

Fall Rye in Iowa



UNIVERSITY OF MINNESOTA

Driven to DiscoverSM

Jochum Wiersma

Happy Rye

- Field Selection
- Crop Rotations and fertility management
- Variety Selection
- Seeding Rates, Dates, and Depths



Field Selection

<i>Tolerance</i>									
<i>Crop</i>	<i>Heat</i>	<i>Drought</i>	<i>Wet/Poor Drainage</i>	<i>Acidity</i>	<i>Alkalinity</i>	<i>Salinity</i>	<i>Weeds</i>	<i>Low Fertility</i>	<i>Winter Hardiness</i>
<i>Spring wheat</i>	Moderate	Moderate	Moderate	>5.5	<7.5		Moderate	Low	--
<i>Winter wheat</i>	Moderate	Moderate	Moderate	>5.5	<7.5		Moderate	Low	Moderate
<i>Durum wheat</i>	Moderate	Moderate	Moderate				Moderate	Low	--
<i>Spelt</i>	Moderate	Moderate	Moderate				Moderate	Moderate	--
<i>Barley (spring)</i>	Moderate	Moderate	Low	>6.0	<8.0	High	Moderate	Moderate	--
<i>Oat (spring)</i>	Low	Low	Low	>4.5	<8.0		Low	Moderate	--
<i>Winter rye</i>	Low	Moderate	Moderate	>5.0	<7.0		High	Moderate	High



Field Selection

- Reasonable well drained
- 'Free' of wild oats
- Know previous crop:
 - Avoid corn (risk of FHB)
 - Avoid heavily manured (risk of lodging due to excess N)
- Know herbicide history
 - Check for potential carry-over problems



Herbicide Carry-over

<i>Group</i>	<i>Product</i>	<i>Crop Rotation Restrictions</i> (months)
<i>Soil Applied</i>	Atrazine	24
	Triallate (Far Go)	18
	Triflurilan (Treflan)	18
	Sulfentrazone (Spartan)	12
<i>Post Applied</i>	Triasulfuron (Amber)	18
	Flucarbazone (Everest)	18
	Imazapic (Plateau)	24
	Imazamox (Pursuit)	18
	Aminopyralid (Milestone)	B
<i>Pre Mix</i>	Authority (sulfentrazone + imazethapyr)	18
	Boundary (S-metalachlor + metribuzin)	12
	Extreme (imazamox + glyphosate)	18



Principles of Crop Rotation

- A crop rotation is the order that crops are planted on the same field. The order of the different crops can have an major impact on grain yield and/or grain quality.
- Crop rotation is the oldest and probably most sustainable form of fertility and pest management:
 - Rotations can control or reduce disease, insect, and weed pressure
 - Rotations can improve soil fertility and soil structure
 - Rotations help manage available soil moisture



Example Rotations

Rotation	Year 1	Year 2	Year 3	Year 4	Year 5
<i>One</i>	Wheat (III-C) ¹	Corn (IV-W)	Soybean (I-W), or Canola (I-C)		
<i>Two</i>	Barley (III-C)	Dry bean (I-W)	Wheat (III-C)	Sunflower (I-W)	
<i>Three</i>	Sugarbeet (II-C)	Wheat (III-C)	Soybean (I-W)	Wheat (III-C)	
<i>Four</i>	Wheat (III-C)	Canola (I-C)	Barley (III-C)	Flax (II-C)	Soybean (I-W)
<i>Five</i>	Wheat (III-C)	Canola (I-C)	Barley (III-C)	Sunflower (I-W)	Dry pea (I-C)
<i>Six</i>	Wheat (III-C)	Canola (I-C)	Corn (IV-W)	Sunflower (I-W)	Dry pea (I-C)
<i>Seven</i>	Winterwheat (III-C)	Canola (I-C)	Barley (III-C)	Field pea (I-C)	Flax (II-C)
<i>Eight</i>	Wheat (III-C)	Corn (IV-W)	Canola (I-C)	Flax (II-W)	Alfalfa (II-P) years 5-7

¹ Roman numerals refer to crop group, C= cool season, W = warm season, and P = perennial.



Fertility Management

- Nitrogen N:
 - Topdress application to established stands in early spring is suggested.
 - MAP or DAP is more than adequate for starter
- Phosphate (P):
 - Aids in winter survival
 - Apply as starter (MAP, DAP)
- Potash (K)
 - Aids in winter survival
- Other nutrients
 - Not suggested



N Guidelines

	OM Level*	Expected Yield (bu./acre)				
		40-49	50-59	60-69	70-79	80 +
Alfalfa (4+ plants/ft ²)	Low	0	0	35	60	95
	Med and high	0	0	0	40	75
Alfalfa (2 to 3 plants/ft ²)	Low	0	0	40	65	90
	Med and high	0	0	20	45	70
Soybeans Alfalfa (1 or less plants/ft ²)	Low	40	65	90	115	140
	Med and high	20	45	70	95	120
Edible beans, field peas	Low	50	75	100	125	150
	Med and high	30	55	80	105	130
Group 1 Crops	Low	0	35	60	85	110
	Med and high	0	0	40	65	90
Group 2 Crops	Low	60	85	110	135	160
	Med and high	40	65	90	115	140



P Guidelines

Expected Yield	Phosphorus (P) Soil Test, ppm*					
	Bray:	0-5	6-10	11-15	16-20	21 +
lb./acre	Olsen:	0-3	4-7	8-11	12-15	16 +
		— P ₂ O ₅ to apply (lb./acre) —				
40-49		40	30	15	0	0
50-59		50	35	20	0	0
60-69		60	45	20	0	0
70-79		70	50	25	0	0
80 +		80	55	25	0	0



K Guidelines

Expected Yield	Potassium (K) Soil Test, ppm*				
	0-40	41-80	81-120	121-160	161 +
lb./acre					
40-49	100	75	45	0	0
50-59	130	95	55	0	0
60-69	155	110	65	0	0
70-79	180	125	75	0	0
80 +	190	135	80	0	0

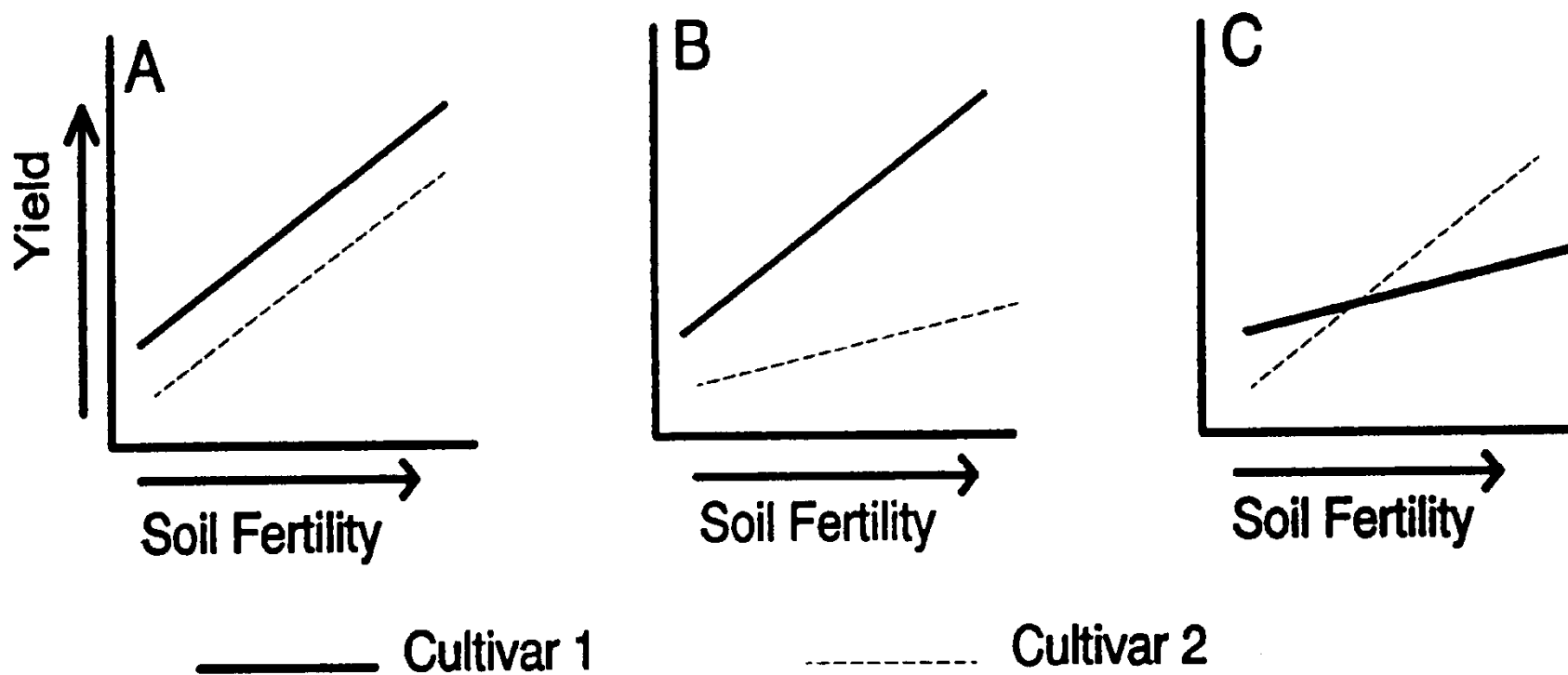


Variety Selection

- Some genetics:
 - Phenotype=Genotype+ G*E Interaction + Environment
 - G*E interaction is defined as the phenotypic expression of a genetic trait as a function of the environment.



G*E Interaction



Yield Trials

- Why does the U of M conduct yield trials?
 - To compare performance of varieties and provide unbiased information to producers in the State.
 - Under the authority granted by the Hatch Act of 1877 to conduct performance trials on farm crops and interpret the data to the public.



Challenges....

- No state funding:
 - Special MDS grant and support from industry
- Voluntary:
 - Entry in the trials is not a prerequisite for seed sales.
- Yield trial protocol versus ‘real world’
 - Do you use fungicides in a variety trial?



Grain Yield of Winter Rye Across Three Southern MN Locations in 2017

Entry	LeCenter	St. Paul	Lamberton	Crookston	Combined
	(bu/A)	(bu/A)	(bu/A)	(bu/A)	(bu/A)
Aroostook	31.6	29.5	81.5	55.4	52.5
Ebon	51.3	30.7	84.4	54.5	55.9
Hazlet	71.8	87.0	116.0	85.7	88.3
KWS Bono	149.3	117.9	152.8	117.7	125.4
KWS Brasetto	112.7	105.3	143.8	111.9	115.9
KWS Daniello	89.6	136.9	140.0	101.1	113.3
KWS Dolaro	143.4	105.3	139.0	101.4	112.5
KWS Gatano	124.0	110.8	144.8	115.5	117.7
KWS Progas	98.8	87.0	129.7	116.3	102.3
Maton II	42.0	34.6	80.4	48.3	51.8
Musketeer	41.2	46.8	95.2	71.1	66.0
ND Dylan	52.7	58.9	100.6	70.5	71.9
Oklon	39.6	36.3	83.3	45.9	54.3
Prima	39.4	54.5	99.2	80.5	70.3
Rymin	57.4	54.4	102.5	80.8	74.2
Spooner	51.7	50.2	88.4	72.6	60.6
Tulus*	102.5	78.5	158.5	55.5	124.6
Wheeler	38.6	24.1	74.2	29.7	45.1
LSD(0.1)	21.1	16.6	5.7	20.6	5.4
* Winter Triticale					



Grain Yield of Winter Rye Across Southern MN Locations from 2015-2017

Entry	LeCenter	St. Paul	Lamberton	Kimball ²	Crookston	Combined
	(bu/A)	(bu/A)	(bu/A)	(bu/A)	(bu/A)	(bu/A)
Aroostook	53.7	50.6	63.9	53.7	41.0	37.4
Dukato	97.5	76.1	96.7	97.5	66.4	69.5
Elbon	60.0	47.8	69.3	60.0	43.6	40.9
Hazlet	91.0	86.4	94.8	91.0	77.7	70.3
KWS Bono ¹	145.3	113.2	131.4	145.3	103.5	104.8
KWS Brasetto ¹	123.9	103.0	116.2	123.9	102.6	94.0
Maton II	55.8	49.0	63.1	55.8	38.3	35.4
Musketeer	68.4	52.9	78.1	68.4	63.2	53.8
Oklon	55.1	52.2	64.0	55.1	39.5	38.1
Prima	71.6	62.6	90.2	71.6	66.5	60.4
Rhymin	82.8	67.5	86.5	82.8	65.4	62.1
Spooner	76.6	71.0	81.5	76.6	57.7	56.5
SU Cossani ²	132.6	111.7	112.6	132.6	88.4	93.4
SU Forsetti ²	130.9	109.9	118.7	130.9	94.2	97.6
SU Memphisto ²	134.2	115.0	114.4	134.2	98.3	99.2
SU Performer ²	125.4	115.3	129.2	125.4	97.7	100.2
Tulus ³	89.1	66.5	114.8	89.1	61.7	67.6
Wheeler	36.0	30.7	49.1	36.0	24.6	19.6
LSD(0.1)	13.0	14.8	11.0	13.0	11.4	6.2
¹ 2016 and 2017 data						
² 2015 and 2016 data						
³ Winter triticale						

- Hybrid rye varieties are far superior in yield and agronomic performance
- Rhymin and Hazlet are probably still the best grain varieties of the available OP
- OK varieties are small seeded and not very well suited for MN



A Word of Caution

- Rye is a long-day species:
 - It will flower more rapidly as photoperiod increases
 - The literature suggests that rye has about an 18 hr. plus optimum photoperiod (i.e. really adapted to northern latitudes)
 - Non-optimal day lengths (i.e. shorter than 18 hrs.) likely delay heading and thus maturity, which may pose a risk of above optimum temperatures during grain fill.



Planting Depth

- Optimum planting depth is ~ 1.5 inches:
 - Quick emergence
 - Good likelihood for optimum seed to soil contact
 - Deep enough that soil moisture will not be depleted near the seed before seedling roots can root deep enough to sustain plant
 - Deep enough that plant will be anchor itself well with the crown roots that develop after seedling emergence
- Rye is more tolerant to greater seeding depths than either wheat or barley:
 - Length of sub-crown internode
 - Length of coleoptile



Row Spacing

- Seedbed utilization should be 15% or higher when moisture is not rate limiting:
 - Double disk drills: 6” and 7” inch spacing ideal, 10” acceptable
 - Airseeder: 10” and 12” row spacing acceptable as long as seed is banded



Starting Off Right

- To raise a good crop of rye start with:
 - Picking top yielding variety from regional trial data
 - Seeding early
 - Seeding $\sim 1.0 \times 10^6$ viable seed/acre
 - Using a suitable grain drill and calibrate it
 - Seeding about 1.5 deep



Sources of Winterkill

- Lethal temperatures at crown
 - Ice crystal formation
- Desiccation
 - Lack of snow cover
- Suffocation
 - Ice sheeting in fall
 - Flooding in the spring
- Soil heaving



Cultural Practices

- Minimize winterkill by:
 - Variety selection
 - Planting within optimum window:
 - 2 to 3 leaf rye is the optimum growth stage
 - Avoid fall infections of powdery mildew
 - No-till seeding and maintaining standing stubble
 - Use starter fertilizer

