

Planting Date and Seeding Rate decisions for Optimize Winter Barley Yield and Quality

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Cropping Systems Agronomy
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 Michigan Crop
improvement association

Integrated Barley Management: Yield vs Quality

- Crop rotation
- Variety Selection
- Planting Date
- Plant Population (seed rates)
- Row Spacing
- Fertility management
- Pest management
- Harvest timing



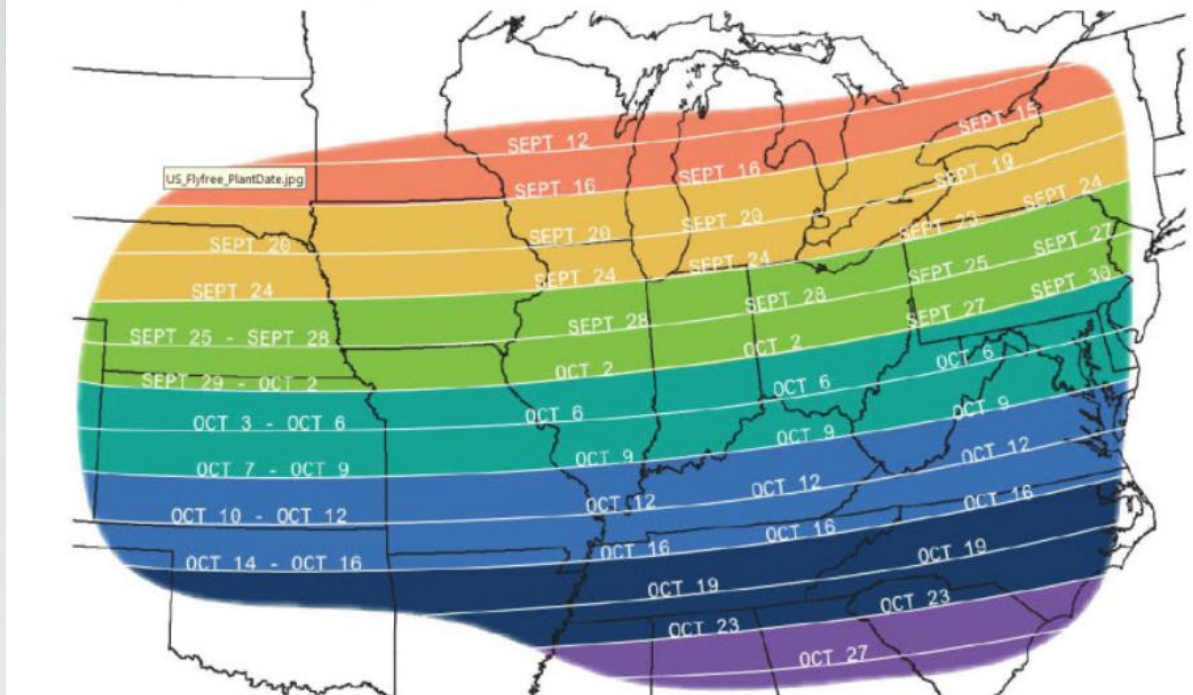
Winter Wheat



Winter Barley

Vs Spring Barley

Plant date vs Hessian Fly Free Dates

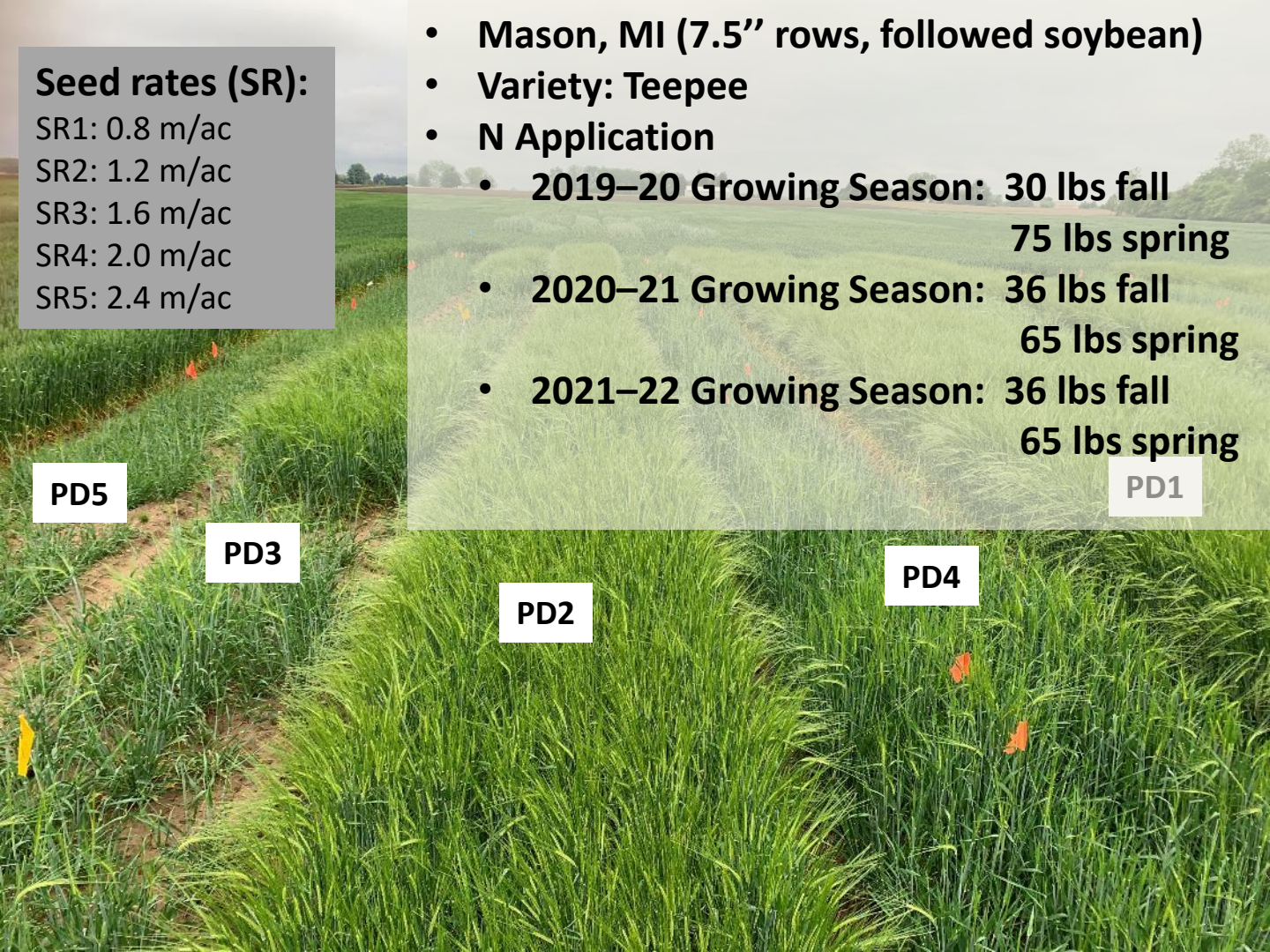
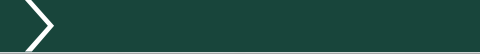


Ingham county- Sept 17

https://www.canr.msu.edu/news/planting_winter_wheat_crop

Hessian fly-free-dates for Michigan

County	Sept.	County	Sept.	County	Sept.	County	Sept.
Alcona	6	Eaton	16	Lapeer	15	Ogemaw	10
Allegan	20	Emmett	4	Leelanau	8	Osceola	10
Alpena	9	Genesee	17	Lenawee	25	Oscoda	7
Antrim	4	Gladwin	12	Livingston	16	Otsego	6
Arenac	13	Grand Traverse	8	Macomb	18	Ottawa	19
Barry	18	Gratiot	15	Manistee	13	Presque Isle	8
Bay	14	Hillsdale	19	Mason	13	Roscommon	7
Benzie	16	Huron	13	Mecosta	12	Saginaw	16
Berrien	23	Ingham	17	Midland	15	Sanilac	15
Branch	19	Ionia	16	Missaukee	9	St. Clair	16
Calhoun	19	Iosco	7	Monroe	21	St. Joseph	23
Cass	22	Isabella	11	Montcalm	15	Shiawassee	16
Charlevoix	3	Jackson	16	Montmorency	7	Tuscola	15
Cheboygan	4	Kalamazoo	20	Muskegon	18	Van Buren	22
Clare	12	Kalkaska	5	Newaygo	15	Washtenaw	18
Clinton	17	Kent	18	Oakland	16	Wayne	18
Crawford	6	Lake	13	Oceana	16	Wexford	9



Plant dates (PD):

2019–20 growing season:

- PD1: Sept 19
- PD2: Oct 7
- PD3: Oct 18
- PD4: Oct 29
- PD5: Nov 15

2020–21 growing season:

- PD1: Sept 17
- PD2: Sept. 29
- PD3: Oct 14
- PD4: Oct 29
- PD5: Nov 12

2021–22 growing season:

- PD1: Sept 19
- PD2: Sept. 30
- PD3: Oct 16
- PD4: Oct 30
- PD5: Nov 17

Seed rates (SR):

- SR1: 0.8 m/ac
- SR2: 1.2 m/ac
- SR3: 1.6 m/ac
- SR4: 2.0 m/ac
- SR5: 2.4 m/ac

PD5

PD3

PD2

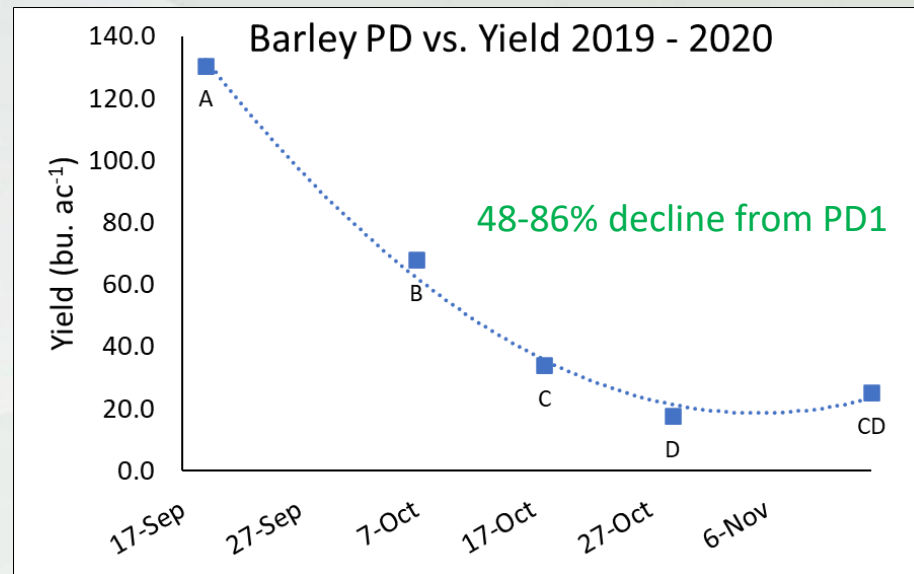
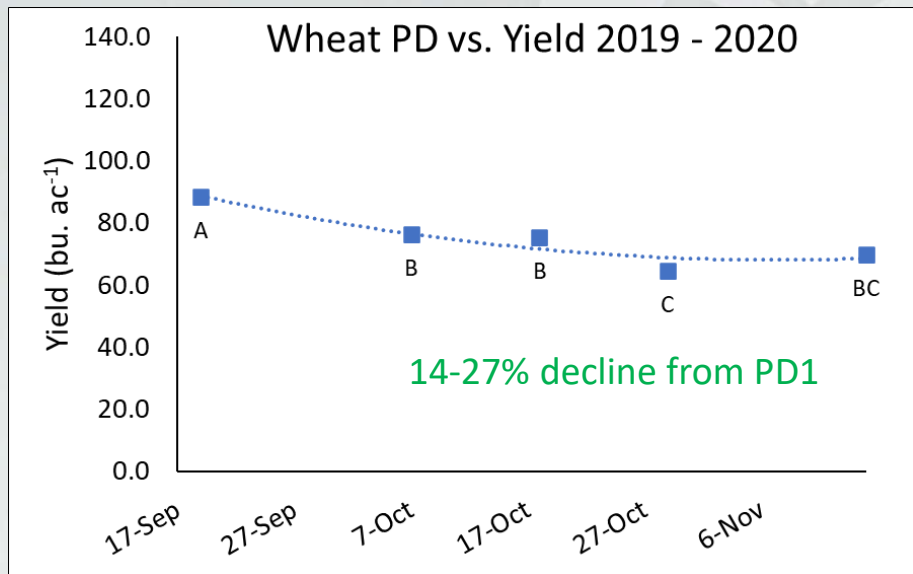
PD4

PD1

- Mason, MI (7.5" rows, followed soybean)
- Variety: Teepee
- N Application
 - 2019–20 Growing Season: 30 lbs fall
75 lbs spring
 - 2020–21 Growing Season: 36 lbs fall
65 lbs spring
 - 2021–22 Growing Season: 36 lbs fall
65 lbs spring

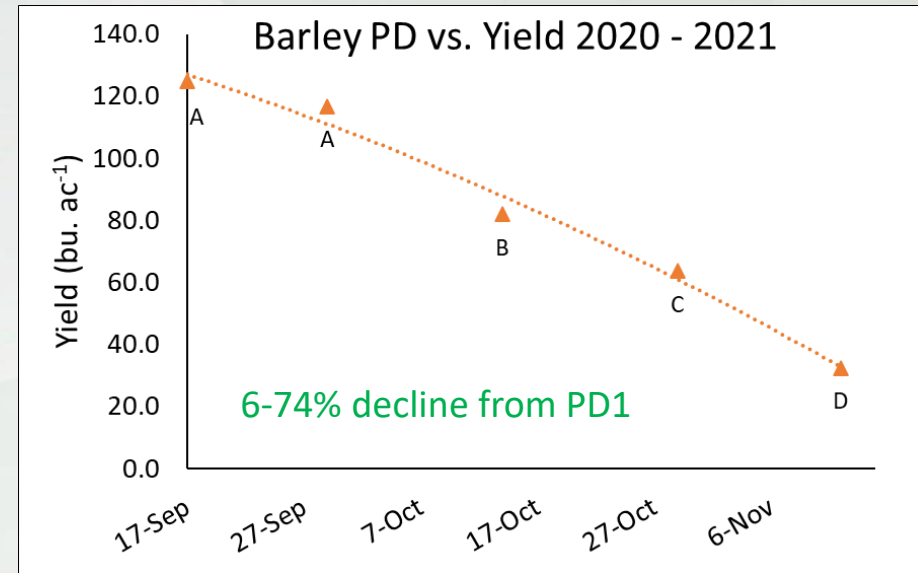
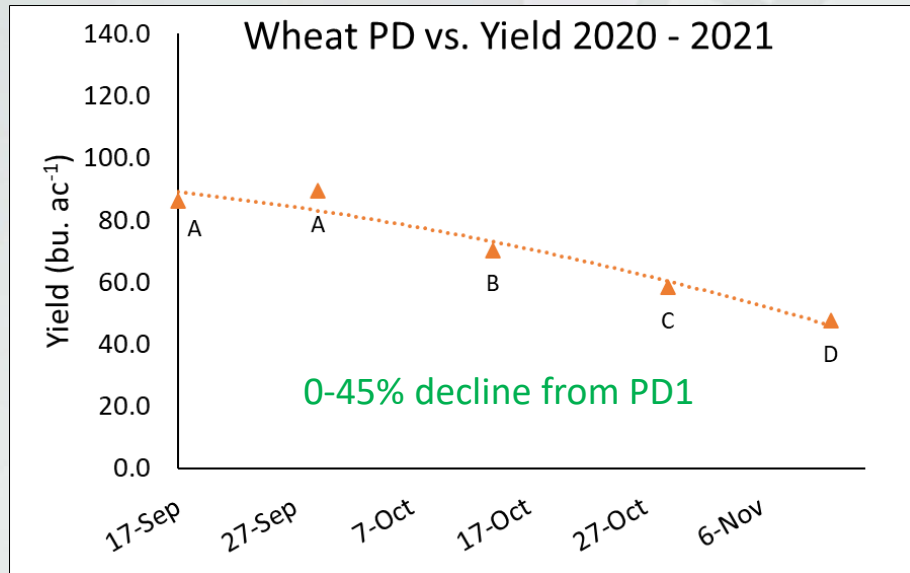
Planting Date Impacts on Yield: 2019–2020

- Yield declined with later planting, but eventually levelled out
- Yield response was more significant in barley



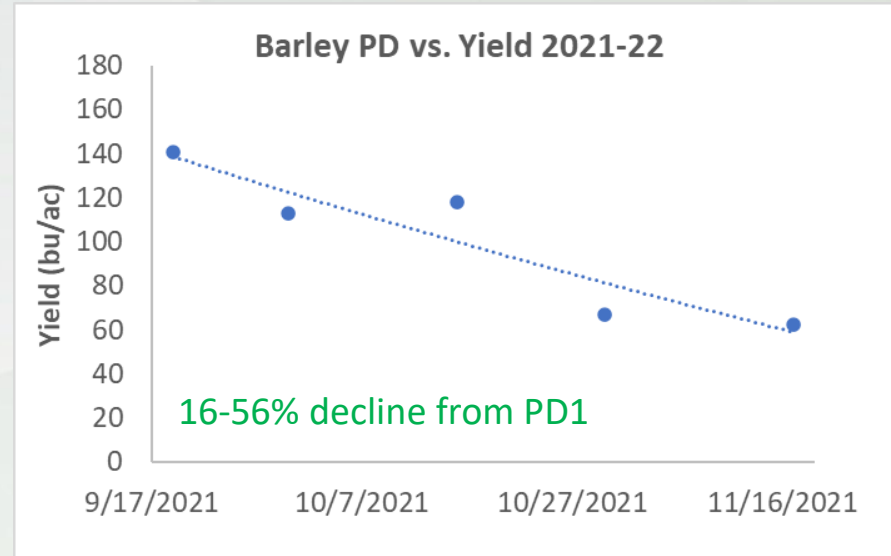
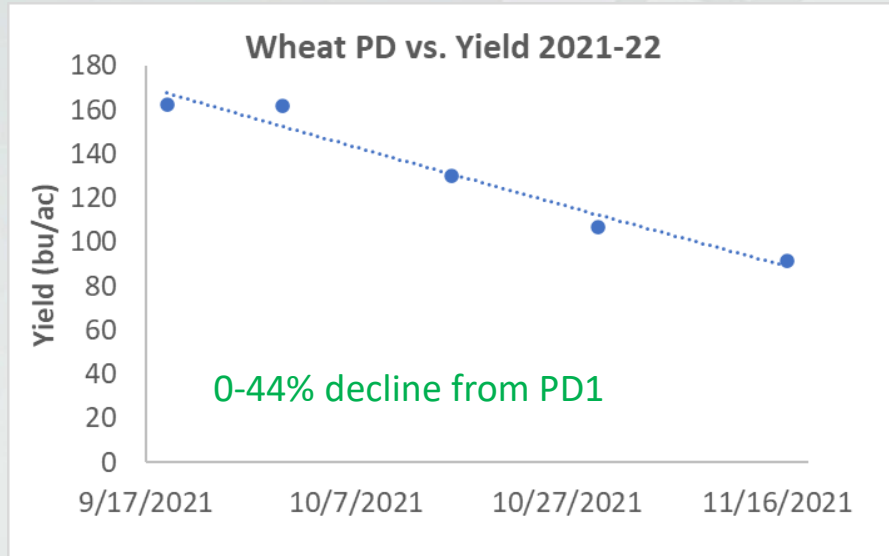
Planting Date Impacts on Yield: 2020–2021

- Yield declined with later planting, and response became greater with later planting
- Response was again greater in barley than in wheat

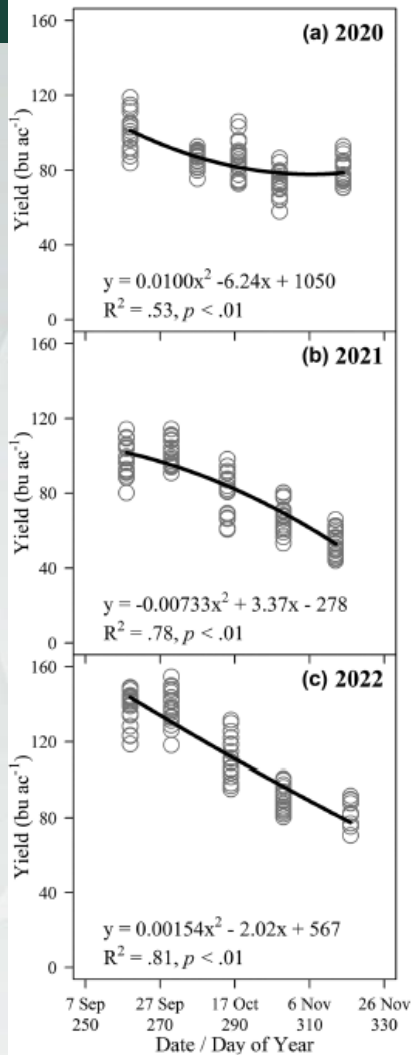


Planting Date Impacts on Yield: 2021–2022

- Yield declined with later planting, and response became greater with later planting (similar to 2020-21 but not 2019-20)
- Decline was greater in barley

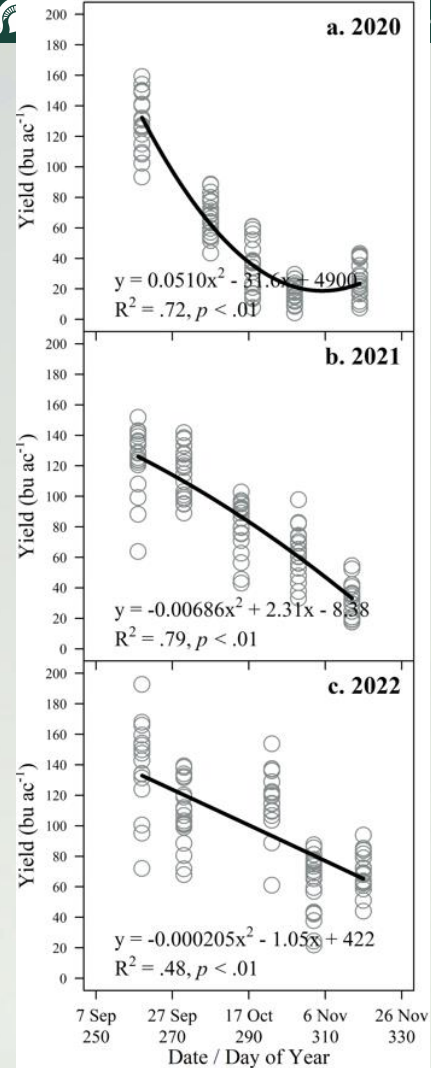


Planting Date Impacts



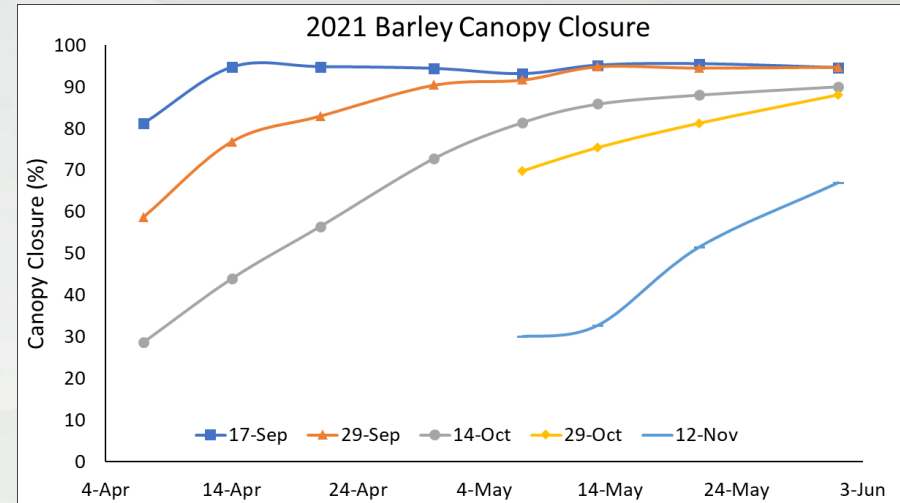
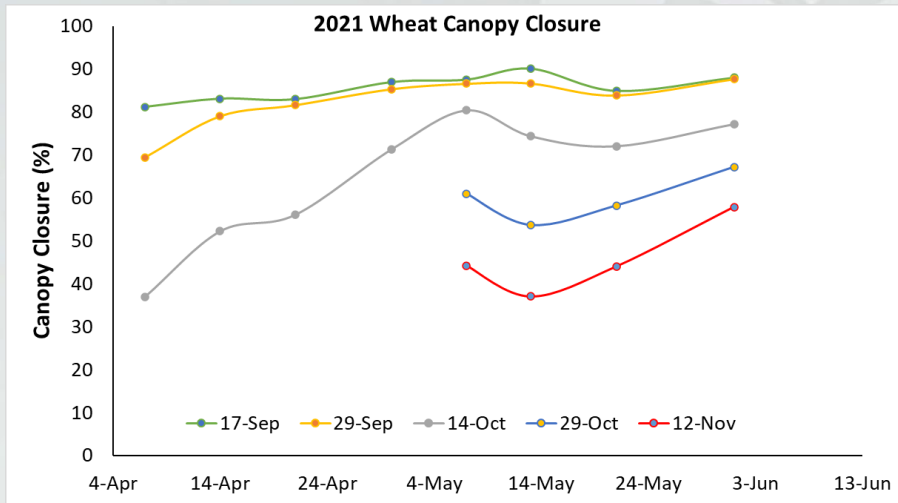
<<< Wheat

Barley>>>

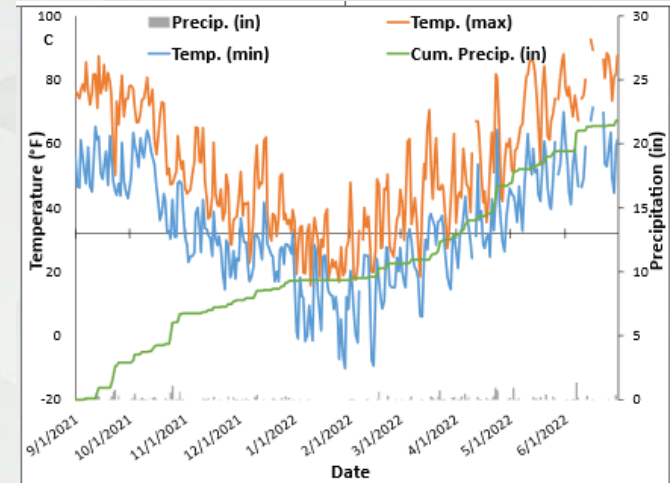
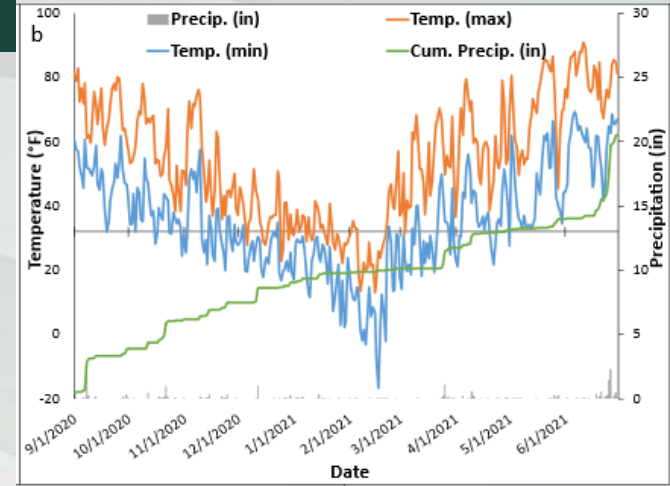
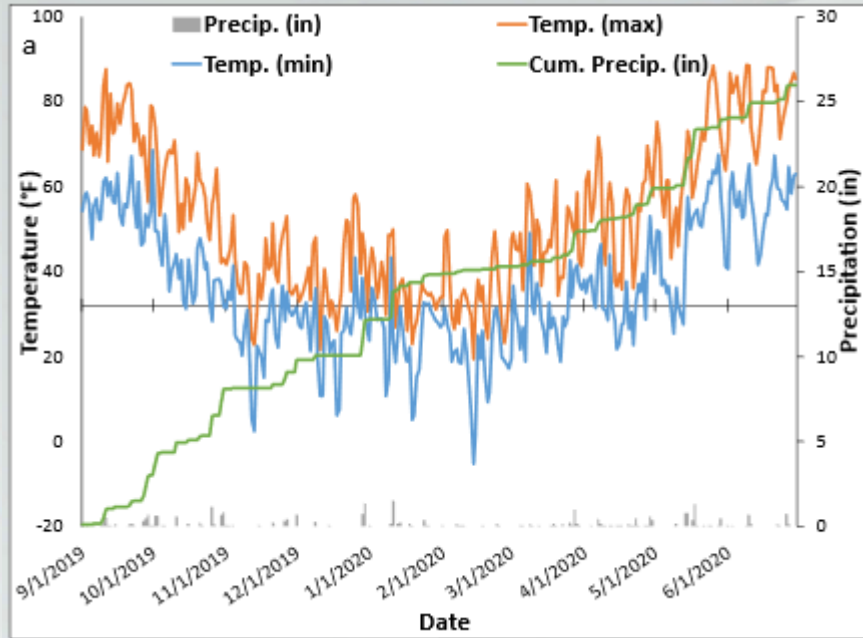


Canopy Closure: 2020-21

- First 2 planting dates had ideal canopy closure
- Planting after mid-Oct resulted in delayed/lower canopy closure



Weather



➤ 2020 (milder temps., wetter) than 2021, 2022

Wheat vs Barley spring growth



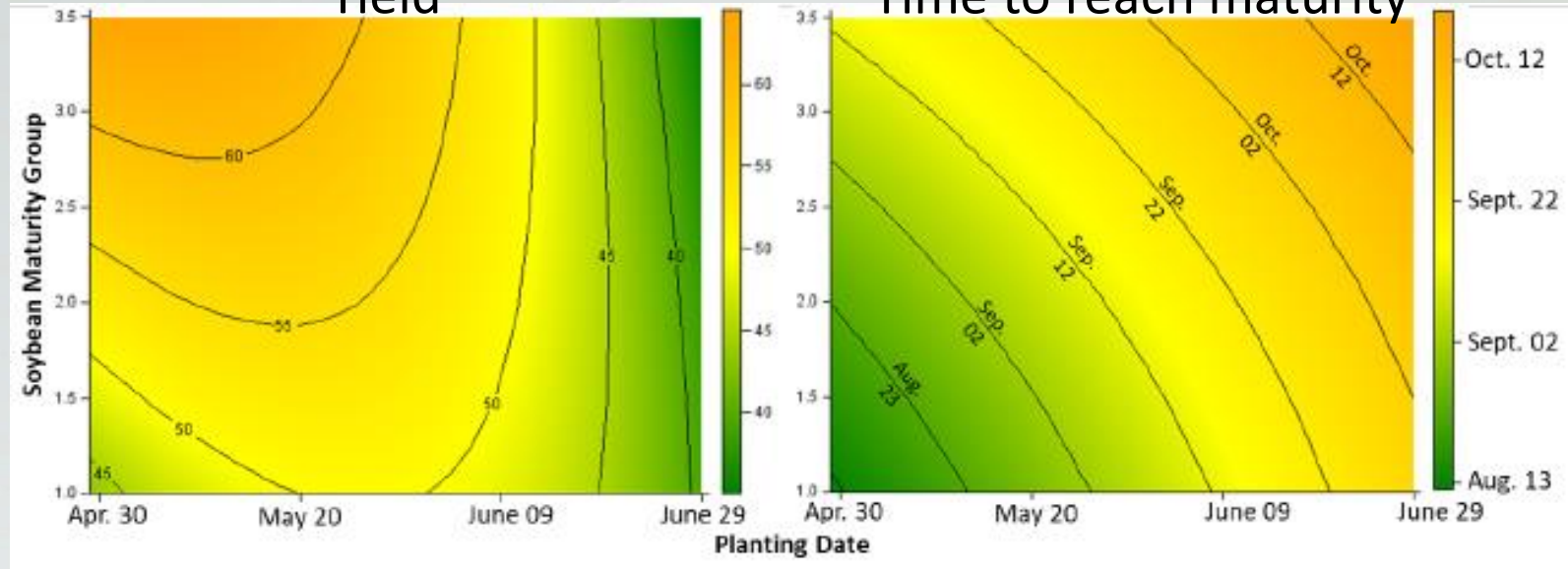
Winter Wheat



Winter Barley

Pictures taken on March 14

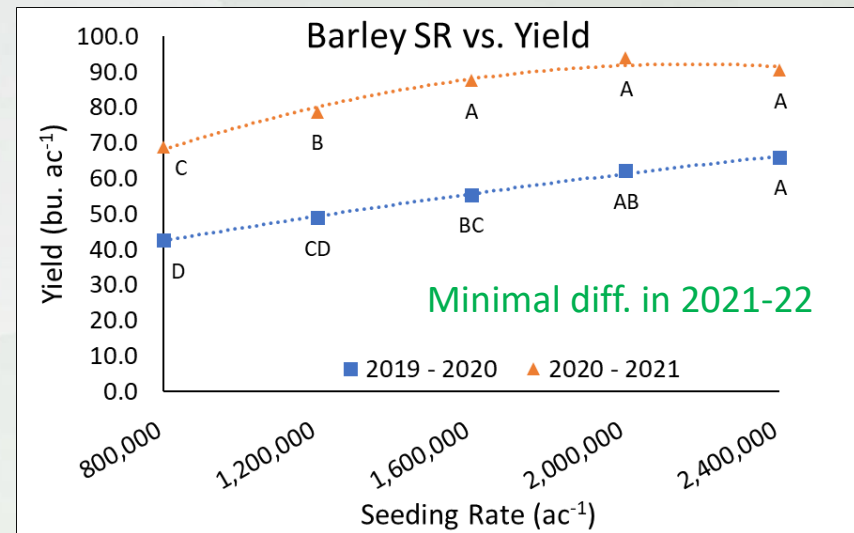
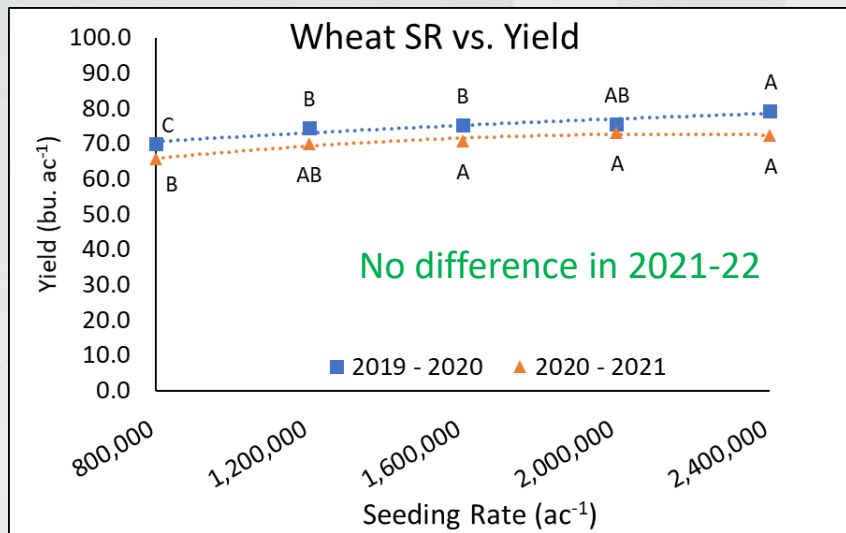
Management of previous crop (Soybean) for timely barley planting



- Manage soybean for early harvest
 - Plant early. Select field where this is possible.
 - Optimal maturity group (e.g., don't use late-maturity after mid-May planting)
 - Use of harvest aids on soybean (desiccants- Gramoxone, Defol 5, Sharpen)

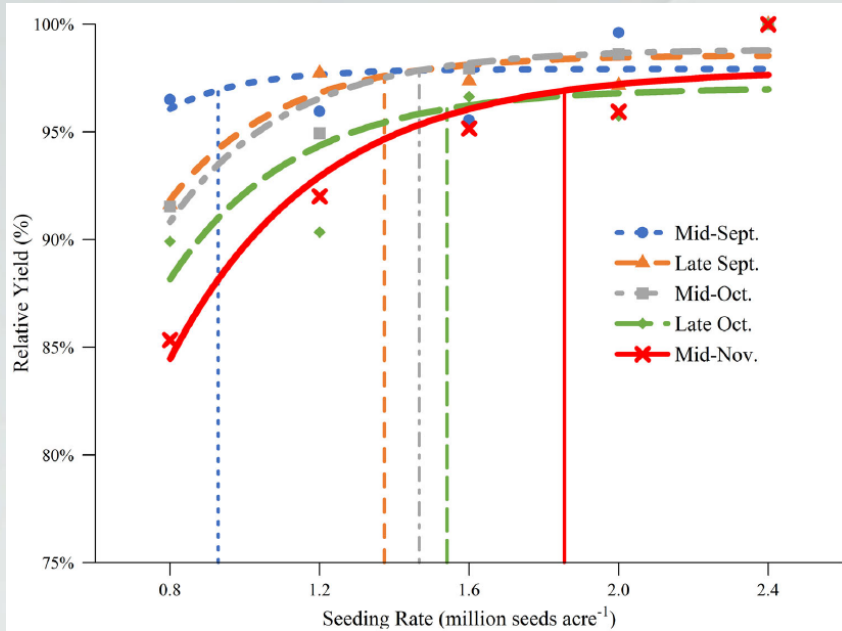
Yield by Seeding rate

- Barley more responsive to seeding rate than wheat (minimal response in both crops in 2021-22)
- Optimal seeding rate for barley ~**1.6–2.0 million seeds/ac**



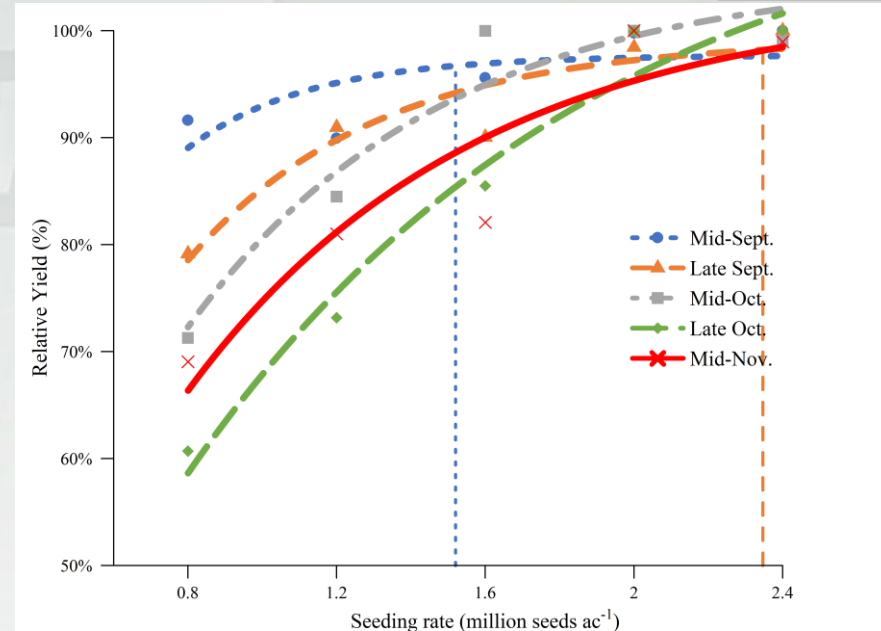
Yield: Plant date x Seeding rate

Winter
Wheat



Copeland et al., 2023 <https://doi.org/10.1002/cft2.20240>

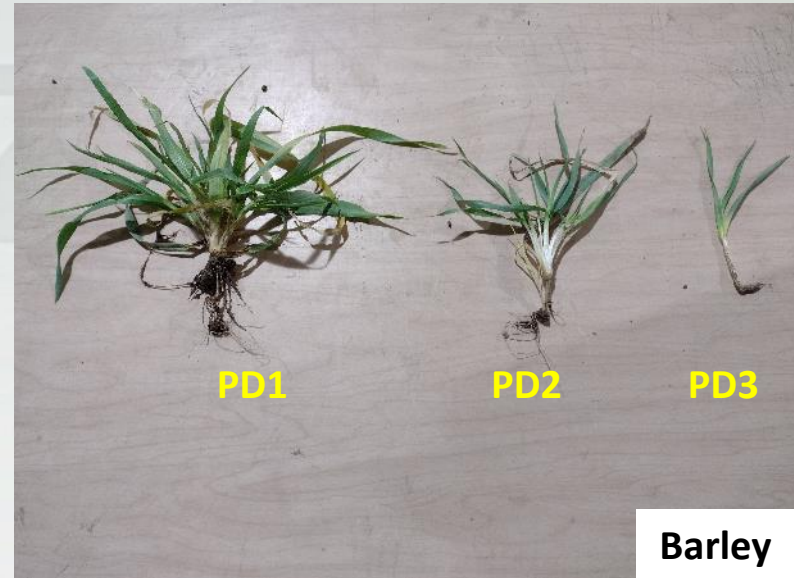
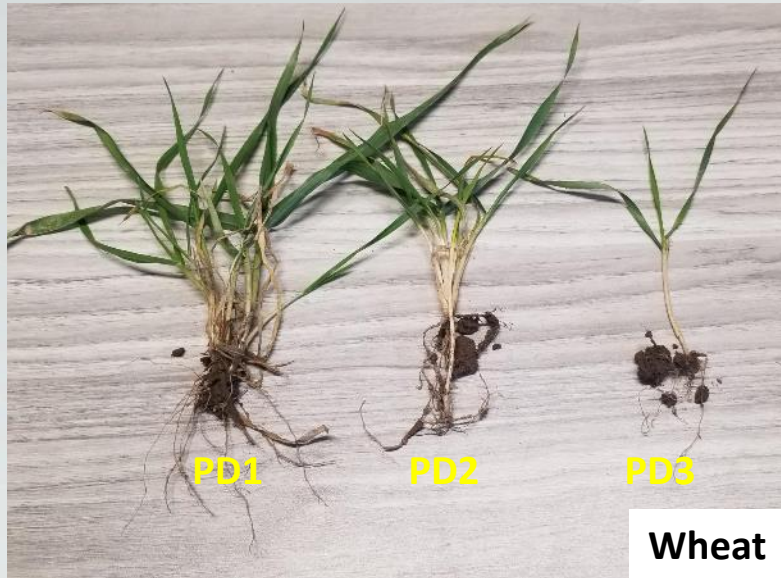
Winter
Barley



Prelim. Data

- Optimal seeding rate increases with delay in planting
- Barley is more responsive to increase in seeding rate than wheat

Tillering



- More tillering in barley than wheat
 - Does not necessarily equal higher yield (+ quality issues)
- Lower populations and more prostrate growth habit in barley
- Variability in tiller development: can lead to quality issues

Maturity



- High variability among tillers at lower seeding rates (and later plant dates)
- Earlier maturity for barley than wheat (by 7-14 days), heavily influenced by planting date (and seeding rate)- potential for **Double Crop Soybeans**

Seeding rates

- Use seeds/acre (NOT bushels/acre)
- MSU recommendation between 1.6 -2.4 million seeds/acre
- Specific rate depends on planting time

Red Devil

- Target: 1.8 million
- 14,996 seeds/pound
- Calibrate drill to plant:
 $1,800,000 \div 14,996$
 $= 120.0 \div 90\%$
 germ= 133 lbs/a

Sunburst

- Target: 1.8 million
- 11,948 seeds/pound
- Calibrate drill to plant:
 $1,800,000 \div 11,948$
 $= 150.7 \div 90\%$
 germ= 167 lb/a

Seed drill calibration

Seed size (seeds per pound)	Target seeding rates (millions of seeds per acre)					
	1.2	1.4	1.6	1.8	2.0	2.2
Actual pounds of seed required per acre *						
9,000	133	156	178	200	222	244
10,000	120	140	160	180	200	220
11,000	109	127	145	164	182	200
12,000	100	117	133	150	167	183
13,000	92	108	123	138	154	169
14,000	86	100	114	129	143	157
15,000	80	93	107	120	133	147
16,000	75	88	100	113	125	138

*Target seeding rate divided by seeds per pound = required pounds of seed per acre.

Malt Quality: 2019-20

Plant date	Protein (%)	Plump kernels (%)	Thin kernels (%)	Germination (4ml 72 hr GE)
Criteria	≤12%	>90%	<3%	>98%
19-Sep	10.3 C	84.4 C	2.2 A	99.2 A
7-Oct	12.6 B	96.1 A	0.2 B	98.4 AB
18-Oct	14.7 A	95.7 A	0.4 B	93.2 C
29-Oct	16.4 A	90.8 B	1.7 A	95.5 BC
15-Nov	15.6 A	92.4 AB	1.4 A	95.9 BC
P value	<0.001	<0.001	<0.001	<0.001

Data from 3 higher seed rates (1.6, 2.0, 2.4 m seeds/ac)

- RVA (for PHS): <120 only for PD 5
- DON (vomitoxin) <0.15 ppm for all samples (low head scab year)

Malt Quality: 2020-21

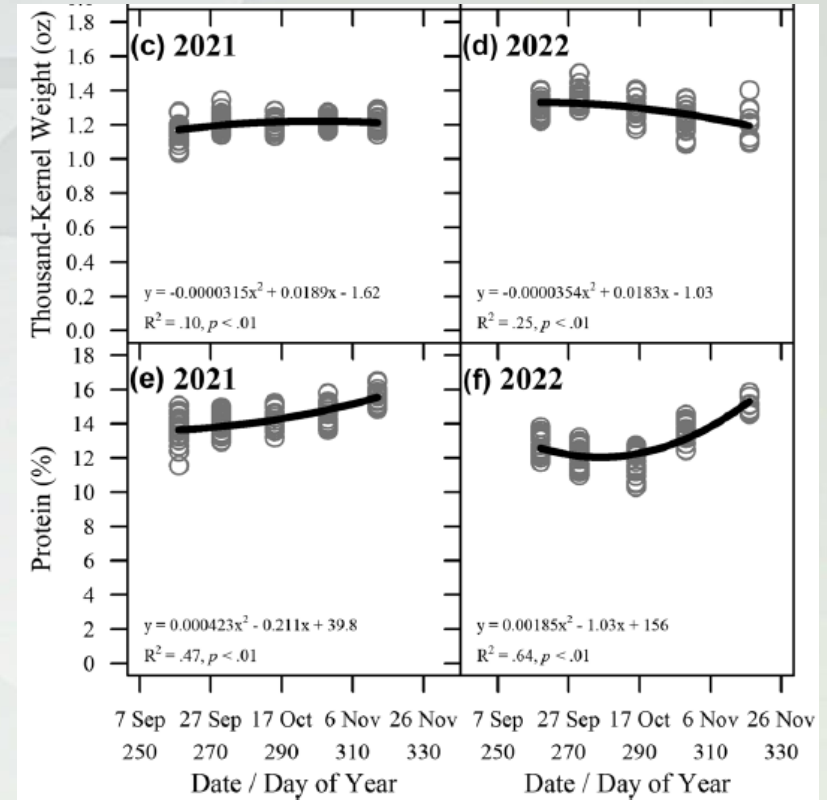
Plant date	Protein (%)	Plump kernels (%)	Thin kernels (%)	Germination (4ml 72 hr GE)
Criteria	≤12%	>90%	<3%	>98%
17-Sep	11.5 A	86.9 B	1.4 B	90.1 B
29-Sep	11.9 A	90.6 AB	1.0 BC	93.7 A
14-Oct	12.6 A	93.0 A	0.7 C	93.6 A
29-Oct	12.6 A	94.6 A	0.8 C	91.7 AB
12-Nov	12.8 A	88.0 A	3.3 A	80.1 C
P value	0.08	<0.001	<0.002	<0.003

Data from 3 higher seed rates (1.6, 2.0, 2.4 m seeds/ac)

- DON (vomitoxin) <0.15 ppm for all samples (low head scab year)
- 2021-22: Similar trends (DON <0.30 ppm, RVA >120)

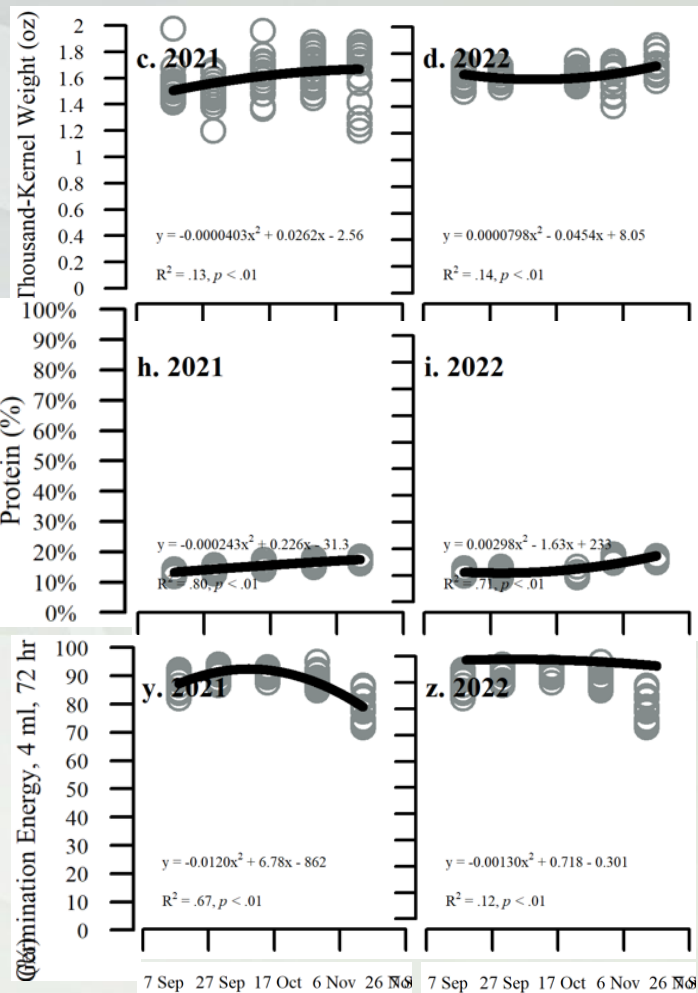
Quality: Winter Wheat planting date

- Kernel weight had minimal impact with delay in wheat planting
- Protein content in wheat increased with delay in planting



Quality: Winter Barley planting date

- Kernel weight had minimal impact with delay in barley planting
- Protein content in barley increased with delay in planting
- Overall, most quality traits had a positive response to increase in seeding rates



Take Home Messages

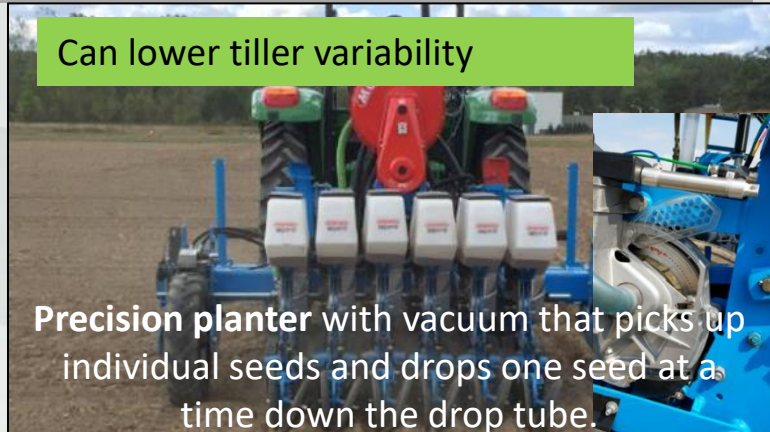
- **Early planting** (at or within 2 weeks of fly free date): Target fields where this can be achieved (for both barley and soybean)
- Barley more responsive to seeding rate than wheat, higher rates critical (≥ 1.6 m seed/ac), along with **high seed quality and germ**
- Yield penalty from delayed planting not reduced by increasing seeding rate, responses depends on growing season weather
- For high **grain quality**, managing for crop uniformity critical in addition to chasing high yields
 - Kernel plumpness might be lower under very-early planting
 - Low stands can produce good yields, but grain quality is a concern

Planting Systems- achieve faster/early planting?



Conventional drill with rotating gear that "spills" seed into the drop tube.

Drill (JD 1590 No Till Drill)- 7.5" rows



Can lower tiller variability

Precision planter with vacuum that picks up individual seeds and drops one seed at a time down the drop tube.

Precision Planter-PP (Monosem 4NG Planter)- 5" rows



Can increase tiller variability

Broadcast Incorporation (BI)??: Horsch Joker with Gandy Air Seeder, Degelman Pro Till, Vertical Tillage Tool (**No row spacing**)

- **Patrick Copeland**
- **Brook Wilke**
- **Dennis Pennington**
- Calvin Canfield
- Tom Siler
- Micalah Blohm
- Sam Martin
- Harkirat Kaur
- Lillian Wierenga
- Eric Olson
- Kelly Ish
- Madeline Yaek
- Cole Mallory
- Braden Heimbaugh
- Lucas Para
- **Chris Kapp (quality)**
- **Vince Coone (seed)**

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Thanks!

