ASSESSMENT OF DWARF BUNT AND COMMON BUNT RESISTANCE IN WHEAT DIFFERENTIAL LINES

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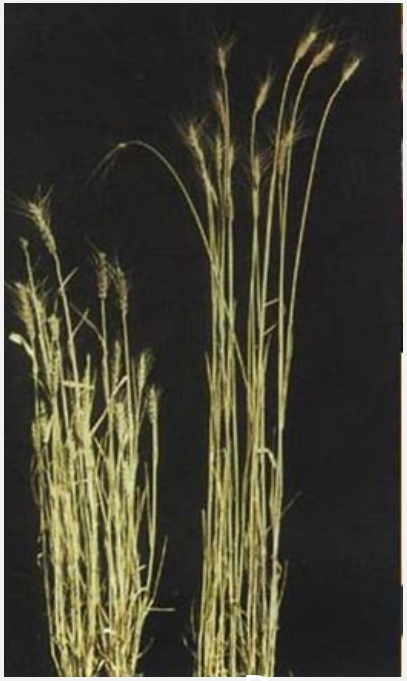
IMPORTANCE OF THE DISEASE

- Dwarf bunt (caused by *T. controversa* Kühn) and common bunt (caused by *Tilletia laevis* Kühn and *T. tritici* (Bjerk.) Wint) are two destructive diseases.
- Severely reduce grain yield and quality when epidemic occurs.

COMMON SYMPTOMS OF CB AND DB

A: Severe height reduction causing dwarfing (DB)



B: Increase in tiller number (DB, sometimes CB)

C: Increased grain size, more green and open glume exposing infected seed (CB & DB)

D: Increased florets

E: Mature seed more rounded and bigger in size, with brownish to blackish color, releasing black teliospores (DB & CB)

Credit: CIMMYT

ESSENTIAL TO REASSESS BUNT RESISTANCE IN DIFFERENTIAL LINES

- Resistance to CB and DB was controlled by the same set of genes, *Bt1* to *Btp.*
- Bunt differential lines have been extensively used in genetic study of the resistance genes.
- Multiple genes were observed in some of differential lines.
- Different genetic control was observed in the same differential line.

OBJECTIVE OF THE PRESENT STUDY

To assess genetic variation for resistance to common bunt and dwarf bunt in a set of differential lines over years and across different countries

MATERIALS USED

Bt-0	**PI 209794**
Bt-1	PI 554101
Bt-2	PI 554097
Bt-3	CItr 6703
Bt-4	PI 11610
Bt-5	CItr 11458
Bt-6	CItr 10061
Bt-7	PI 554100
Bt-8	PI 554120
Bt-9	PI 554099
Bt-10	PI 554118
Bt-11	PI 554119
Bt-12	PI 119333
Bt-13	PI 181463
Btp	PI 173437
Bt-unknown	PI 173438

DISEASE SCREENING TRIALS

Published data:

- DB BLUE data, Gordon et al., 2020: CB BLUE data, Ehn et al., 2022

Utah State University Trials, USA:

- Composite inoculum of dwarf bunt races collected in Logan, UT
- *Bt1* to *Bt13* differentials were assessed for dwarf bunt resistance from 2016 to 2022, 16DB_UT, 17DB_UT, 18DB_UT, 19DB_UT, 20DB_UT, 22DB_UT

IFA, Austria Trials:

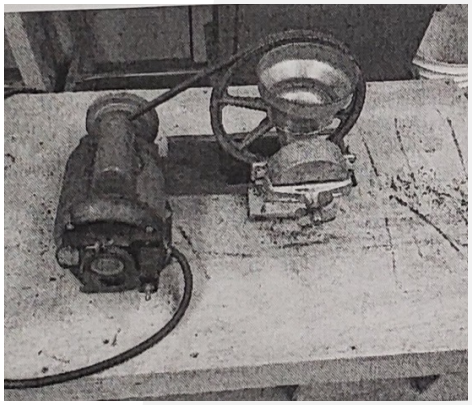
- "IFA aggressive" inoculum of common bunt
- *Bt1* to *Bt7*, *Bt11*, *Bt12*,*Bt13* and *Btp* were assessed in 2021 and 2022

University of Idaho Greenhouse Trials:

- Locally collected composite inoculum of common bunt was used
- *Bt2, Bt4, Bt7, Bt8, Bt9, Bt10, Bt12, Bt13* bunt differential lines were assessed in two greenhouse experiments in 2022

INOCULATION METHOD AT USU

- Grind the spores
- Mix with water and make slurry solution
- Spray in field with tractor at seedling stage right before snowing
- We use 1 gram of ground spores per 1.2-meter row for inoculation

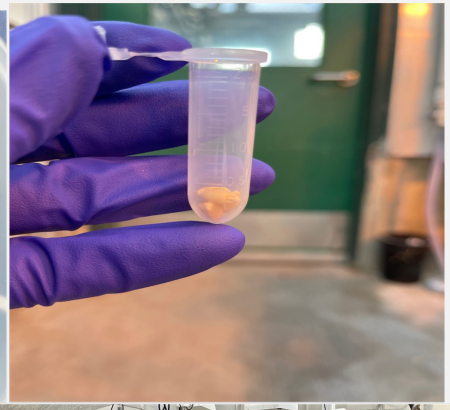


Grind

Spore water Slurry

Spray

INOCULATION METHOD AT UI



DATA COLLECTION AND ANALYSIS

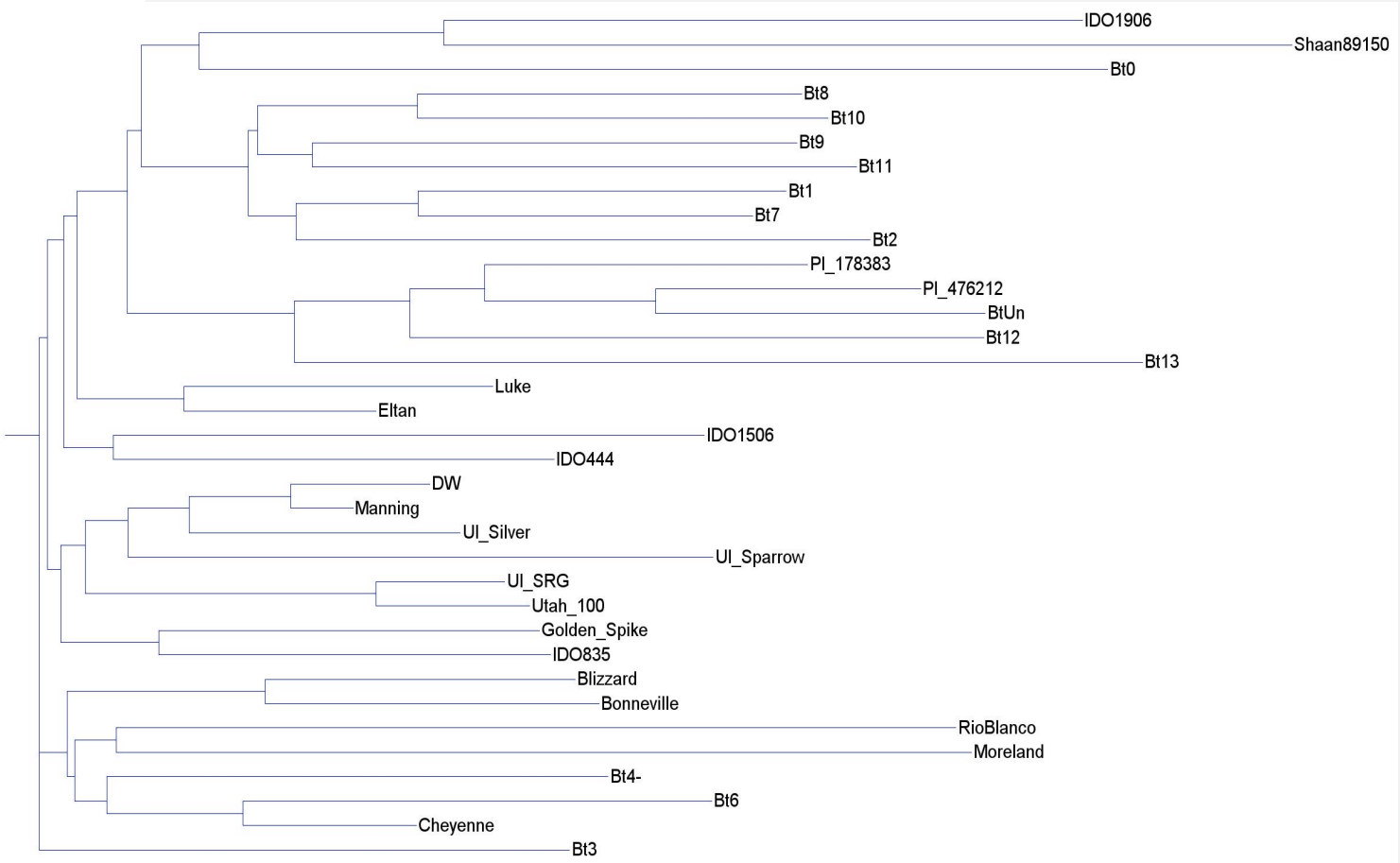
- Percentage of bunt infection was calculated based on visual assessment in the field in the differential lines.
- Wheat 90K iSelect data for differential line was used to make relationship tree using TASSEL software.
- KASP markers associated with dwarf bunt resistance for the 6DL QTL.
- Statistical Analysis: Bar graphs were made using excel.

RESULTS

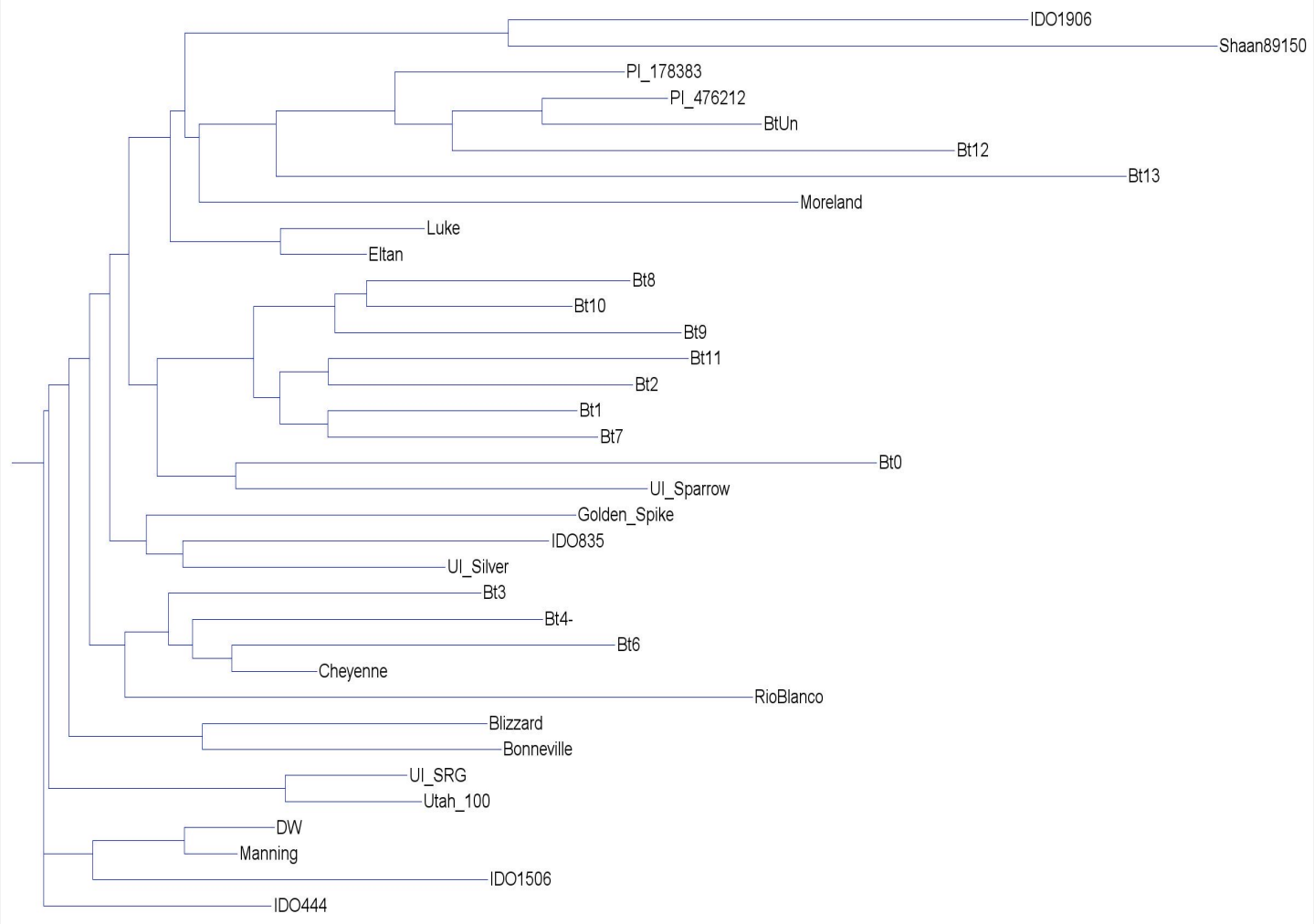
HEAD TYPE CHARACTERIZATION

Fig1: Head type of differential lines (A=*Bt-0*, B=*Bt-1*, C= *Bt-2*, D=*Bt-3*, E=*Bt-4*, F=*Bt-7*, G=*Bt-8*, H=*Bt-9*, I= *Bt-9* (another type of head), J=*Bt-10*, K=*Bt-11*, L=*Bt-12*, M=*Bt-13*, N= *Btp*)

CLUSTER ANALYSIS – ALL SNP



SNP ON 6D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Shaan89150
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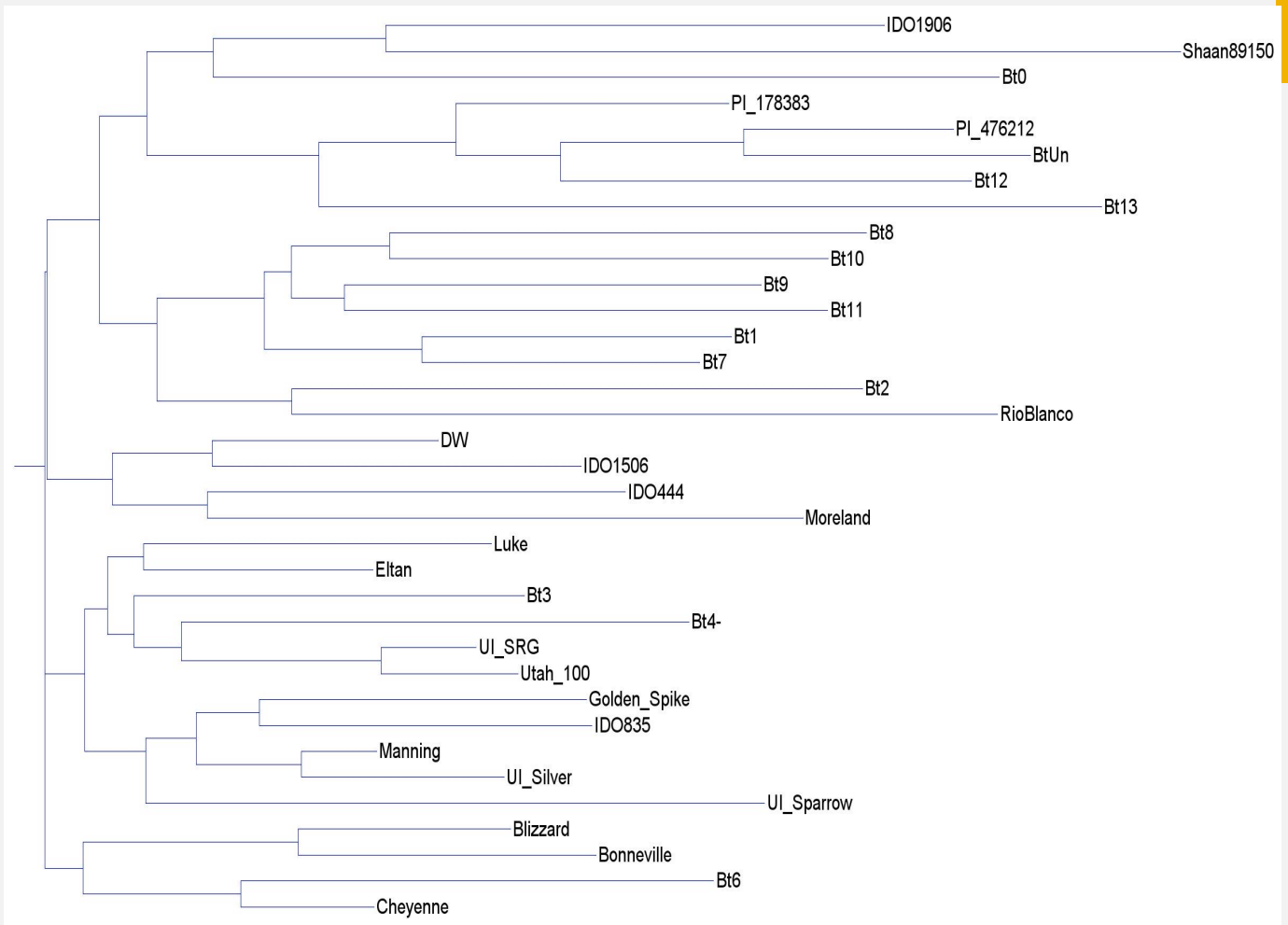
PI_476212
BtUn
Bt12
Bt13
Moreland
Luke
Eltan
Bt8
Bt10
Bt9
Bt11
Bt2
Bt1
Bt7
Bt0
UI_Sparrow
Golden_Spike
IDO835
UI_Silver
Bt3
Bt4-
Bt6
Cheyenne
RioBlanco
Blizzard
Bonneville
UI_SRG
Utah_100
DW
Manning
IDO1506
IDO444

SNP ON 7D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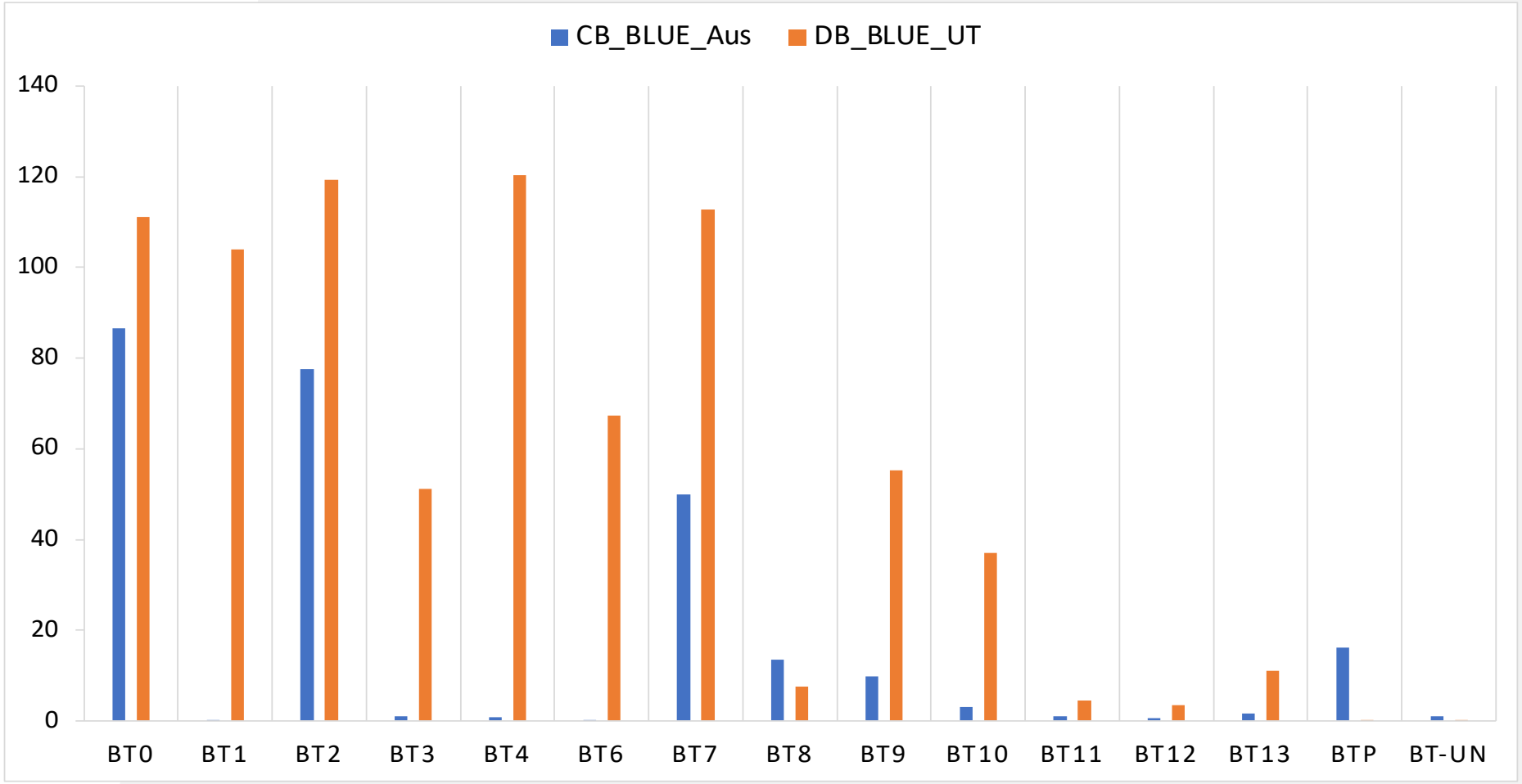
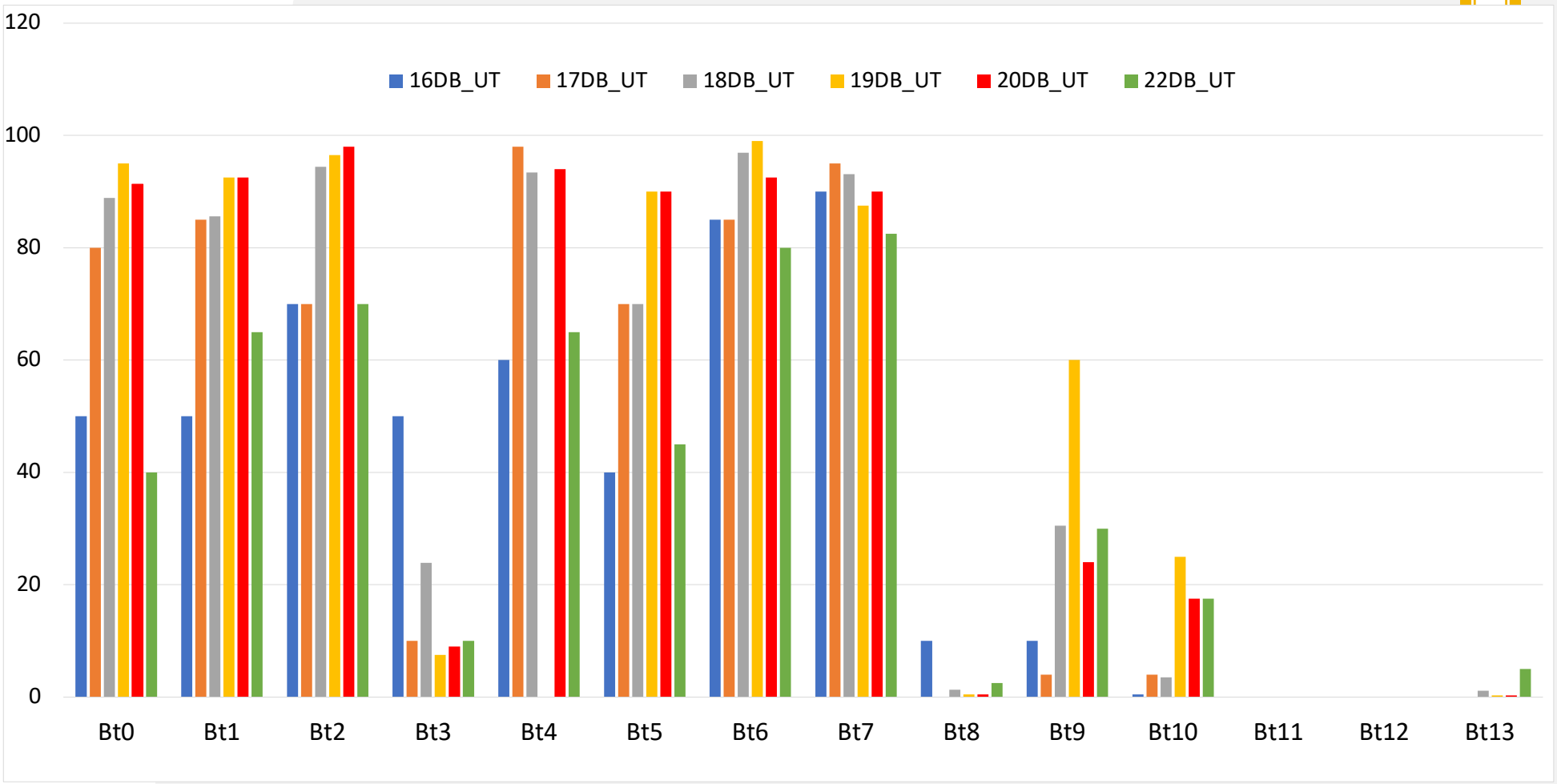
Moreland
Luke
Eltan
Bt3
Bt4-
UI_SRG
Utah_100
Golden_Spike
IDO835
Manning
UI_Silver
UI_Sparrow
Blizzard
Bonneville
Bt6
Cheyenne

CB & DB INCIDENCE PUBLISHED DATA

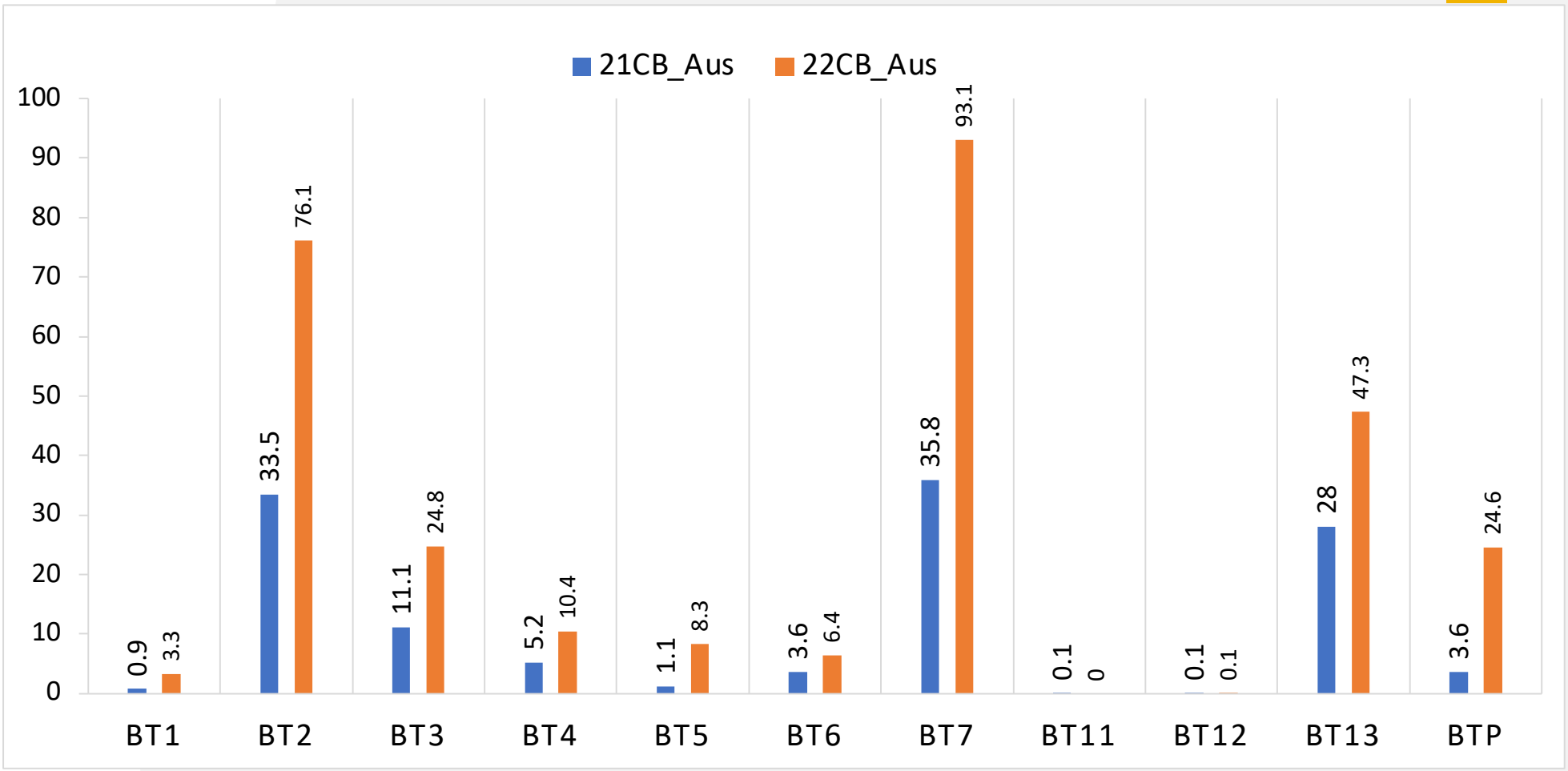
(Gordon et al., 2020; Ehn et al., 2022)



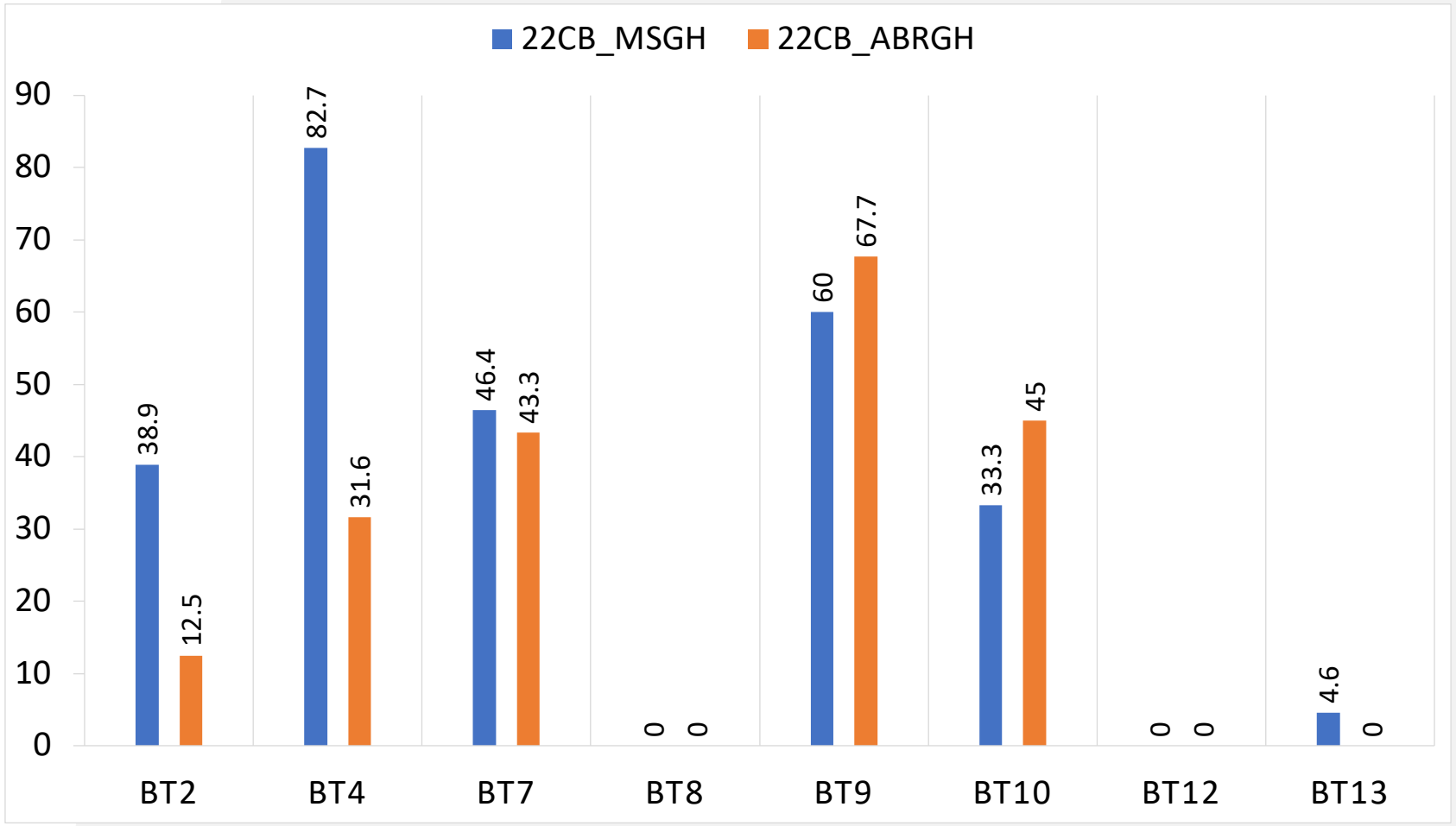
DWARF BUNT INCIDENCE ACROSS YEARS IN UT, USA



COMMON BUNT INCIDENCE ACROSS YEARS IN BOKU, AUSTRIA



COMMON BUNT INCIDENCE IN GREENHOUSE, UI, USA



SUMMARY

- The differential lines Bt-8, Bt-11, and Bt-12 consistently showed resistant reactions to both Europe common bunt races, Idaho common bunt races, and Utah dwarf bunt races.
- Bt-9 and Bt-10 exhibited resistant reactions to Europe common bunt races but susceptible reactions to Idaho common bunt races. Additionally, their reactions to Utah dwarf bunt races varied over the years. Bt-13 is opposite to Bt-9 and Bt-10.
- Our assessment of head types in the greenhouse revealed some unexpected variations, particularly in Bt-9.
- Cluster tree shows the similarity and differences of differential lines with each other

ACKNOWLEDGEMENT

CALL FOR COLLABORATION

- Collect sources of differential lines
- Jointly assess CB and DF resistance in same disease nurseries
- Jointly assess marker haplotypes
- Joint grant applications