treatments:
  - Nine cultivars of switchgrass + Prairieview big bluestem
  - Inoculate using teliospore suspension
- Suspension made using hemocytometer
- Suspension poured onto injured crowns
- Assess for smut incidence



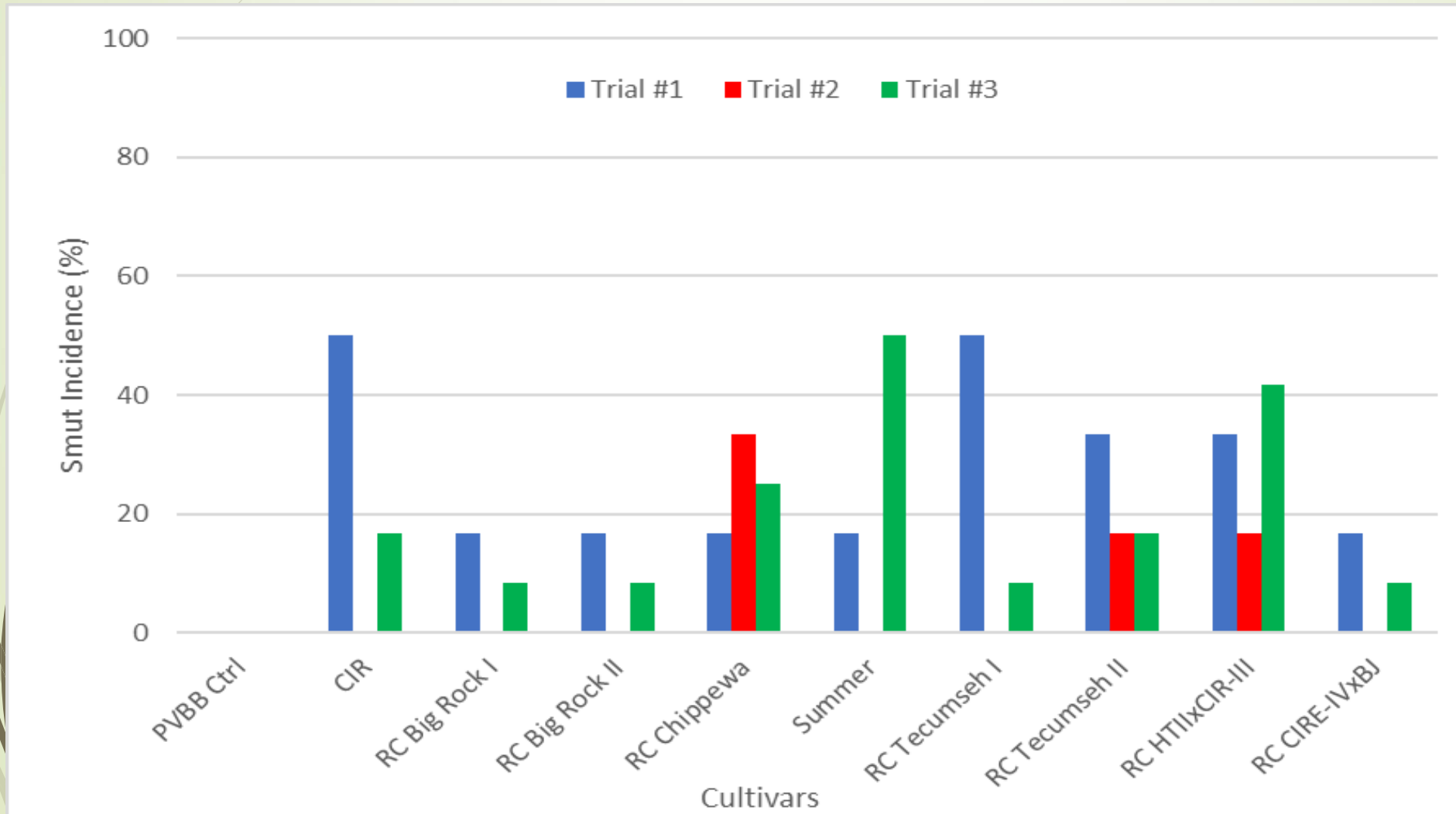






# Objective 2: Cultivar Trial

## Head Smut Incidence





## Objective 2 Summary

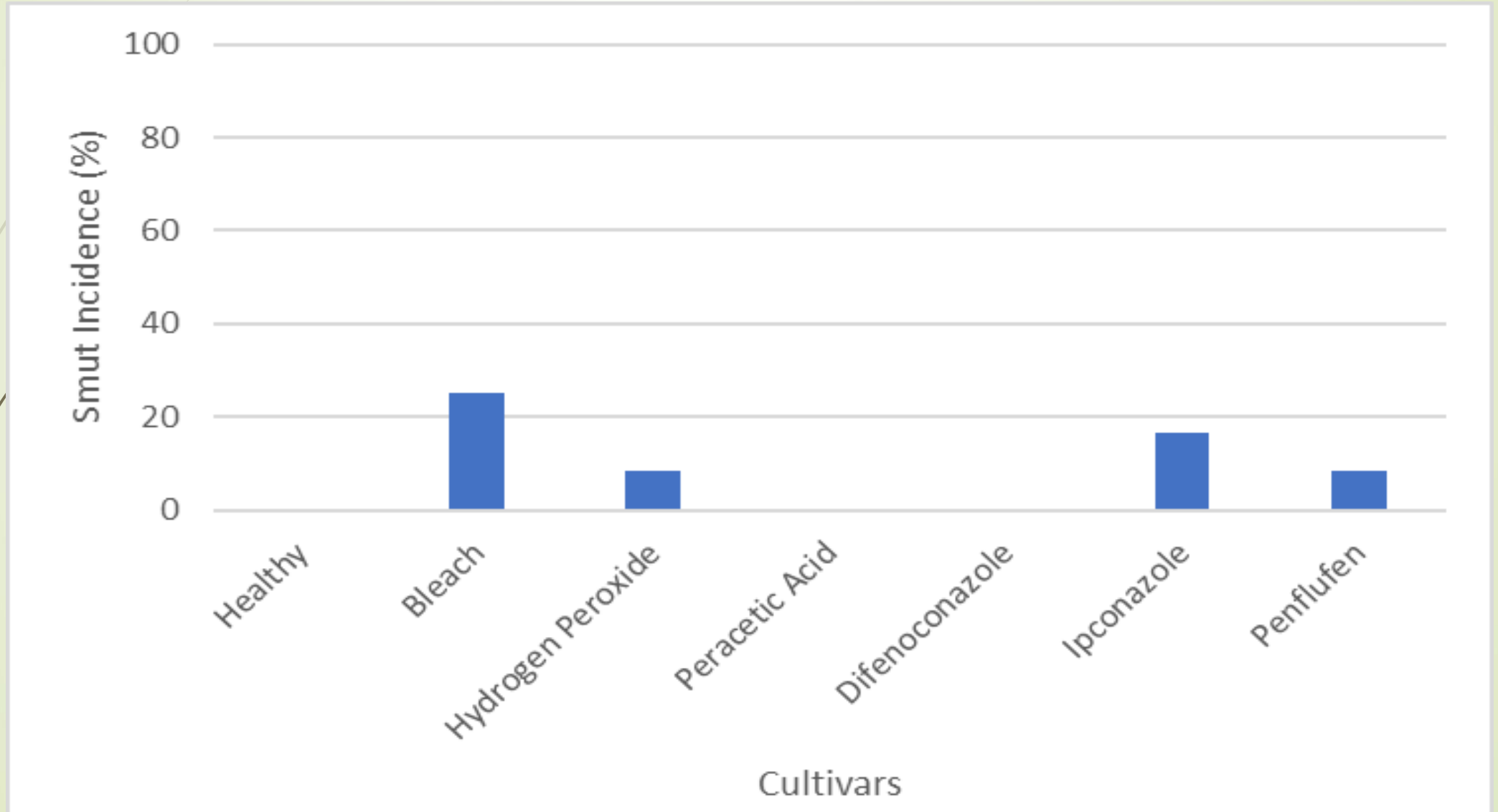
- ▶ All switchgrass cultivars are susceptible to head smut
  - ▶ Some more than others
  - ▶ More susceptible (>20% SI): Cave-in-Rock, RC Chippewa, Summer, RC Tecumseh I, RC Tecumseh II and RC (High TidexCIR-III)
  - ▶ <20% SI: RC Big Rock I, RC Big Rock II and RC (CIRE-IVxBlue Jacket)
- ▶ Look at disease severity next

# Objective 3: Seed Treatment

- Cultivar: Cave-in-Rock
- Treatments:
  - One negative control (water)
  - Three surface sterilants
    - ❖ Bleach, peracetic acid, hydrogen peroxide
  - Three fungicides
    - ❖ Difenoconazole, ipconazole, penflufen
- Inoculum suspension poured onto soil and onto crown of switchgrass
- Assess for smut incidence



# Objective 3: Seed Treatment



# Objective 3 Summary

- ▶ Head smut found in bleach, hydrogen peroxide, ipconazole and penflufen treatments
- ▶ No head smut in water, peracetic acid and difenoconazole treatments
- ▶ May see more head smut with more reps



# Objective 4: Mixed Species Trial

1. Prairie View Big Bluestem (control)
2. Prairie View Big Bluestem Late C5
3. Prairie View Big Bluestem Early C4
4. Cave-in-Rock
5. RC Big Rock I
6. RC Big Rock II
7. RC Chippewa
8. Summer
9. RC Tecumseh I
10. RC Tecumseh II
11. RC (High Tide II x Cave-in-Rock III)
12. RC (Cave-in-Rock IV x Blue Jacket)
13. Prairie View Big Bluestem + RC Big Rock II
14. Prairie View Big Bluestem + RC Tecumseh II



# ELORA Field



# SIMCOE Field

















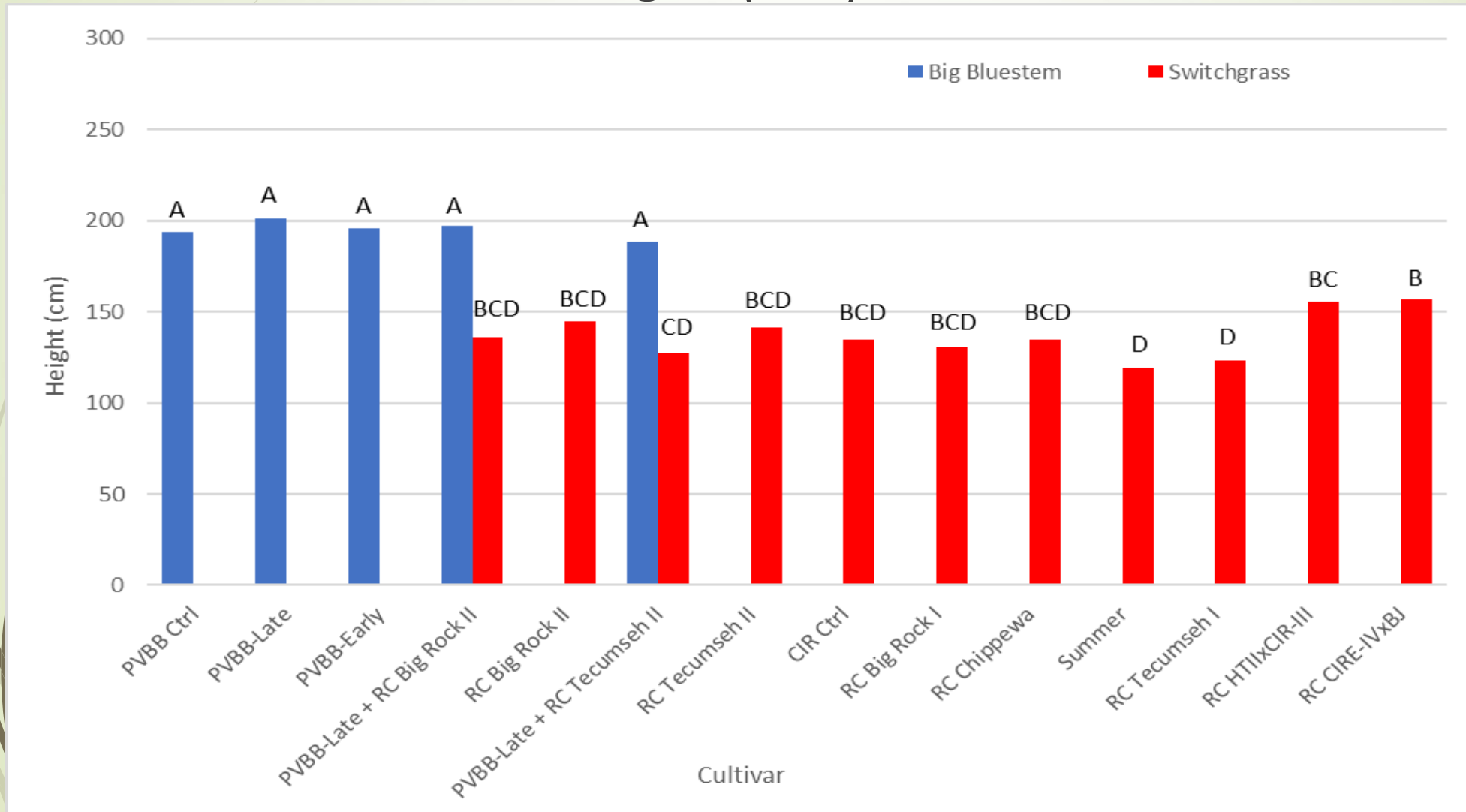




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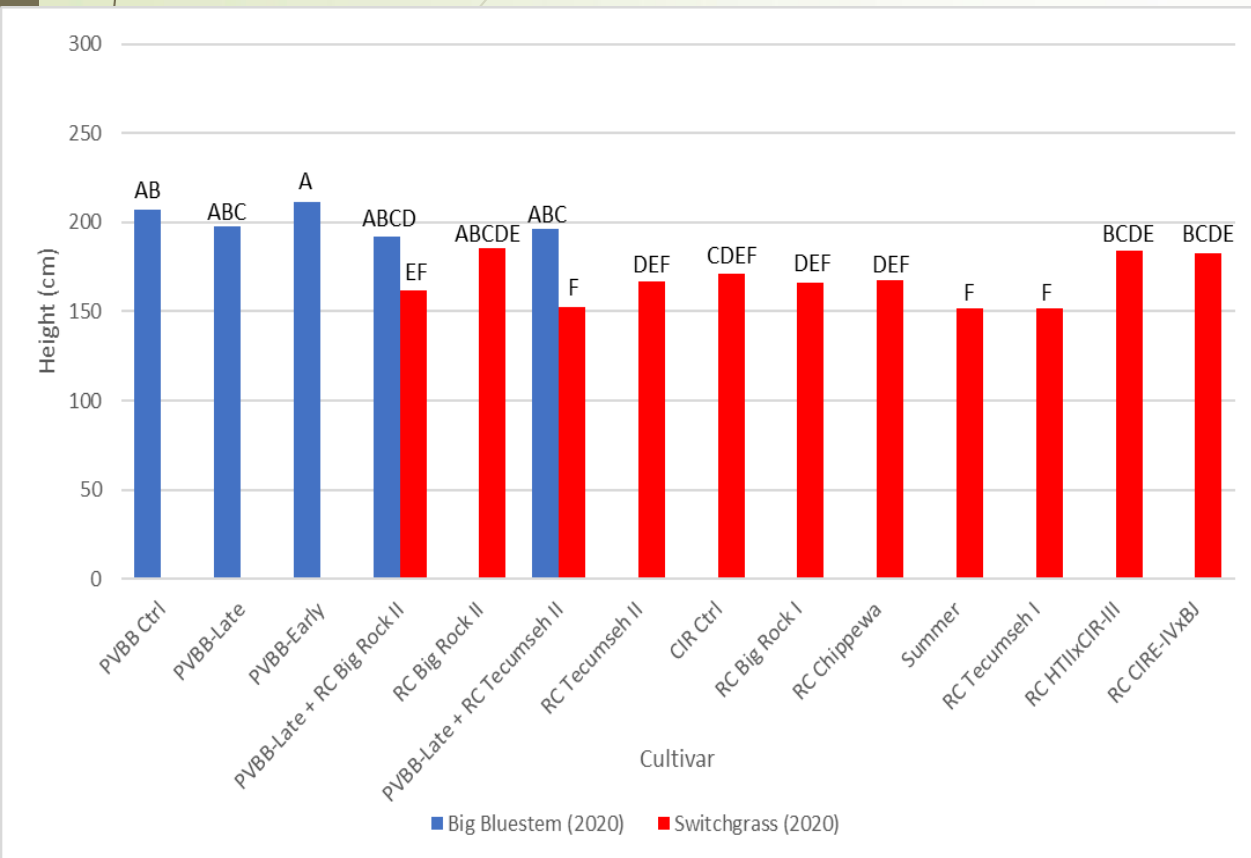
# Objective 4: Mixed Species Trial

Simcoe 2019 Data: Height (cm)

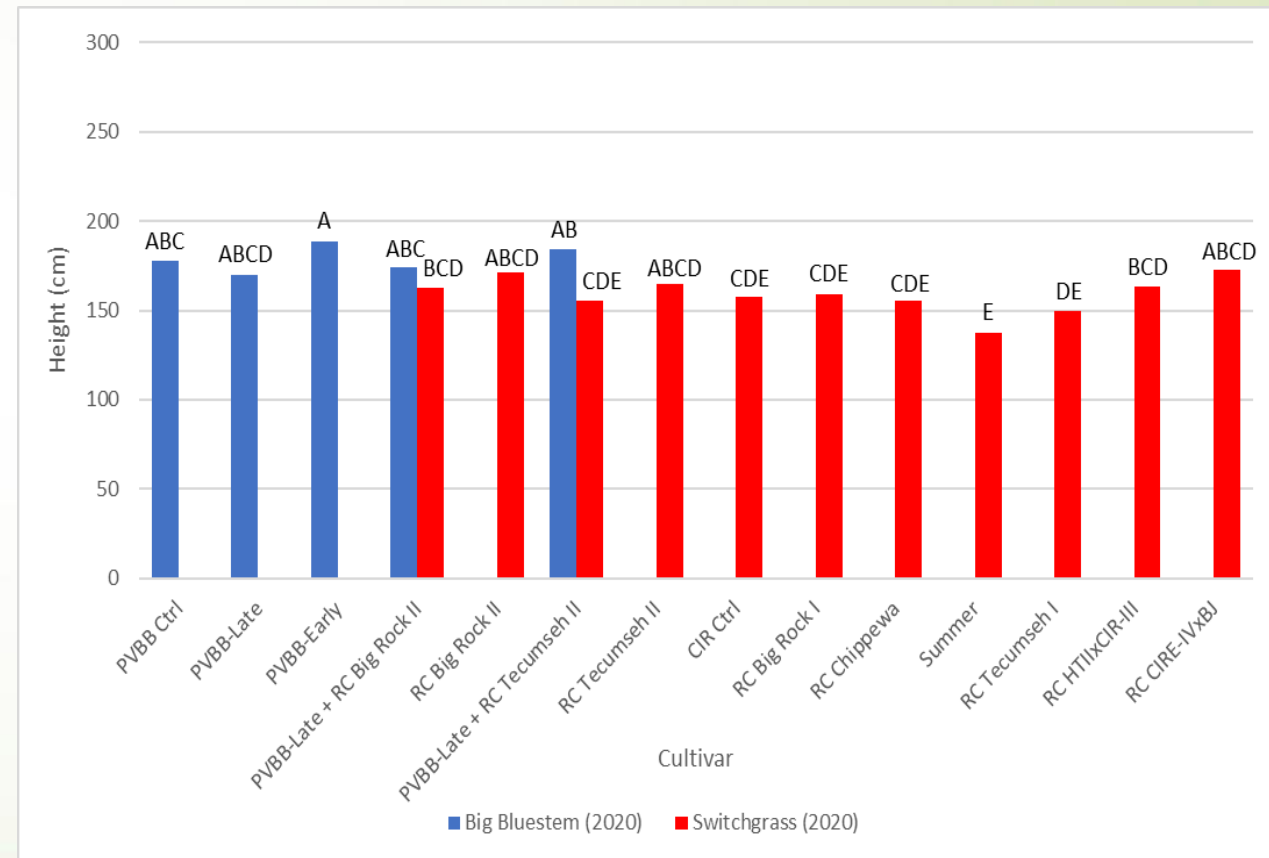


# Objective 4: Mixed Species Trial

## Simcoe and Elora 2020 Height (cm)



Simcoe



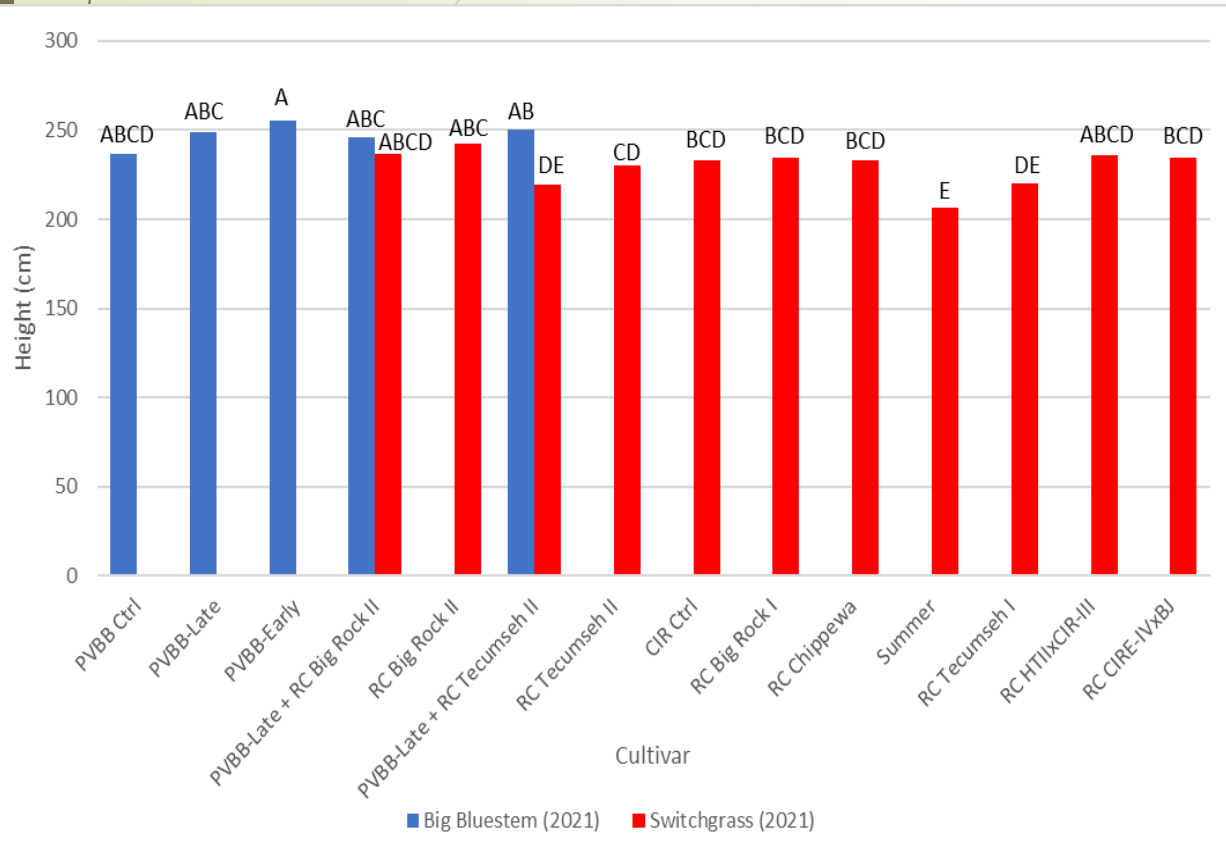
Elora



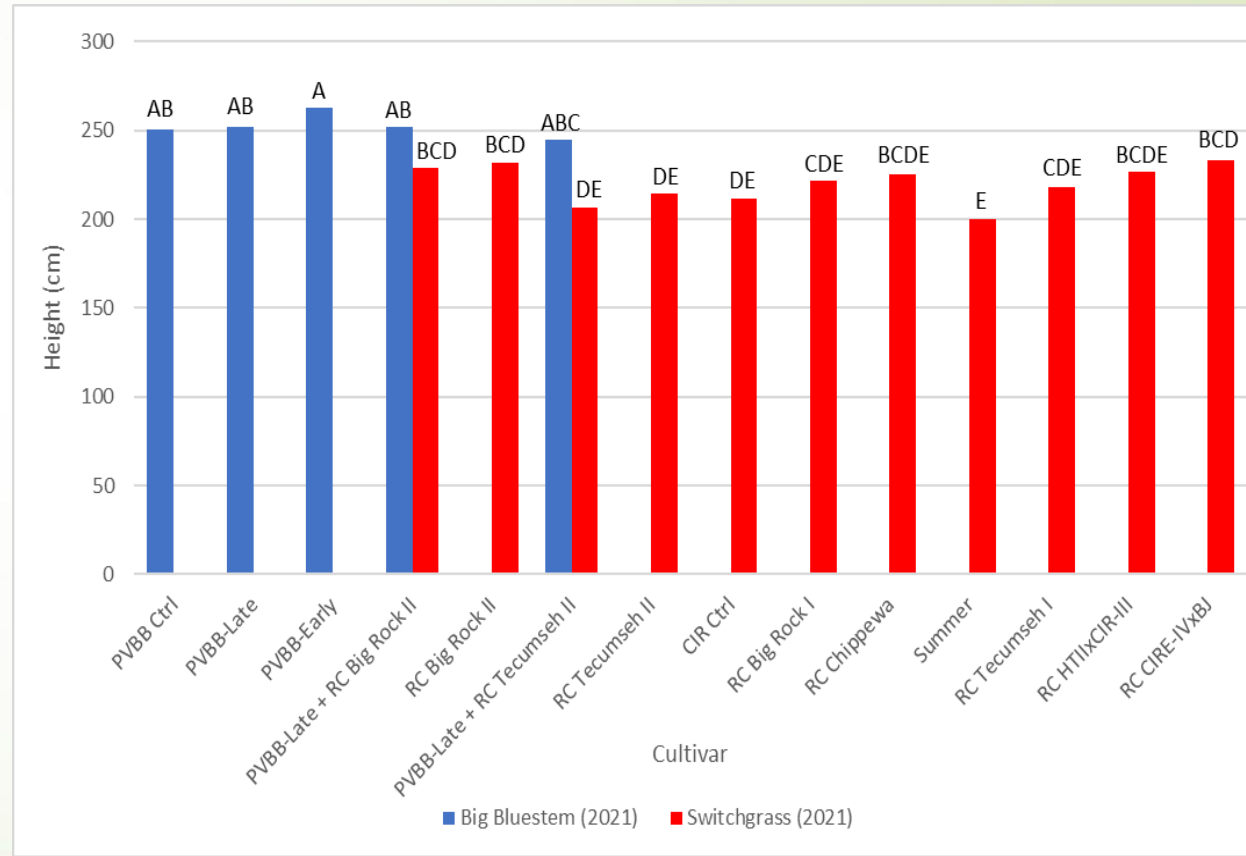
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# Objective 4: Mixed Species Trial

➤ Simcoe and Elora 2021 Height (cm)



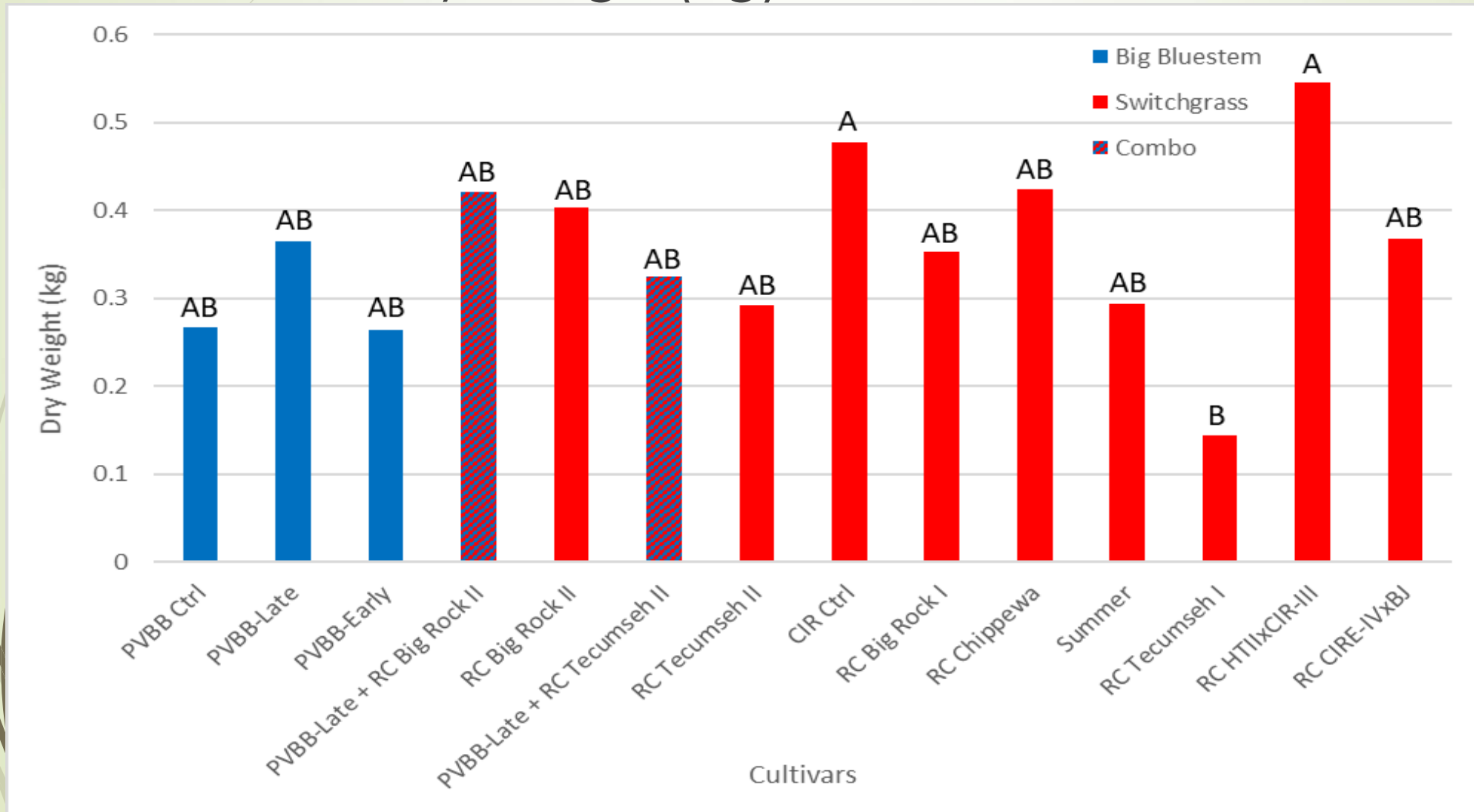
Simcoe



Elora

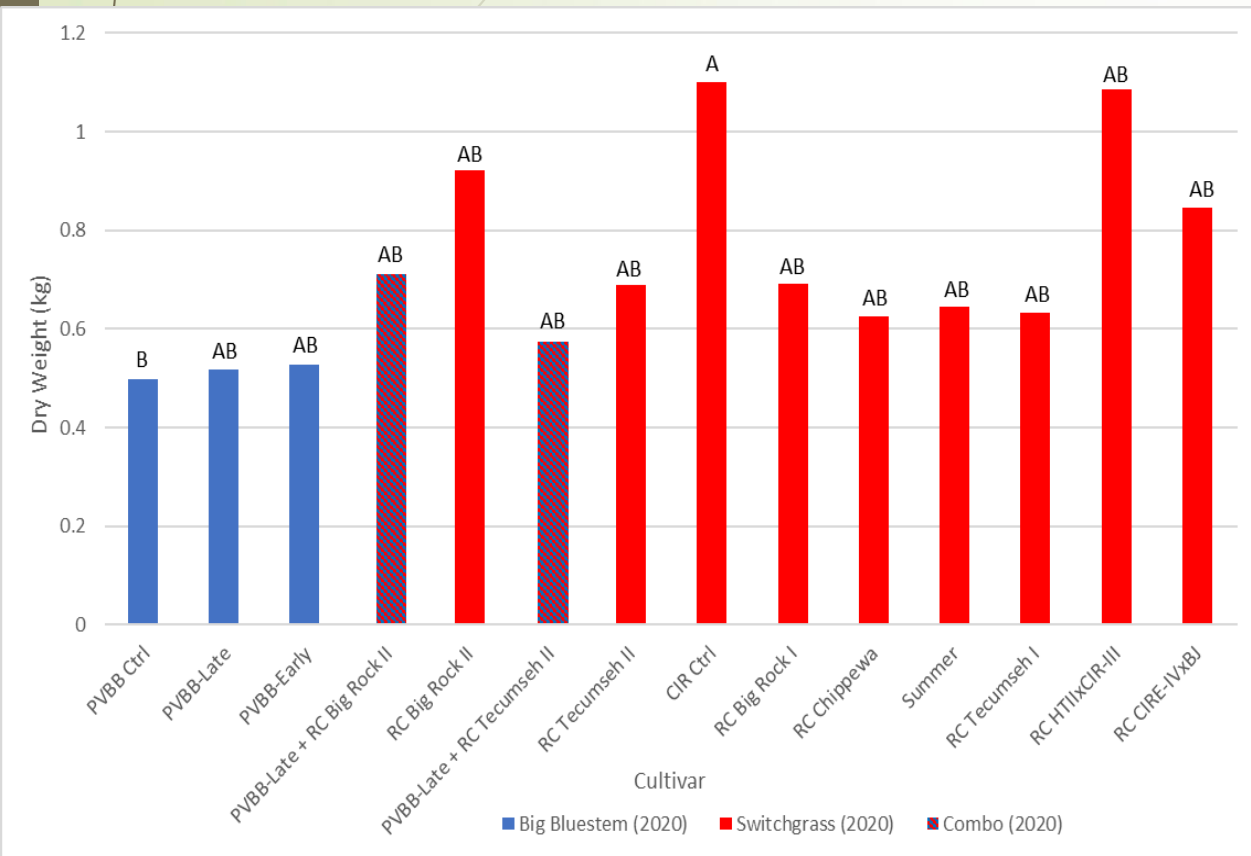
# Objective 4: Mixed Species Trial

➤ Simcoe 2019 Dry Weight(kg)

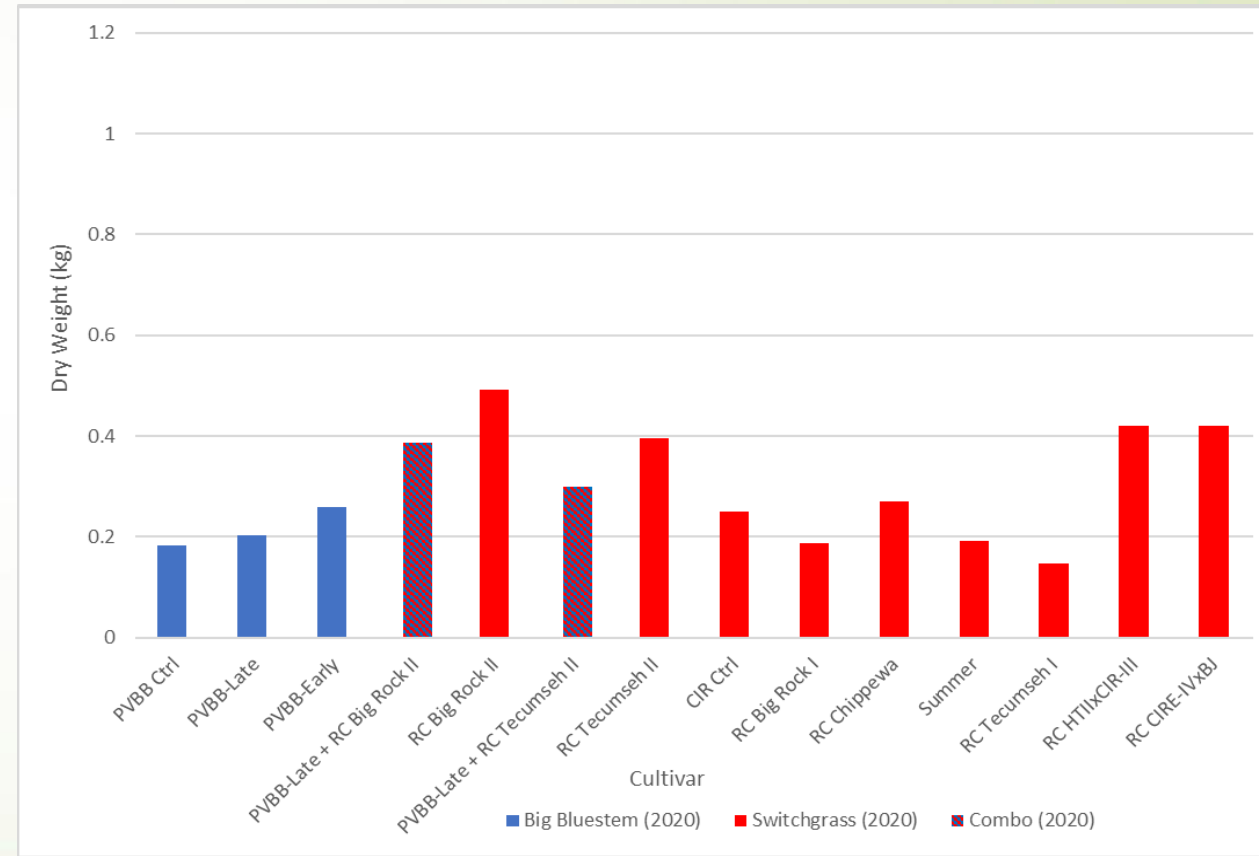


# Objective 4: Mixed Species Trial

## Simcoe and Elora 2020 Dry Weight(kg)



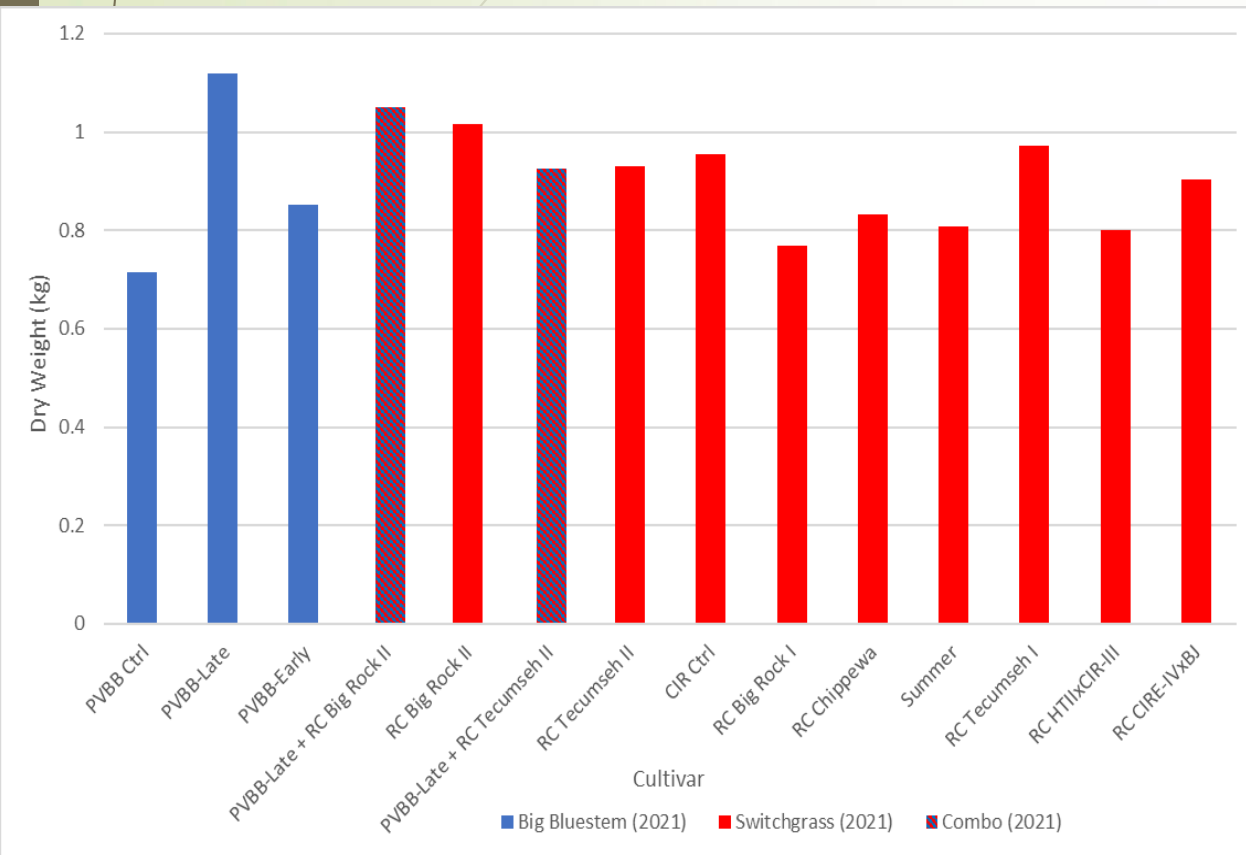
Simcoe



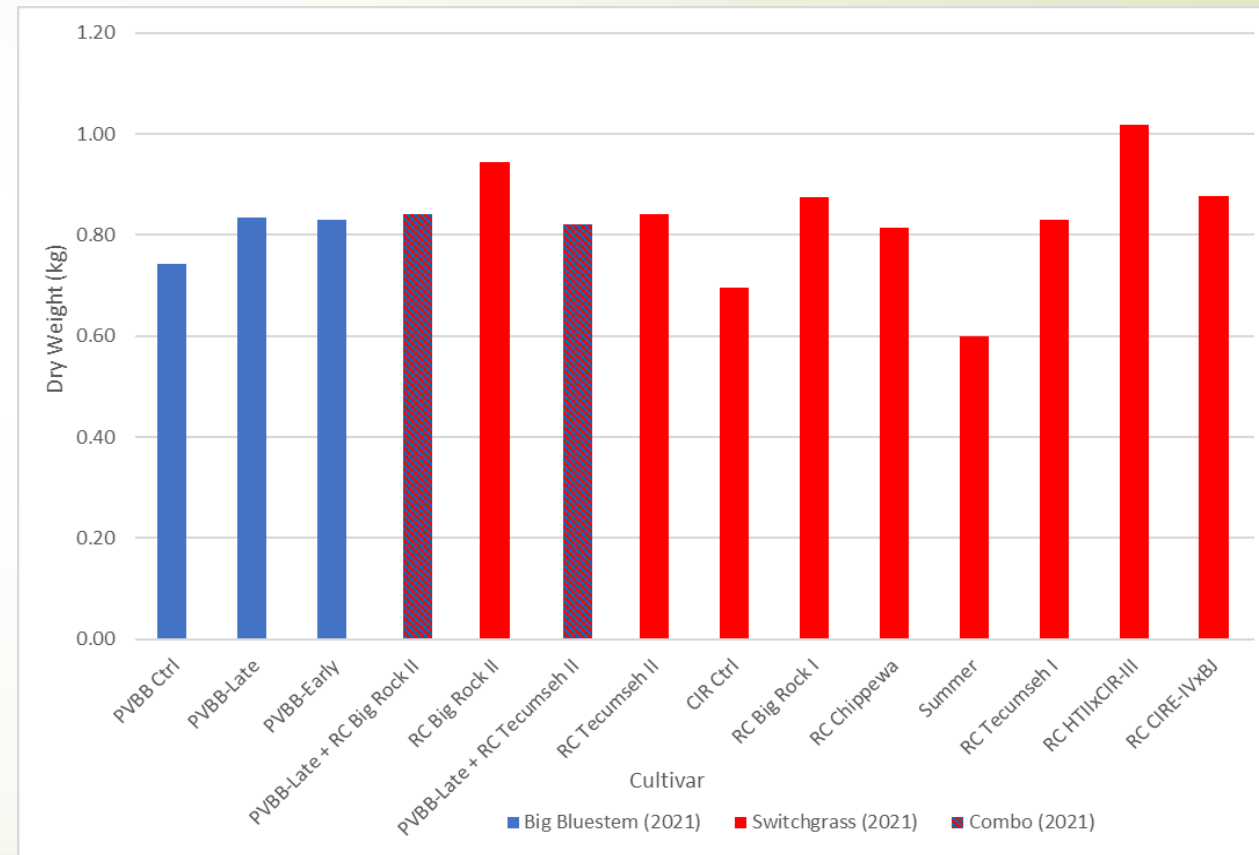
Elora

# Objective 4: Mixed Species Trial

➤ Simcoe and Elora 2021 Dry Weight(kg)



Simcoe



Elora



# Objective 4 Summary

- ▶ Cultivars Summer and RC Tecumseh I tend to be the lowest in height and yield
- ▶ Cultivars RC Big Rock II, RC (High Tide II x Cave-in-Rock III), RC (Cave-in-Rock IV x Blue Jacket), and Cave-in-Rock are the highest in height and yield
- ▶ No difference in switchgrass measurements (both height and yield) between mixed and un-mixed plots

# Acknowledgement

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  - Roger Samson (REAP)
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# Thank you for your time

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Questions?