



Integrated management of **Aphanomyces and Fusarium root rot** in field peas: (1) Impact of variety selection

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Research methods:

Study design:

Randomized studies with six replicates (randomized complete block with a split-split-plot arrangement, main factor = plant date, sub-factor = variety, sub-sub-factor = seed treatment)

Plots 5 ft x 30 ft at planting, 5 ft x approx. 20 ft at harvest.

Plots consist of 7 rows, each 7.5 or 7.0 inches apart

Seeding rate = 330,000 viable seeds/ac

Data collection:

Root rot: assessed at early to mid vegetative growth (4-10 nodes). The percent of the epicotyl + top 2.5 cm of the tap root diseased; assessed on 16, 36, or 50 roots/plot, depending on study and planting date. Half of the roots were collected from each plot end outside of the area assessed for yield.

Wilt: assessed at mid to late pod-fill. A visual estimate of the percent of the plants exhibiting root rot associated wilt symptoms. This was always assessed at a consistent growth stage across field pea varieties within each planting date.

Within each study, every effort was made to assess root rot and wilt at a consistent growth stage across every planting date and every field pea variety.

Yield: moisture was assessed at harvest and yields are reported at a standard 13.5% moisture

Fusarium and Aphanomyces root rot of field peas: **Integrated Management**

Carrington, ND (2024) Study #1 Field 17

		Planting date #1 Date: April 23-24 soil temperature: 45.2°F		Planting date #2 May 10 60.3°F		Planting date #3 May 22 56.4°F		Planting date #4 June 12-13 67.6°F	
average soil temp. at seeding depth in the 1 st 7 days after planting		Wilted plants (%)	Yield (bu/ac)	Wilted plants (%)	Yield (bu/ac)	Wilted plants (%)	Yield (bu/ac)	Wilted plants (%)	Yield (bu/ac)
Field pea variety	Fungicide seed treatment	80-97% pods fully filled	13.5% moisture	75-90% pods fully filled	13.5% moisture	85-100% pods fully filled	13.5% moisture	40-85% pods fully filled	13.5% moisture
AAC IronHorse	Non-treated seed	3 a*	69 a*	18 a*	42 a*	30 a*	38 a*	55 a*	14 b*
AAC IronHorse	Obvius, 4.6 fl oz/cwt	2 a	85 a	13 a	50 a	25 a	44 a	58 a	14 b
AAC IronHorse	Obvius, 4.6 fl oz/cwt + Relenya, 0.4 fl oz/cwt	3 a	85 a	17 a	54 a	24 a	37 a	59 a	13 b
AAC IronHorse	Vibrance Total, 5 fl oz/cwt	3 a	77 a	15 a	50 a	23 a	45 a	44 a	17 a
AAC IronHorse	Vibrance Total, 5 fl oz + Trebuset, 0.614 fl oz/cwt	3 a	73 a	12 a	50 a	23 a	42 a	37 a	19 a
		CV: 47.1	14.6	36.1	14.1	28.8	20.4	59.8	13.3
AAC Julius	Non-treated seed	10 a*	74 a*	27 a*	36 a*	57 a*	18 a*	71 b*	12 bc*
AAC Julius	Obvius, 4.6 fl oz/cwt	8 a	77 a	22 a	42 a	53 a	25 a	72 b	12 bc
AAC Julius	Obvius, 4.6 fl oz/cwt + Relenya, 0.4 fl oz/cwt	10 a	80 a	26 a	41 a	57 a	19 a	72 b	12 c
AAC Julius	Vibrance Total, 5 fl oz/cwt	8 a	87 a	23 a	44 a	47 a	25 a	65 ab	16 ab
AAC Julius	Vibrance Total, 5 fl oz + Trebuset, 0.614 fl oz/cwt	6 a	83 a	20 a	45 a	45 a	26 a	58 a	17 a
		CV: 44.8	10.9	25.6	19.0	19.0	31.8	11.2	17.5
ND Dawn	Non-treated seed	10 b*‡	73 a*	41 a*	31 b*	44 a*	29 a*	58 a*	15 a*
ND Dawn	Obvius, 4.6 fl oz/cwt	5 a	79 a	39 a	41 a	47 a	27 a	62 a	14 a
ND Dawn	Obvius, 4.6 fl oz/cwt + Relenya, 0.4 fl oz/cwt	6 ab	74 a	38 a	38 ab	46 a	28 a	65 a	13 a
ND Dawn	Vibrance Total, 5 fl oz/cwt	5 a	77 a	29 a	43 a	36 a	32 a	59 a	17 a
ND Dawn	Vibrance Total, 5 fl oz + Trebuset, 0.614 fl oz/cwt	5 a	79 a	31 a	42 a	36 a	33 a	58 a	18 a
		CV: 20.8	7.1	23.2	14.5	30.8	24.6	17.8	20.9
Caphorn	Non-treated seed	20 b*	67 a*	78 c*	23 a*	78 ab*	10 ab*	84 a*	4 a*
Caphorn	Obvius, 4.6 fl oz/cwt	9 ab	71 a	64 b	25 a	73 ab	10 ab	88 a	4 a
Caphorn	Obvius, 4.6 fl oz/cwt + Relenya, 0.4 fl oz/cwt	9 ab	78 a	68 bc	24 a	83 b	8 b	84 a	3 a
Caphorn	Vibrance Total, 5 fl oz/cwt	8 a	74 a	54 a	26 a	73 ab	13 ab	89 a	4 a
Caphorn	Vibrance Total, 5 fl oz + Trebuset, 0.614 fl oz/cwt	8 a	72 a	53 a	32 a	65 a	16 a	76 a	6 a
		CV: 60.9	9.9	11.0	27.3	10.6	36.4	17.6	59.8
AAC Profit	Non-treated seed	47 b*	50 b*	89 b*	10 c*	80 b*	10 a*	90 ab*	2 b*
AAC Profit	Obvius, 4.6 fl oz/cwt	33 ab	47 b	80 ab	15 abc	82 b	10 a	90 ab	3 b
AAC Profit	Obvius, 4.6 fl oz/cwt + Relenya, 0.4 fl oz/cwt	33 ab	51 b	83 ab	14 bc	86 b	8 a	91 b	2 b
AAC Profit	Vibrance Total, 5 fl oz/cwt	28 a	70 a	80 ab	20 ab	76 ab	9 a	88 ab	3 a
AAC Profit	Vibrance Total, 5 fl oz + Trebuset, 0.614 fl oz/cwt	24 a	59 ab	69 a	21 a	63 a	16 a	78 a	5 a
		CV: 29.2	14.7	10.4	25.0	10.2	38.2	8.3	33.7
LG Amigo	Non-treated seed	72 b*	27 a*	96 b*	6 b*	95 b*	4 a*	66 a*	4 a*
LG Amigo	Obvius, 4.6 fl oz/cwt	51 a	37 a	88 b	8 ab	88 b	9 a	65 a	5 a
LG Amigo	Obvius, 4.6 fl oz/cwt + Relenya, 0.4 fl oz/cwt	60 ab	30 a	91 b	6 b	95 b	6 a	59 a	6 a
LG Amigo	Vibrance Total, 5 fl oz/cwt	52 ab	39 a	83 ab	10 ab	86 b	6 a	66 a	6 a
LG Amigo	Vibrance Total, 5 fl oz + Trebuset, 0.614 fl oz/cwt	56 ab	39 a	68 a	12 a	66 a	8 a	59 a	9 a
		CV: 19.9	26.5	10.2	38.4	9.5	61.0	11.8	39.7

Seeding rate = 330,000 viable seeds/ac Row spacing = 7.5 inches

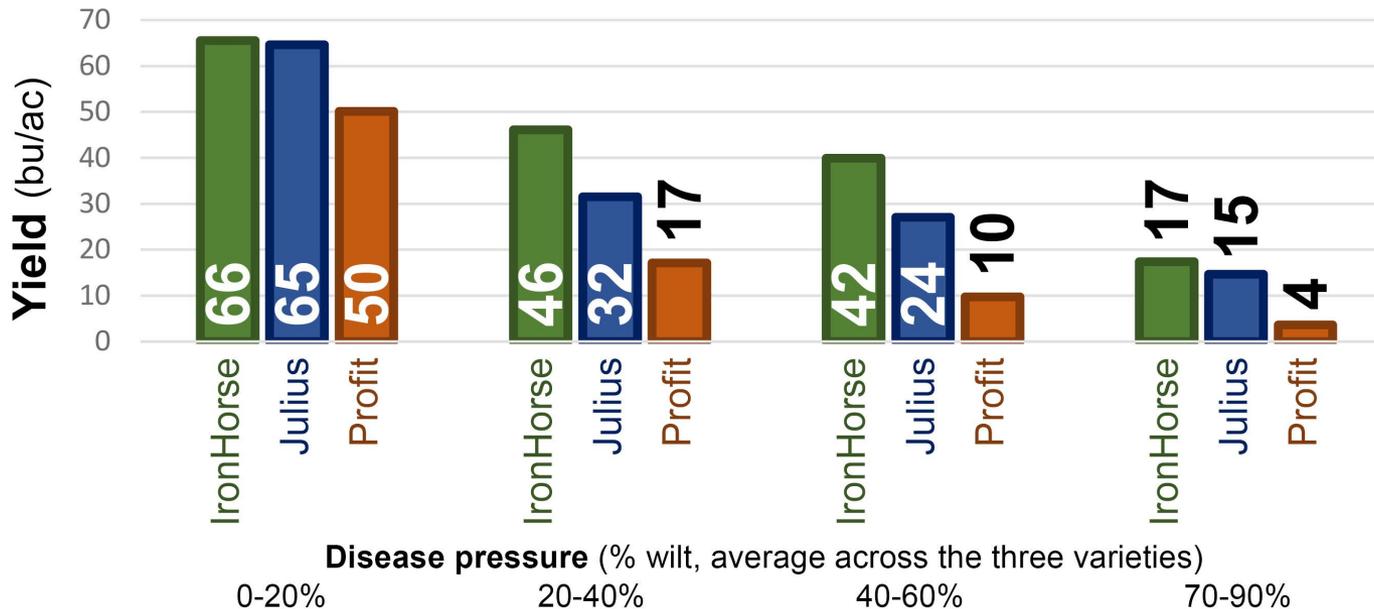
Fusarium and Aphanomyces root rot of field peas: **Integrated Management**

Carrington, ND (2024) Study #2 Field 18 south

		Planting date #1		Planting date #2		Planting date #3		Planting date #4	
		Date: April 23		May 12		May 22		June 12	
		soil temperature: 45.8°F		58.6°F		55.3°F		67.0°F	
average soil temp. at seeding depth in the 1 st 7 days after planting		Wilted plants (%)		Wilted plants (%)		Wilted plants (%)		Wilted plants (%)	
Field pea variety	Fungicide seed treatment	85-100% pods fully filled	Yield (bu/ac)	70-100% pods fully filled	Yield (bu/ac)	85-100% pods fully filled	Yield (bu/ac)	78-100% pods fully filled	Yield (bu/ac)
		13.5% moisture	13.5% moisture						
AAC IronHorse	Non-treated seed	3 a*	62 a*	6 a*	47 a*	7 a*	45 a*	78 a*	21 b*
AAC IronHorse	Obvious, 4.6 fl oz/cwt	1 a	69 a	6 a	43 a	7 a	45 a	73 a	24 ab
AAC IronHorse	Obvious, 4.6 fl oz/cwt + Relenya, 0.4 fl oz/cwt	2 a	68 a	8 a	44 a	9 a	46 a	77 a	21 b
AAC IronHorse	Vibrance Total, 5 fl oz/cwt	2 a	65 a	4 a	44 a	6 a	44 a	73 a	25 ab
AAC IronHorse	Vibrance Total, 5 fl oz + Trebuset, 0.614 fl oz/cwt	1 a	65 a	3 a	45 a	5 a	45 a	69 a	25 a
		CV: 62.8	7.9	58.6	9.8	35.2	7.0	12.5	11.2
AAC Julius	Non-treated seed	3 a*	55 a*	17 b*	31 a*	20 a*	32 b*	92 a*	17 c*
AAC Julius	Obvious, 4.6 fl oz/cwt	5 a	60 a	10 ab	34 a	28 a	31 b	92 a	18 bc
AAC Julius	Obvious, 4.6 fl oz/cwt + Relenya, 0.4 fl oz/cwt	6 a	57 a	13 ab	33 a	24 a	32 b	92 a	17 bc
AAC Julius	Vibrance Total, 5 fl oz/cwt	2 a	58 a	7 a	35 a	19 a	35 ab	86 a	20 ab
AAC Julius	Vibrance Total, 5 fl oz + Trebuset, 0.614 fl oz/cwt	1 a	61 a	7 a	35 a	21 a	38 a	85 a	23 a
		CV: 113.7	6.6	46.6	14.1	28.4	8.5	6.8	9.7
ND Dawn	Non-treated seed	5 a*	49 a*	14 a*	36 a*	21 a*	32 b*	93 ab*	19 b*
ND Dawn	Obvious, 4.6 fl oz/cwt	2 a	59 a	11 a	40 a	13 a	39 a	94 b	19 b
ND Dawn	Obvious, 4.6 fl oz/cwt + Relenya, 0.4 fl oz/cwt	2 a	59 a	13 a	42 a	15 a	38 ab	94 b	18 b
ND Dawn	Vibrance Total, 5 fl oz/cwt	3 a	55 a	15 a	34 a	17 a	37 ab	88 ab	24 a
ND Dawn	Vibrance Total, 5 fl oz + Trebuset, 0.614 fl oz/cwt	3 a	59 a	10 a	37 a	11 a	39 ab	88 a	25 a
		CV: 96.0	11.6	44.4	13.9	40.4	11.2	4.2	12.2
Caphorn	Non-treated seed	14 a*	58 a*	34 a*	28 a*	36 b*	26 b*	94 b*	9 b*
Caphorn	Obvious, 4.6 fl oz/cwt	13 a	58 a	24 a	32 a	30 ab	30 ab	88 ab	12 ab
Caphorn	Obvious, 4.6 fl oz/cwt + Relenya, 0.4 fl oz/cwt	19 a	56 a	25 a	33 a	30 ab	28 b	94 ab	10 b
Caphorn	Vibrance Total, 5 fl oz/cwt	14 a	58 a	26 a	31 a	24 ab	31 ab	84 ab	12 b
Caphorn	Vibrance Total, 5 fl oz + Trebuset, 0.614 fl oz/cwt	14 a	57 a	23 a	34 a	21 a	34 a	82 a	16 a
		CV: 39.0	7.6	25.9	14.5	26.7	11.0	8.7	17.5
AAC Profit	Non-treated seed	24 b*	50 a*	55 b*	19 c*	65 b*	16 c*	99 a*	4 b*
AAC Profit	Obvious, 4.6 fl oz/cwt	13 ab	55 a	42 ab	26 b	57 ab	18 bc	97 a	5 ab
AAC Profit	Obvious, 4.6 fl oz/cwt + Relenya, 0.4 fl oz/cwt	20 ab	51 a	41 ab	23 bc	63 b	17 c	99 a	4 b
AAC Profit	Vibrance Total, 5 fl oz/cwt	11 ab	54 a	33 a	26 b	47 a	23 ab	95 a	6 ab
AAC Profit	Vibrance Total, 5 fl oz + Trebuset, 0.614 fl oz/cwt	9 a	53 a	30 a	30 a	42 a	24 a	96 a	7 a
		CV: 42.6	7.4	19.9	14.3	16.6	13.8	2.9	32.8
LG Amigo	Non-treated seed	28 a*	12 b*	44 b*	10 a*	61 b*	7 b*	92 ab*	5 bc*
LG Amigo	Obvious, 4.6 fl oz/cwt	22 a	19 a	38 ab	10 a	59 b	8 ab	92 ab	5 bc
LG Amigo	Obvious, 4.6 fl oz/cwt + Relenya, 0.4 fl oz/cwt	22 a	21 a	36 ab	10 a	68 b	7 b	96 b	5 c
LG Amigo	Vibrance Total, 5 fl oz/cwt	16 a	23 a	24 a	11 a	57 b	10 ab	86 a	7 b
LG Amigo	Vibrance Total, 5 fl oz + Trebuset, 0.614 fl oz/cwt	14 a	21 a	24 a	12 a	37 a	11 a	86 a	10 a
		CV: 63.7	16.2	24.9	17.7	17.1	21.4	6.6	18.3

Seeding rate = 330,000 viable seeds/ac Row spacing = 7.5 inches

Fusarium and Aphanomyces root rot of field peas: **Impact of variety selection**



Carrington, ND (2024)

Results across 2 studies, 4 plant dates/study (April 23-June 13)

Seeding rate:

330,000 viable seeds/ac

Row spacing = 7.5 inches

Wilt was assessed at late pod-fill.

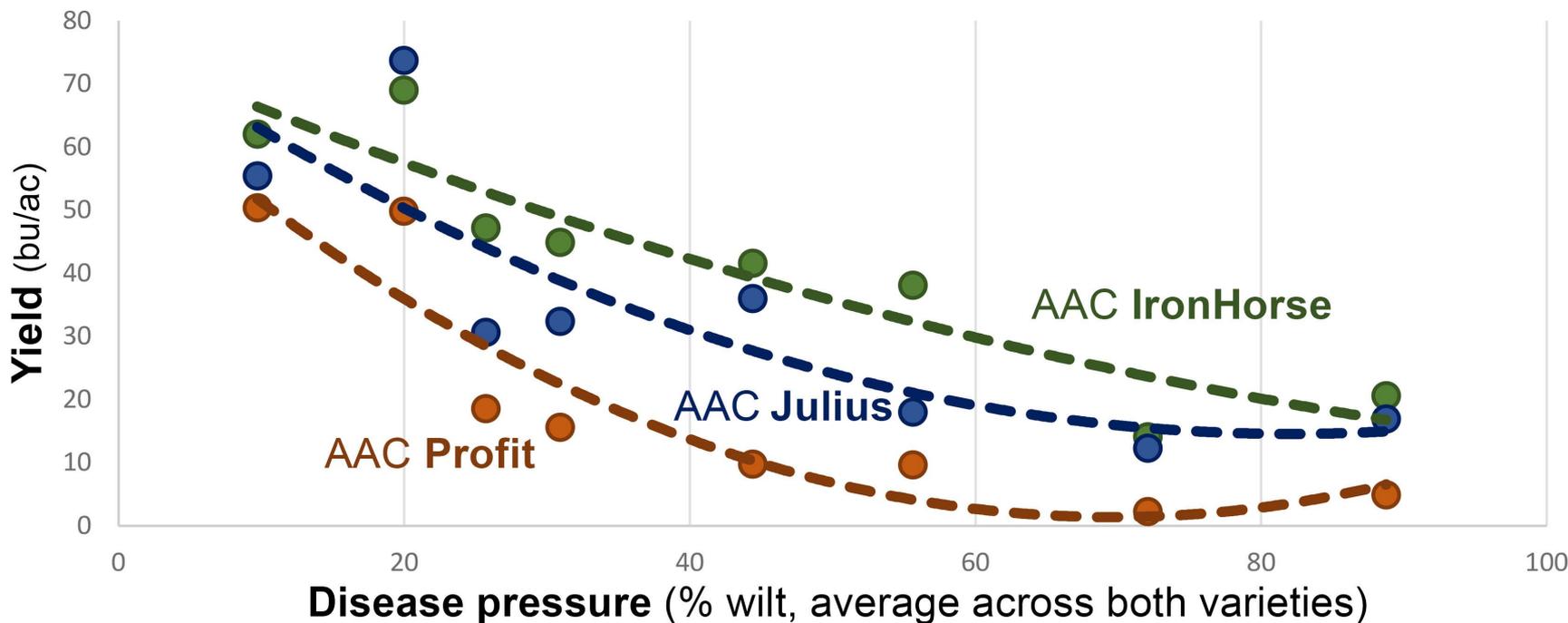
Visual estimate of the percent of the plants exhibiting wilt symptoms.

Plant date #1: 80-100% pods fully filled

Plant date #2: 70-100% pods fully filled

Plant date #3: 85-100% pods fully filled

Plant date #4: 40-100% pods fully filled



Fusarium and Aphanomyces root rot of field peas: **Impact of variety selection**

Carrington, ND (2024)

Results across 2 studies, 4 plant dates/study (April 23-June 13)

Seeding rate:

330,000 viable seeds/ac

Row spacing = 7.5 inches

Wilt was assessed at late pod-fill.

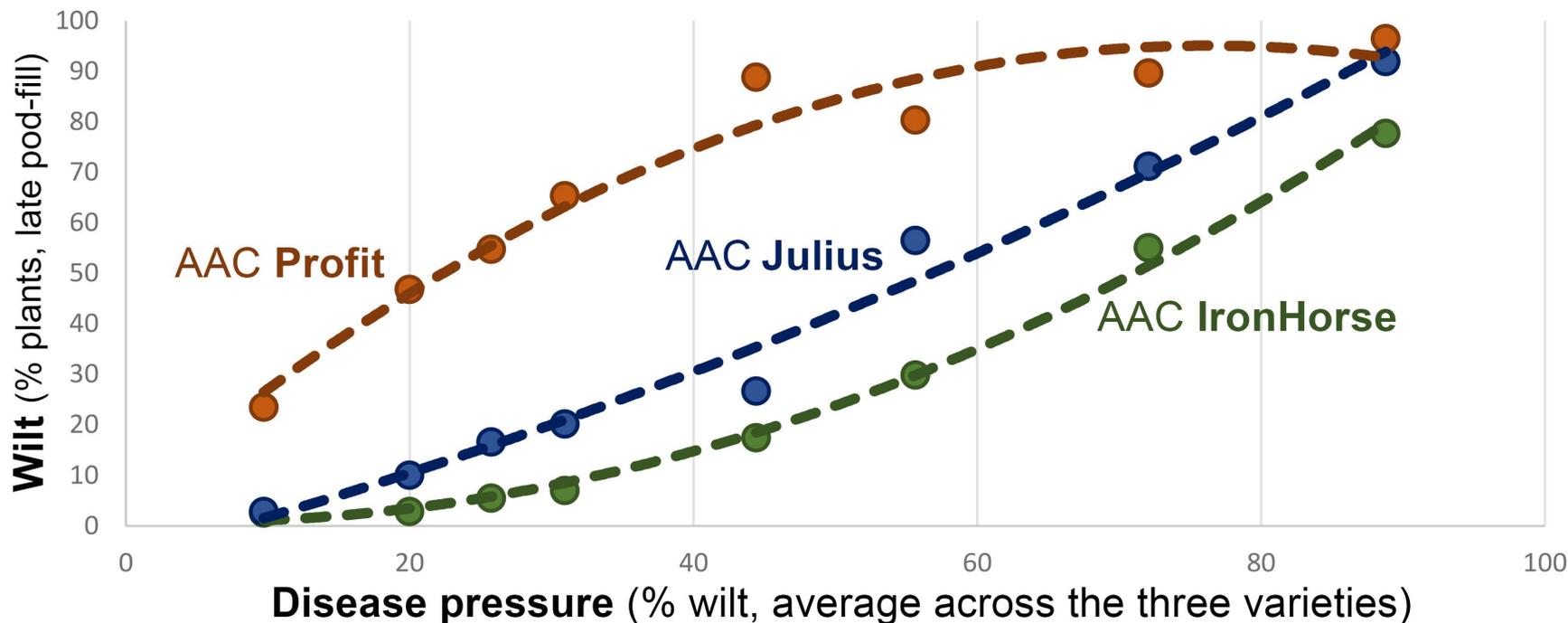
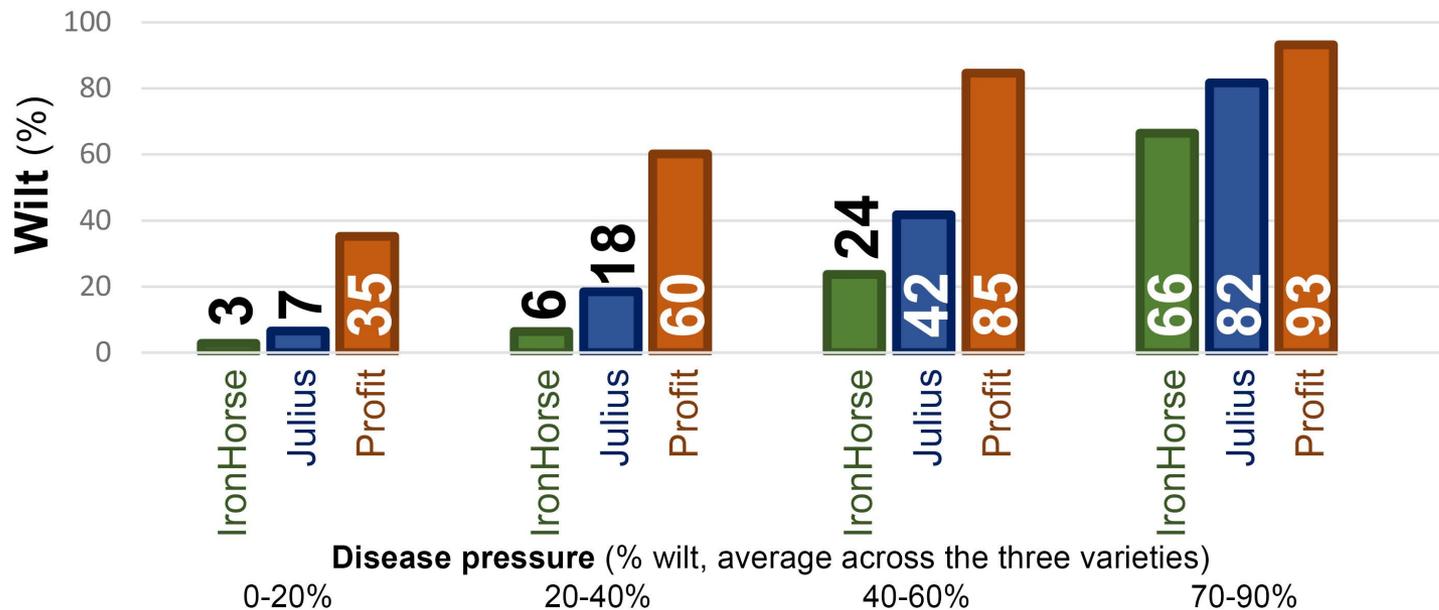
Visual estimate of the percent of plants exhibiting wilt symptoms.

Plant date #1: 80-100% pods fully filled

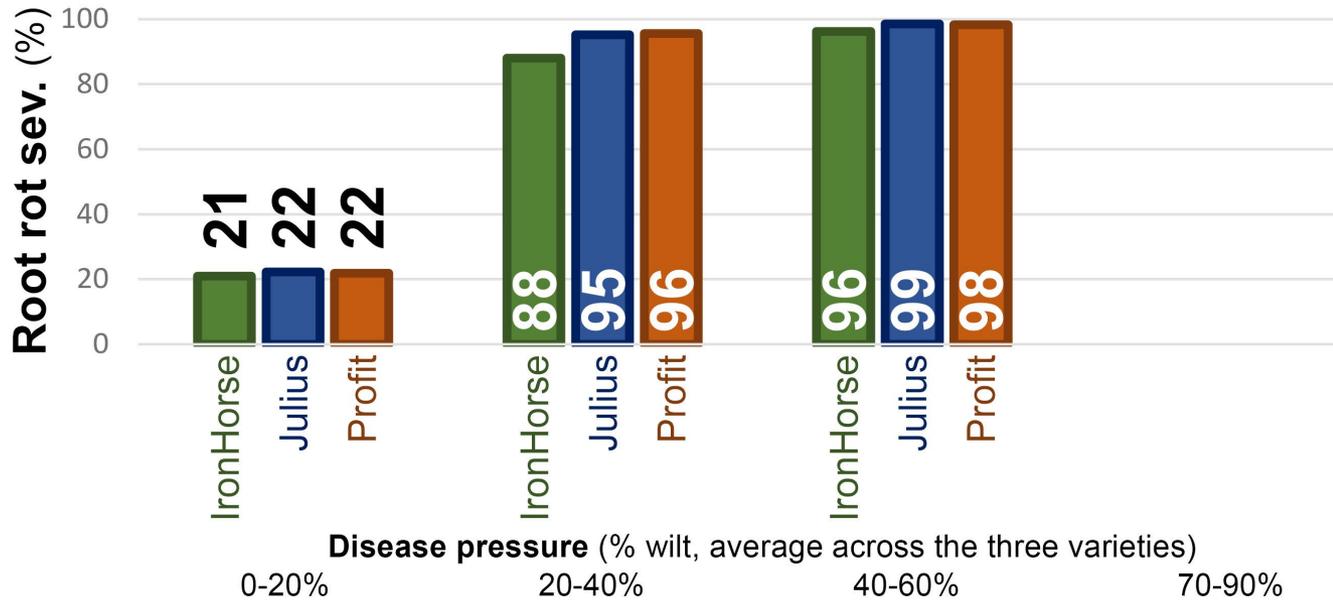
Plant date #2: 70-100% pods fully filled

Plant date #3: 85-100% pods fully filled

Plant date #4: 40-100% pods fully filled



Fusarium and Aphanomyces root rot of field peas: **Impact of variety selection**



Carrington, ND (2024)

Results across 2 studies, 4 plant dates/study (April 23-June 13)

Seeding rate:

330,000 viable seeds/ac

Row spacing = 7.5 inches

Root rot was assessed at early/mid vegetative growth.

Percent of the epicotyl plus first 2.5 cm of the tap root exhibiting yellow-brown cortical decay characteristic of Aphanomyces root rot and necrosis characteristic of Fusarium root rot

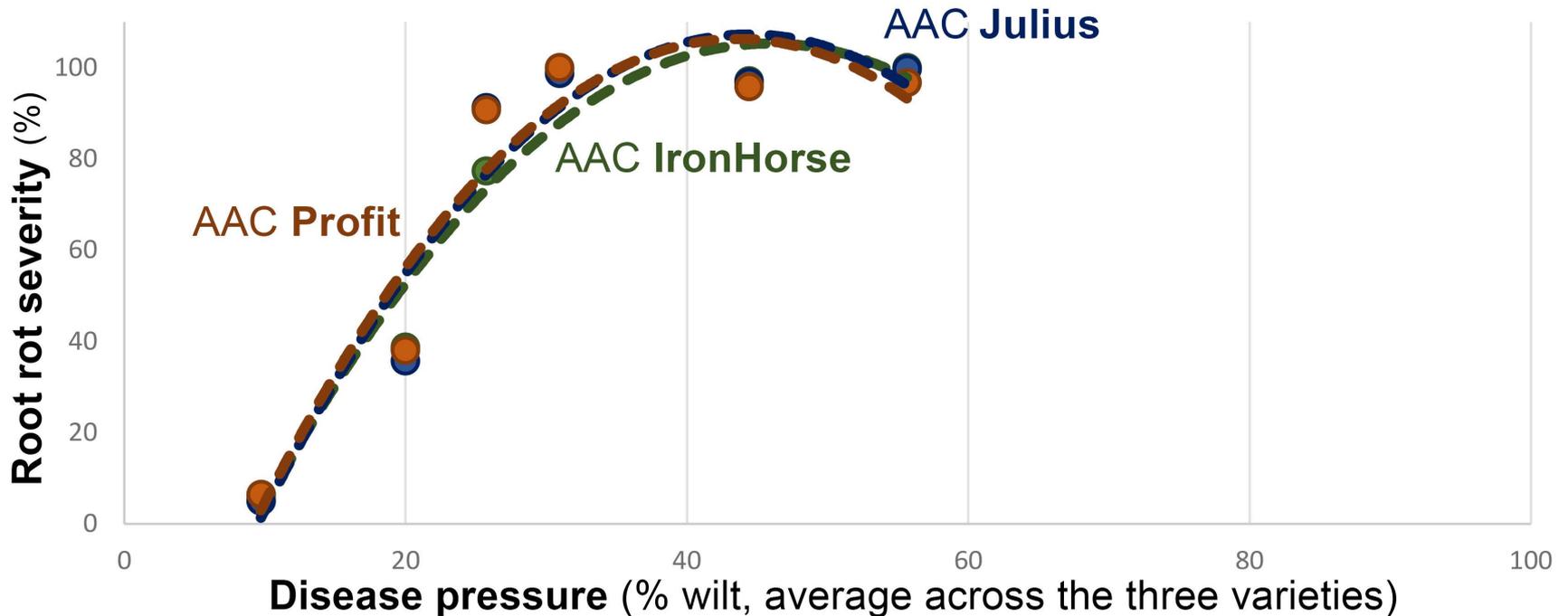
Plant date #1: 4-6 nodes

Plant date #2: 6-8 nodes

Plant date #3: 5-9 nodes

Plant date #4: root rot not assessed

Sample size = 36 plants/plot x 6 replicates (plant dates #1, #2); 16 plants/plot x 6 replicates (plant date #3)



Fusarium and Aphanomyces root rot of field peas: **Impact of variety selection**

Pathogen diagnostic testing for studies conducted in 2024 is in progress.

Diagnostic testing results from the same field where study #2 was conducted in 2024:

	Field: F18 south	F18 north	F18 north
Last year seeded to peas:	2015	2020	2019
Years out of peas:	7	2	3
<i>Aphanomyces euteiches</i> (thousand DNA copies/gram of root)			
AAC Julius , non-treated	25260	16818	10670
AAC Profit , non-treated	751	10563	957
<i>Fusarium oxysporum</i> (thousand DNA copies/gram of root)			
AAC Julius , non-treated	0	1.9	0
AAC Profit , non-treated	0	0	0
<i>Fusarium avenaceum</i> (thousand DNA copies/gram of root)			
AAC Julius , non-treated	0	0	0
AAC Profit , non-treated	0	0	0

Carrington, ND (2023)

- Diagnostic qPCR testing conducted by the National Agriculture Genotyping Center.
- Results 3 studies conducted on Field 18. Each study was conducted with 3 or 4 planting dates (June 22-June 9).
- Results represent the average across four qPCR tests per study (one per planting date). Each test represents a combined sample of six 1-cm long epicotyl segments, one collected from each of the six experimental replicates. The 1-cm long epicotyl segments were collected from a plant with root rot symptoms typical of that plot. Testing was only conducted on plants grown from non-treated seed.

Fusarium and Aphanomyces root rot of field peas: Impact of variety selection

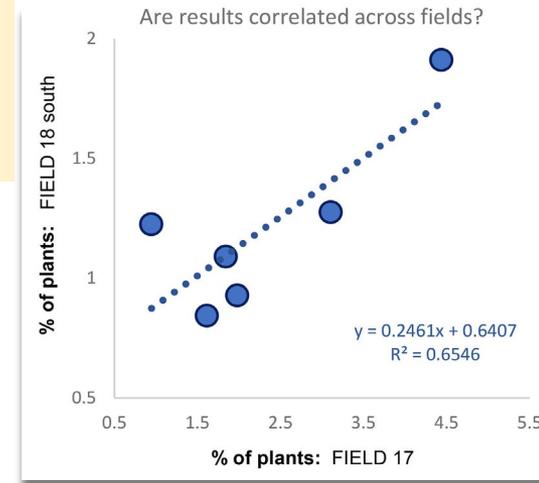
Carrington, ND (2024):

Vascular necrosis characteristic of *Fusarium oxysporum* wilt was observed only at low levels

Vascular necrosis

% of plants with vascular discoloration typical of *F. oxysporum* wilt

	Field 17	Field 18 south	Combined analysis
planting date 1	5-6 nodes	4-5 nodes	
planting date 2	6-8 nodes	6-8 nodes	
planting date 3	7-9 nodes	~5-8 nodes	
AAC IronHorse	1.8 ab	1.1 a	1.5 a
AAC Julius	4.4 c	1.9 a	3.2 a
ND Dawn	1.6 ab	0.8 a	1.2 a
Caphorn	2.0 ab	0.9 a	1.5 a
AAC Profit	3.1 bc	1.3 a	2.2 a
LG Amigo	0.9 a	1.2 a	1.1 a
<i>F</i> , <i>P</i> > <i>F</i> :	7.01, < 0.0001	0.86, 0.5128	2.64, 0.1552
CV:	130.4	233.4	38.8



SAMPLE SIZE USED FOR ANALYSIS:

Plant date #1: 36 roots/plot across 6 replicates

Plant date #2: 36 roots/plot across 6 replicates

Plant date #3: 16 roots/plot across 6 replicates

Plant date #4: vascular necrosis not assessed

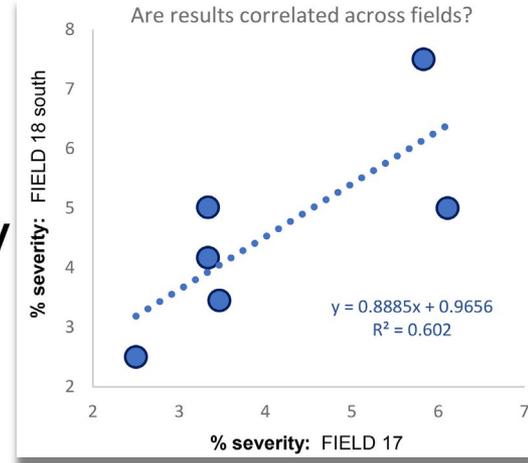
Fusarium and Aphanomyces root rot of field peas: **Impact of variety selection**

Carrington, ND (2024):

Fusarium spp. was only isolated from vascular tissues at low levels, suggesting *F. oxysporum* wilt pressure was not high

Fusarium vascular wilt microbiological assay

% stem sections from which *Fusarium* spp. isolated from vascular tissues



	Field 17	Field 18 south	Combined analysis
planting date 1	5-6 nodes	4-5 nodes	
planting date 2	6-8 nodes	6-8 nodes	
planting date 3	7-9 nodes	~5-8 nodes	
AAC IronHorse	6	8	7 b
AAC Julius	3	3	3 a
ND Dawn	6	5	6 ab
Caphorn	3	4	4 ab
AAC Profit	3	3	3 ab
LG Amigo	3	5	4 ab

SAMPLE SIZE USED FOR ANALYSIS:

Plant date #1: 10 roots/plot across 6 replicates

Plant date #2: 10 roots/plot across 6 replicates

Plant date #3: not assessed

Plant date #4: not assessed

F, P>F:

7.65, 0.0217

CV:

17.8

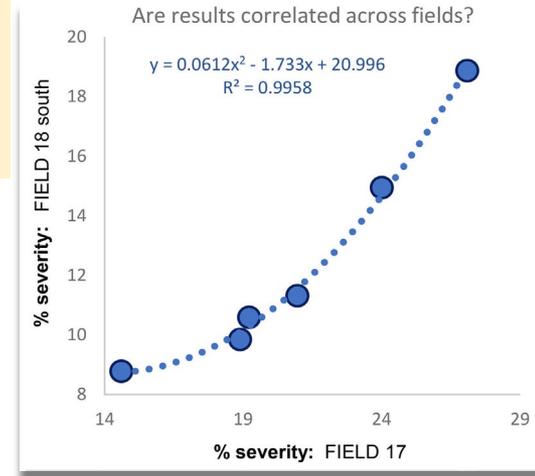
Fusarium and Aphanomyces root rot of field peas: **Impact of variety selection**

Carrington, ND (2024):

Varieties differed in severity of Fusarium root rot symptoms but these differences do not explain agronomic performance

Fusarium root rot

% of epicotyl and top 1-in. of tap root with symptoms of Fusarium root rot



	Field 17	Field 18 south
planting date 1	5-6 nodes	4-5 nodes
planting date 2	6-8 nodes	6-8 nodes
planting date 3	7-9 nodes	~5-8 nodes

Combined analysis

AAC IronHorse	19 ab	10 a	14 ab
AAC Julius	27 b	19 b	23 d
ND Dawn	21 ab	11 ab	16 bc
Caphorn	19 ab	11 ab	15 ab
AAC Profit	24 ab	15 ab	19 cd
LG Amigo	15 a	9 a	12 a

$F, P>F:$ 3.52, 0.0066 3.03, 0.0166 35.70, 0.0006

CV: 58.4 67.5 5.7

SAMPLE SIZE USED FOR ANALYSIS:

Plant date #1: 36 roots/plot across 6 replicates

Plant date #2: 36 roots/plot across 6 replicates

Plant date #3: 16 roots/plot across 6 replicates

Plant date #4: vascular necrosis not assessed

Fusarium and Aphanomyces root rot of field peas: **Impact of variety selection**

Carrington, ND (2024):
Symptoms characteristic of Aphanomyces root rot were predominant. Differences in tolerance drove yield response.

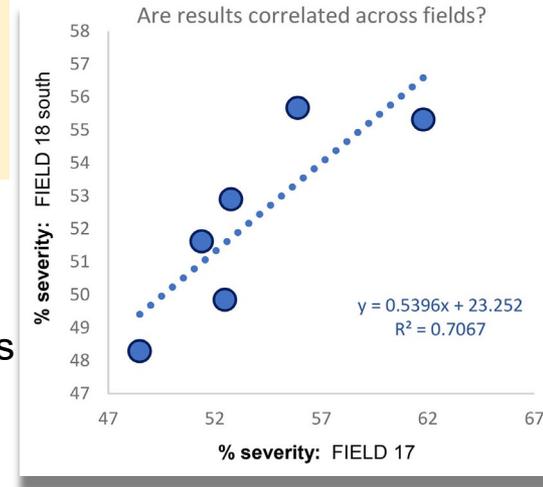
Aphanomyces root rot

% of epicotyl and top 1-in. of tap root with Aphanomyces root rot symptoms

	Field 17	Field 18 south
planting date 1	5-6 nodes	4-5 nodes
planting date 2	6-8 nodes	6-8 nodes
planting date 3	7-9 nodes	~5-8 nodes

	Field 17	Field 18 south	Combined analysis
AAC IronHorse	56 ab	56 a	56 ab
AAC Julius	48 a	48 a	48 a
ND Dawn	53 ab	53 a	53 ab
Caphorn	51 ab	52 a	52 ab
AAC Profit	52 ab	50 a	51 ab
LG Amigo	62 b	55 a	59 b

<i>F</i> , <i>P</i> > <i>F</i> :	3.10, 0.0134	1.26, 0.2934	7.48, 0.0227
CV:	26.4	19.4	3.5

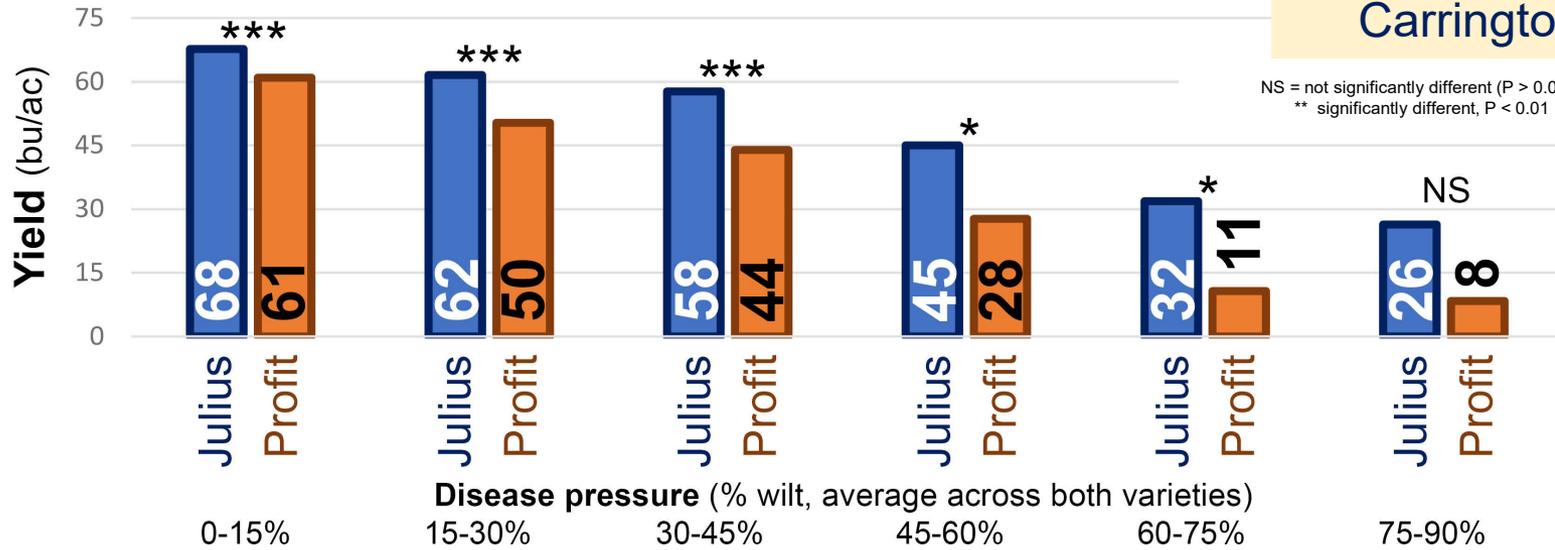


SAMPLE SIZE USED FOR ANALYSIS:

- Plant date #1: 36 roots/plot across 6 replicates
- Plant date #2: 36 roots/plot across 6 replicates
- Plant date #3: 16 roots/plot across 6 replicates
- Plant date #4: vascular necrosis not assessed

Fusarium and Aphanomyces root rot of field peas: **Impact of variety selection**

Carrington, ND (2023)



NS = not significantly different (P > 0.05) * significantly different, P < 0.05
 ** significantly different, P < 0.01 *** significantly different, P < 0.001

Results across 11 studies. 4 plant dates/study (May 22 - June 9)

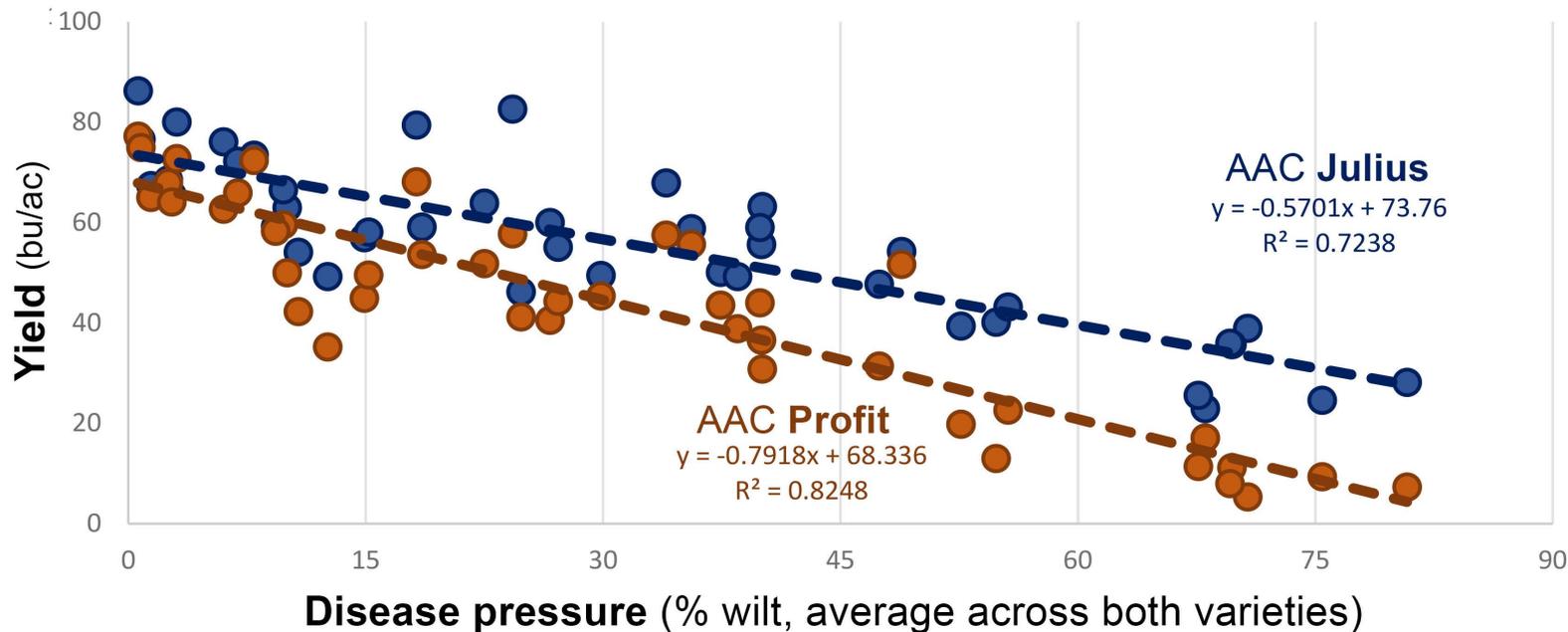
Seeding rate: 330,000 viable seeds/ac

Row spacing = 7.5 inches

Wilt was assessed during pod-fill.

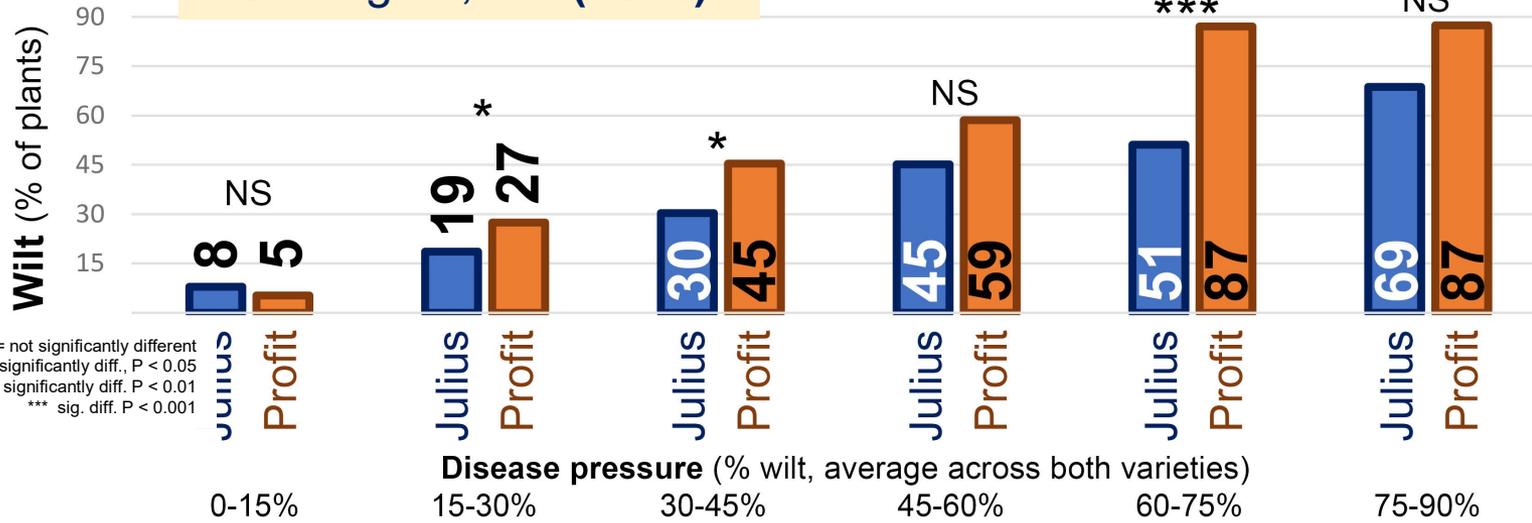
Visual estimate of the percent of the plants exhibiting wilt symptoms.

Plant date #1: 16-45% pods fully filled
 Plant date #2: 16-71% pods fully filled
 Plant date #3: 32-75% pods fully filled
 Plant date #4: 28-91% pods fully filled



Fusarium and Aphanomyces root rot of field peas: **Impact of variety selection**

Carrington, ND (2023)



NS = not significantly different
 * significantly diff., P < 0.05
 ** significantly diff., P < 0.01
 *** sig. diff. P < 0.001

Results across 11 studies, 4 plant dates/study (May 22 - June 9)

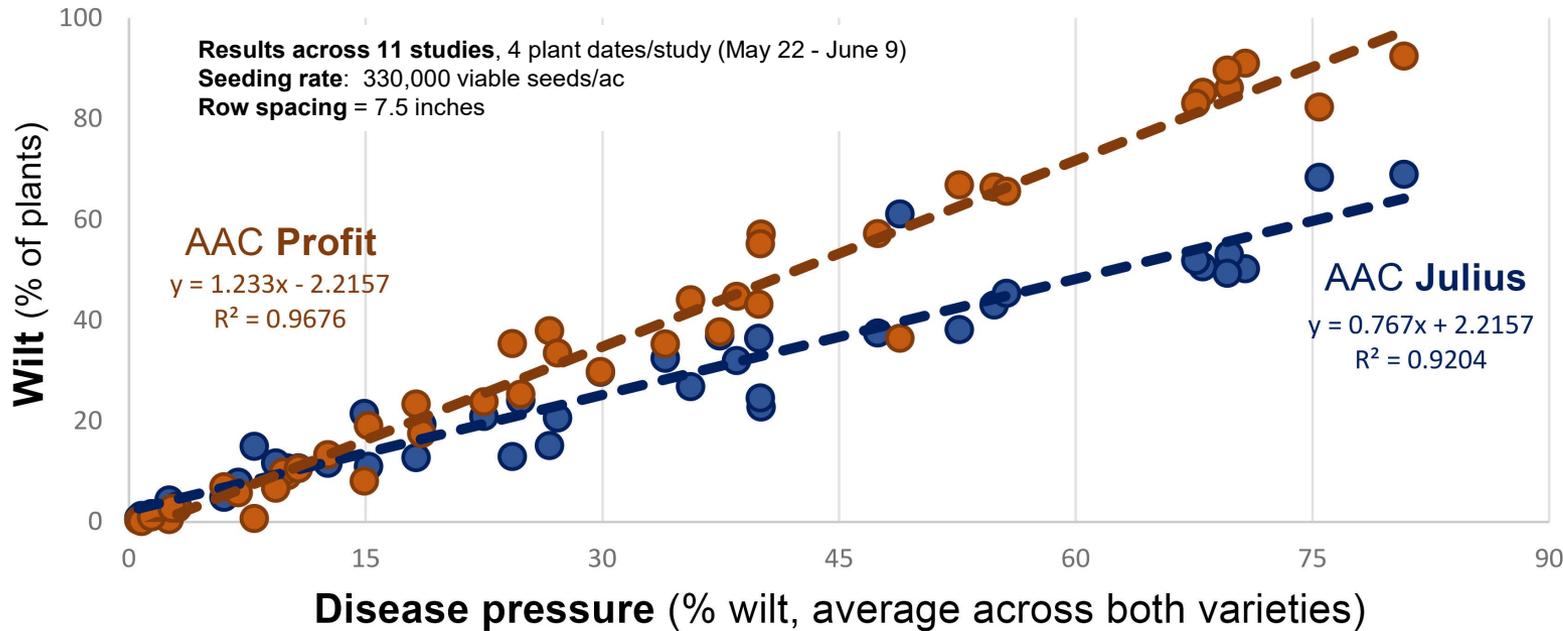
Seeding rate:
330,000 viable seeds/ac

Row spacing = 7.5 inches

Wilt was assessed during pod-fill.

Visual estimate of the percent of the plants exhibiting wilt symptoms.

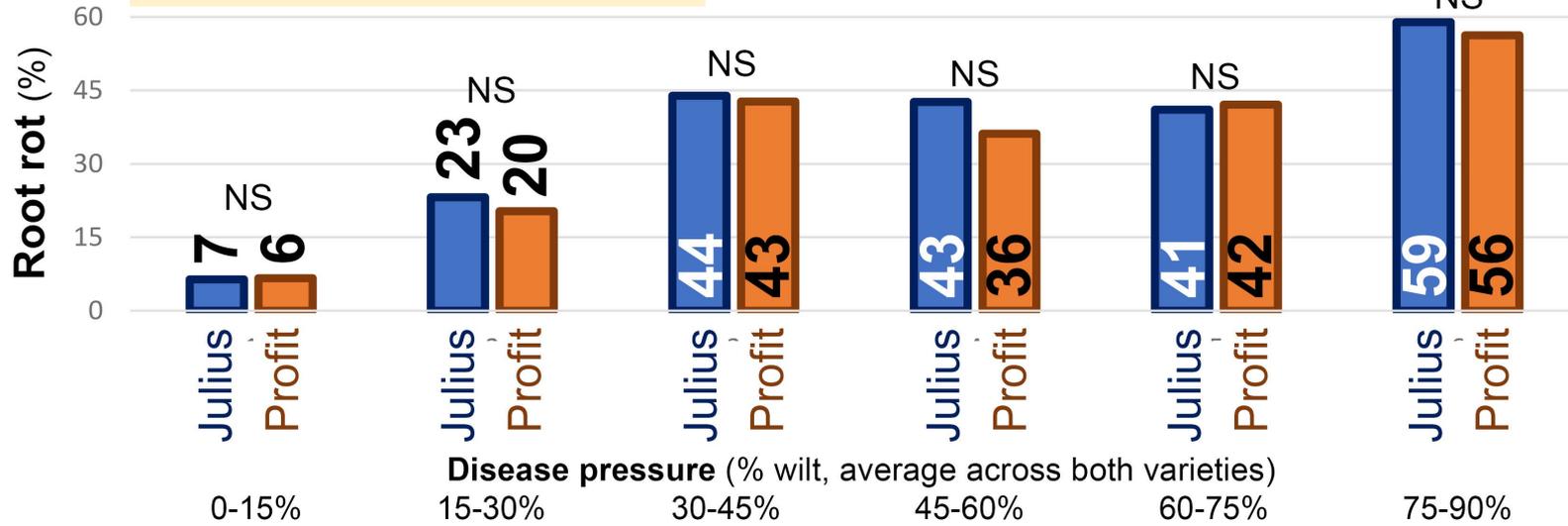
Plant date #1: 16-45% pods fully filled
 Plant date #2: 16-71% pods fully filled
 Plant date #3: 32-75% pods fully filled
 Plant date #4: 28-91% pods fully filled



Fusarium and Aphanomyces root rot of field peas: **Impact of variety selection**

Carrington, ND (2023)

NS = not significantly different * significantly different, P < 0.05
 ** significantly different, P < 0.01 *** significantly different, P < 0.001



Results across 11 studies. 4 plant dates/study (May 22 - June 9)

Seeding rate: 330,000 viable seeds/ac

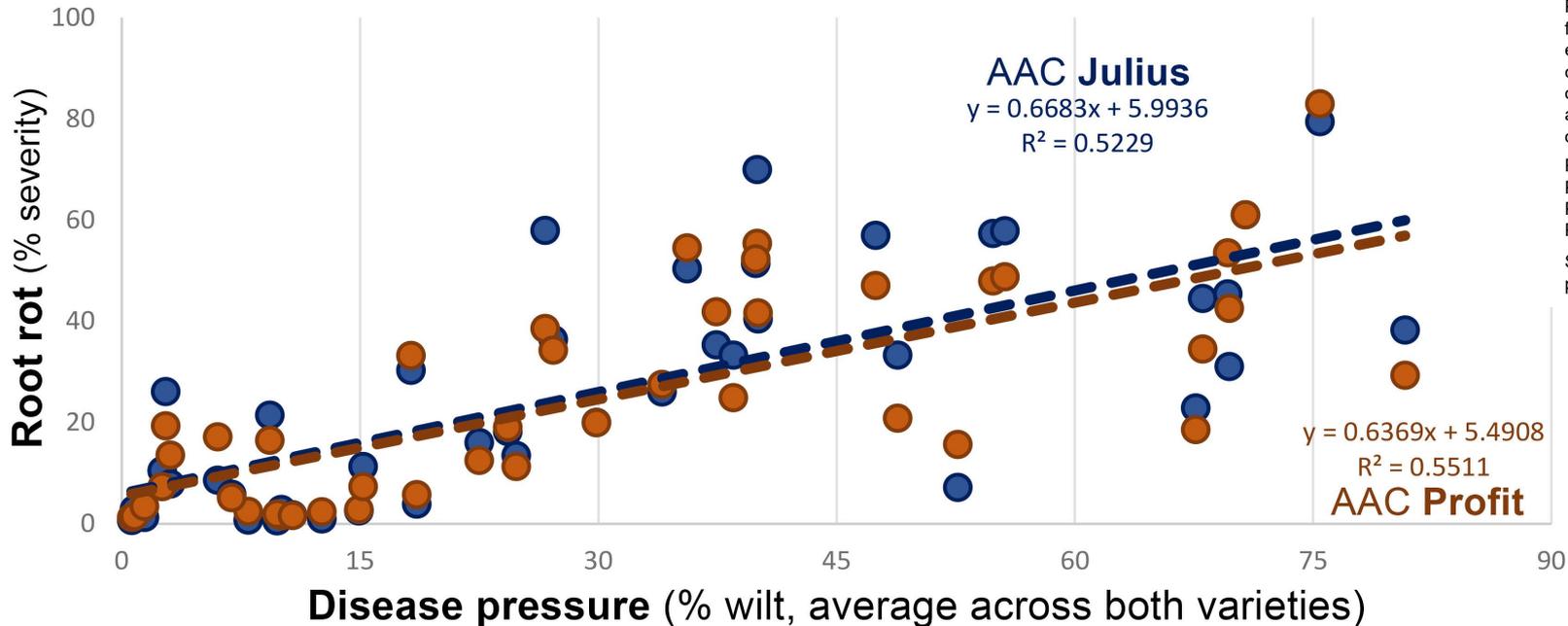
Row spacing = 7.5 inches

Root rot was assessed at early/mid vegetative growth.

Percent of the epicotyl plus first 2.5 cm of the tap root exhibiting yellow-brown cortical decay characteristic of Aphanomyces root rot and necrosis characteristic of Fusarium root rot

Plant date #1: 4-8 nodes
 Plant date #2: 4-8 nodes
 Plant date #3: 4-9 nodes
 Plant date #4: 5-11 nodes

Sample size = 36 plants per plot x 6 replicates



Fusarium and Aphanomyces root rot of field peas: **Impact of variety selection**

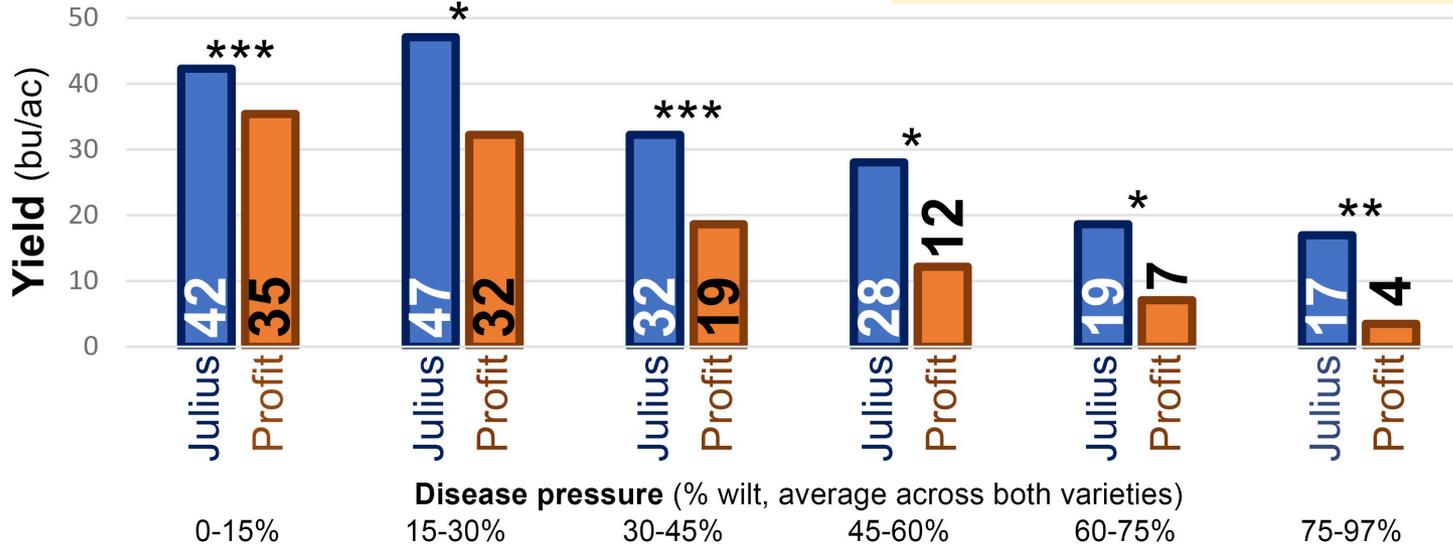
Carrington, ND (2023)

Results across 11 studies, 4 plant dates/study (May 22 - June 9)
Seeding rate: 330,000 viable seeds/ac Row spacing = 7.5 inches

Field:	Field Q9F	Field Q9G	Field Q9A	Field 1	Field Q9B	F18 south	Field Q9D	Q9E east	Q9E west	F18 north	F18 north	COMBINED ANALYSIS
Last year seeded to peas:	2016	2013	2019	2020	2015	2015	2020	2015	2018	2020	2019	
Years out of peas:	12	9	3	2	7	7	2	7	4	2	3	
<i>Aphanomyces euteiches</i> (thousand DNA copies/gram of root)												
AAC Julius, non-treated	0	0	319	154627	47830	25260	38558	10616	17290	16818	10670	29272 a
AAC Profit, non-treated	0	0	47422	120633	37114	751	40581	110068	72670	10563	957	40069 a
<i>Fusarium oxysporum</i> (thousand DNA copies/gram of root)												
AAC Julius, non-treated	1.6	4.8	5.0	0	0	0	0	0	0	1.9	0	1.2 b
AAC Profit, non-treated	0	0	0	0	0	0	0	0	0	0	0	0 a
PLANT POPULATION (plants/ac; early vegetative growth)												
AAC Julius, non-treated	329459 a	328551 a	351311 a	336356				COMBINED ANALYSIS			327039 ab	
AAC Julius, Obvius	337227 a	333452 a	357265 a	343834							334608 a	
AAC Profit, non-treated	336864 a	319730 a	354070 a	343688							324606 b	
AAC Profit, Obvius	315592 a	327680 a	333887 a	350222							322121 b	
CV:	11.7	12.5	8.9	11.6							2.3	
ROOT ROT SEVERITY (%; early/mid vegetative growth)												
AAC Julius, non-treated	4 ab	14 a	6 a	16				COMBINED ANALYSIS			27 b	
AAC Julius, Obvius	2 ab	10 a	6 a	14							23 a	
AAC Profit, non-treated	3 b	11 a	9 a	17							26 ab	
AAC Profit, Obvius	1 a	10 a	7 a	13							23 a	
CV:	91.6	25.1	34	24.6							9.2	
WILTED PLANTS (%; mid/late pod-fill)												
AAC Julius, non-treated	5 b	6 ab	10 a	14				COMBINED ANALYSIS			26 a	
AAC Julius, Obvius	3 b	6 ab	12 a	21							32 ab	
AAC Profit, non-treated	0 a	4 a	7 a	23							37 bc	
AAC Profit, Obvius	1 a	6 b	10 a	31							44 c	
CV:	43.7	19.4	27.8	18.2							21.7	
YIELD (bushels/acre)												
AAC Julius, non-treated	76 a	66 ab	69 a	73				COMBINED ANALYSIS			56 a	
AAC Julius, Obvius	76 a	69 a	68 a	68							52 a	
AAC Profit, non-treated	73 a	63 bc	58 b	59							43 b	
AAC Profit, Obvius	72 a	59 c	57 b	51							37 c	
CV:	7.8	8.7	10.1	13.3	15.1	15	16.9	20	27.9	47.6	26.2	8.2

Fusarium and Aphanomyces root rot of field peas: **Impact of variety selection**

Carrington, ND (2024)



Results across 11 studies, 4 plant dates/study (April 23 - June 13)

Seeding rate: 330,000 viable seeds/ac

Row spacing = 7.5 inches

NS = not significantly different
 * significantly different, P < 0.05
 ** significantly different, P < 0.01
 *** significantly different, P < 0.001

Wilt was assessed at mid to late pod-fill.

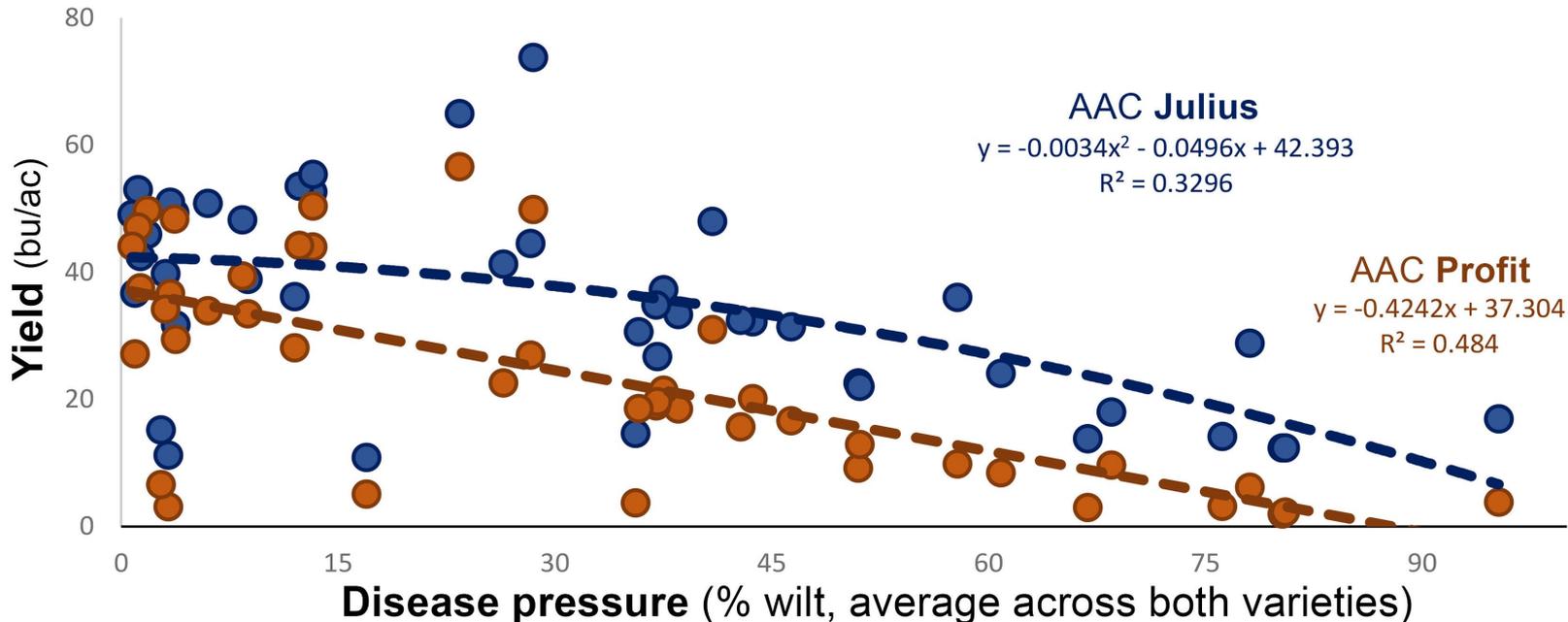
Visual estimate of the percent of the plants exhibiting wilt symptoms.

Plant date #1: 55-100% pods fully filled

Plant date #2: 30-100% pods fully filled

Plant date #3: 30-100% pods fully filled

Plant date #4: 10-100% pods fully filled



Fusarium and Aphanomyces root rot of field peas: **Impact of variety selection**

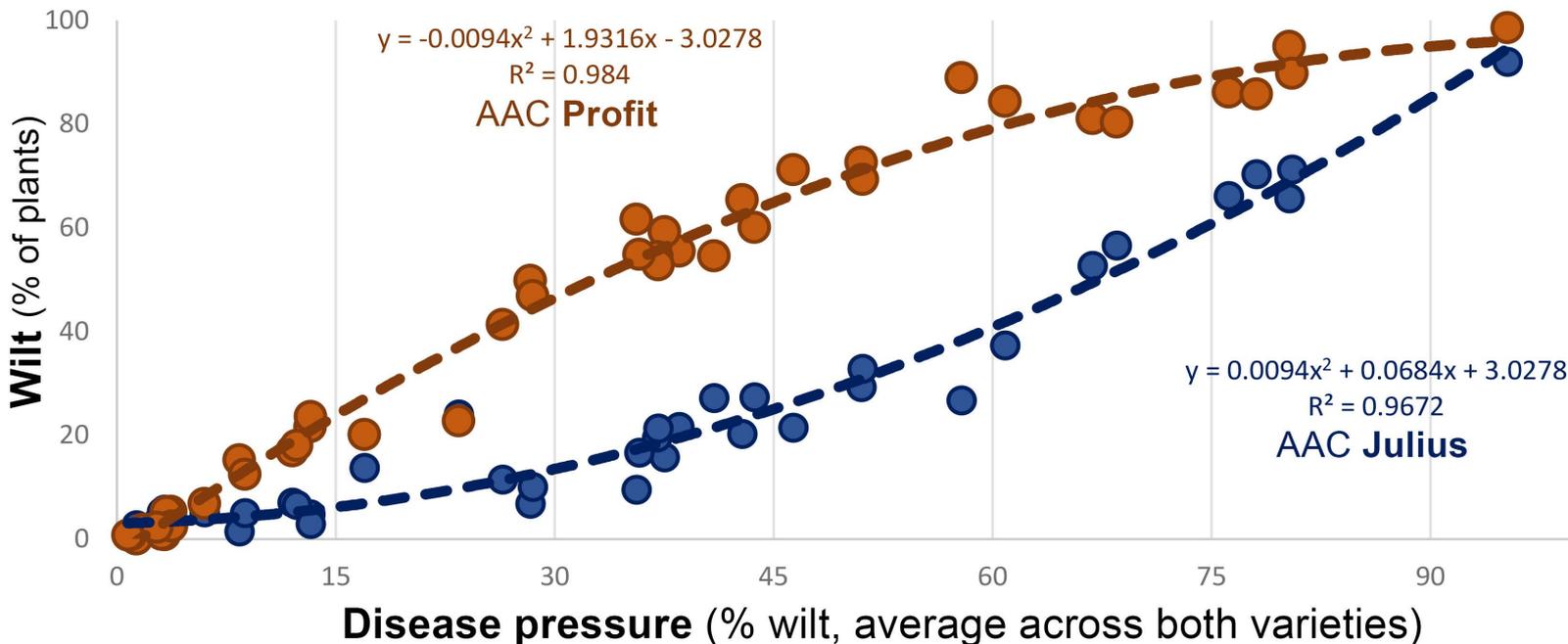
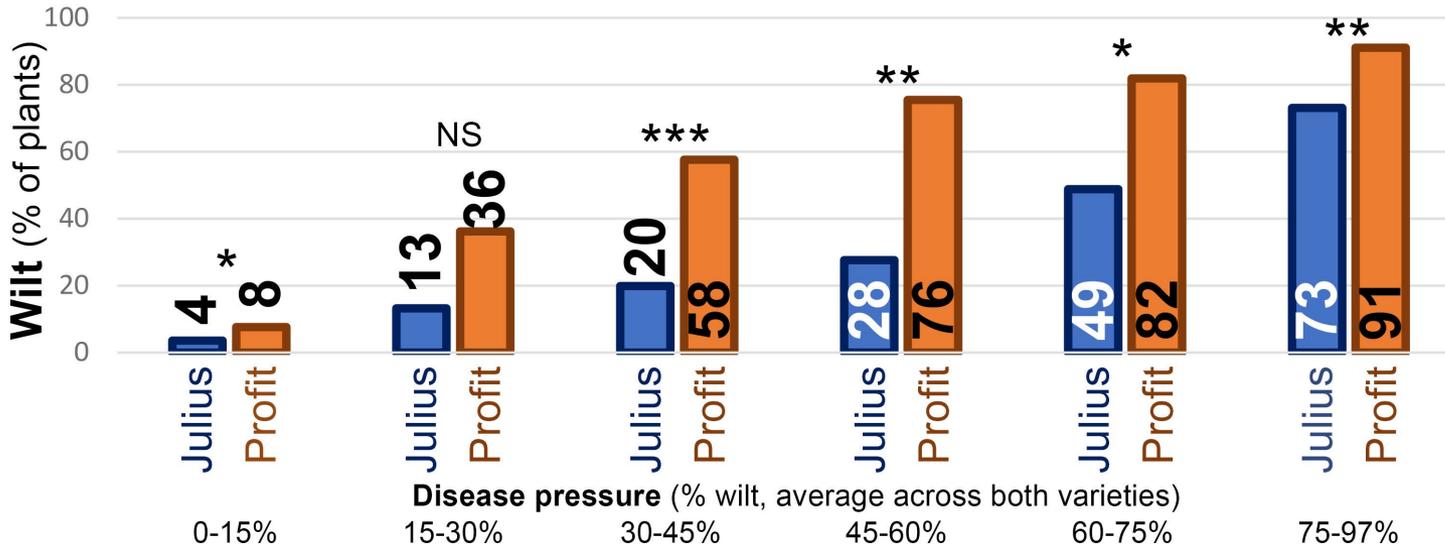
Carrington, ND
(2024)

Results across 11 studies, 4 plant dates/study (April 23 - June 13)

Seeding rate: 330,000 viable seeds/ac

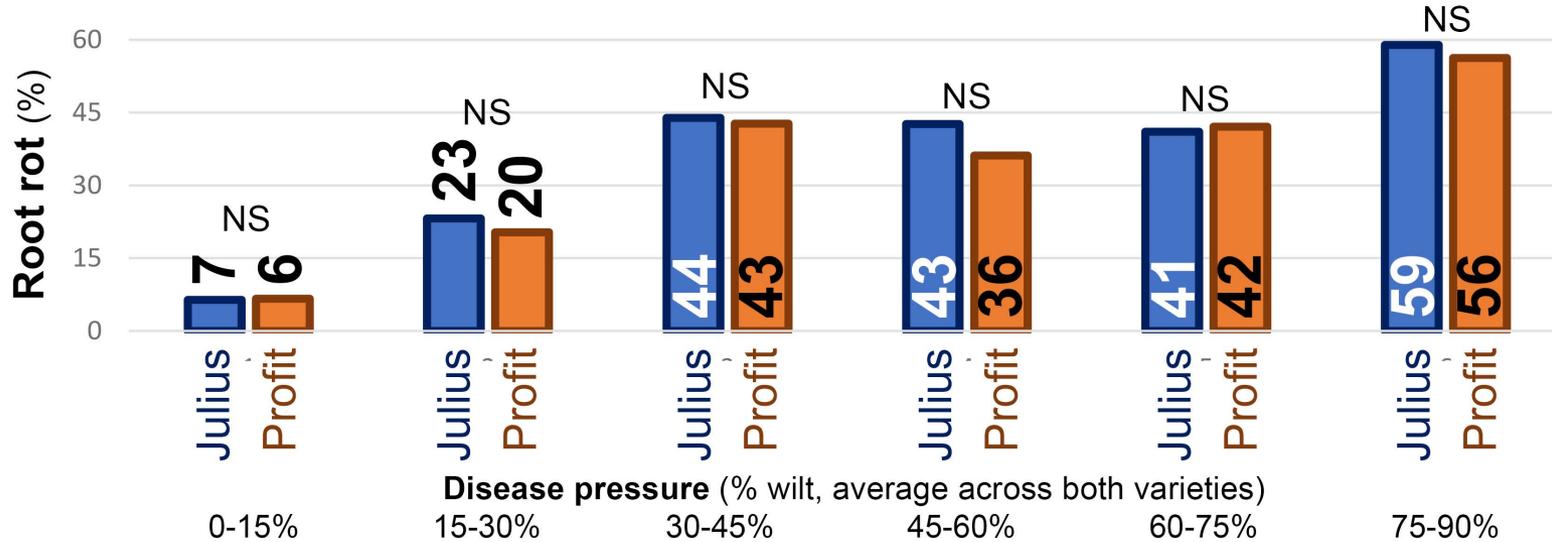
Row spacing = 7.5 inches

NS = not significantly different
* significantly different, P < 0.05
** significantly different, P < 0.01
*** significantly different, P < 0.001



Fusarium and Aphanomyces root rot of field peas: **Impact of variety selection**

Carrington, ND (2024)



Results across 11 studies, 4 plant dates/study (April 23 - June 13)
Seeding rate: 330,000 viable seeds/ac
Row spacing = 7.5 inches

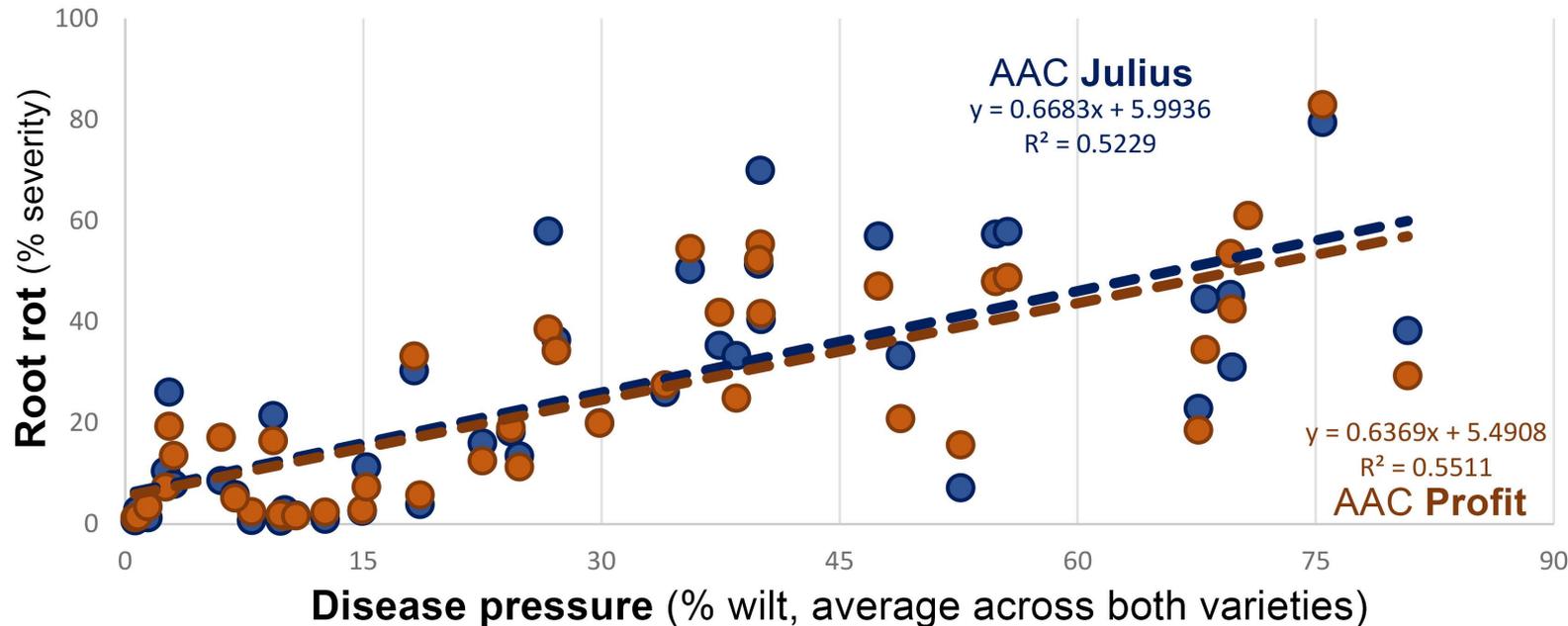
NS = not significantly different
 * significantly different, $P < 0.05$
 ** significantly different, $P < 0.01$
 *** significantly diff., $P < 0.001$

Root rot was assessed at early/mid vegetative growth.

Percent of the epicotyl plus first 2.5 cm of the tap root exhibiting yellow-brown cortical decay characteristic of Aphanomyces root rot and necrosis characteristic of Fusarium root rot

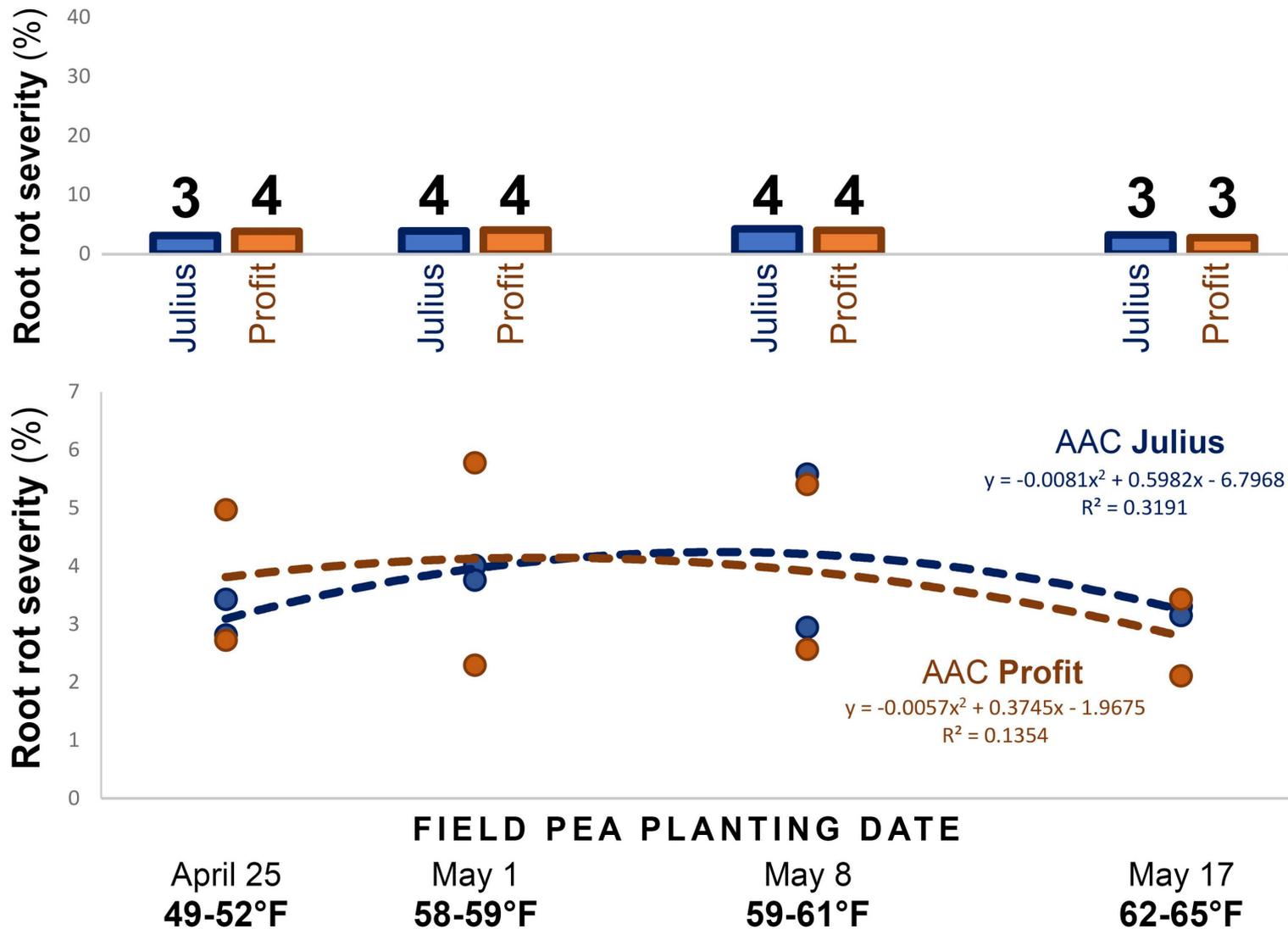
Plant date #1: 4-6 nodes
 Plant date #2: 4-8 nodes
 Plant date #3: 5-11 nodes
 Plant date #4: not assessed

Sample size = 36 plants per plot x 6 replicates (plant dates #1, #2); 16 plants x 6 replicates (plant date #3)



Fusarium and Aphanomyces root rot of field peas: **Impact of variety selection**

Williston, ND (2023): studies conducted under very low root rot pressure



Results across 3 studies, 4 plant dates/study (April 25 – May 17)

Seeding rate: 330,000 viable seeds/ac

Row spacing = 7.0 inches

NS = not significantly different
 * significantly different, $P < 0.05$
 ** significantly different, $P < 0.01$
 *** significantly diff., $P < 0.001$

Root rot was assessed at early/mid vegetative growth.

Percent of the epicotyl plus first 2.5 cm of the tap root exhibiting yellow-brown cortical decay characteristic of Aphanomyces root rot and necrosis characteristic of Fusarium root rot

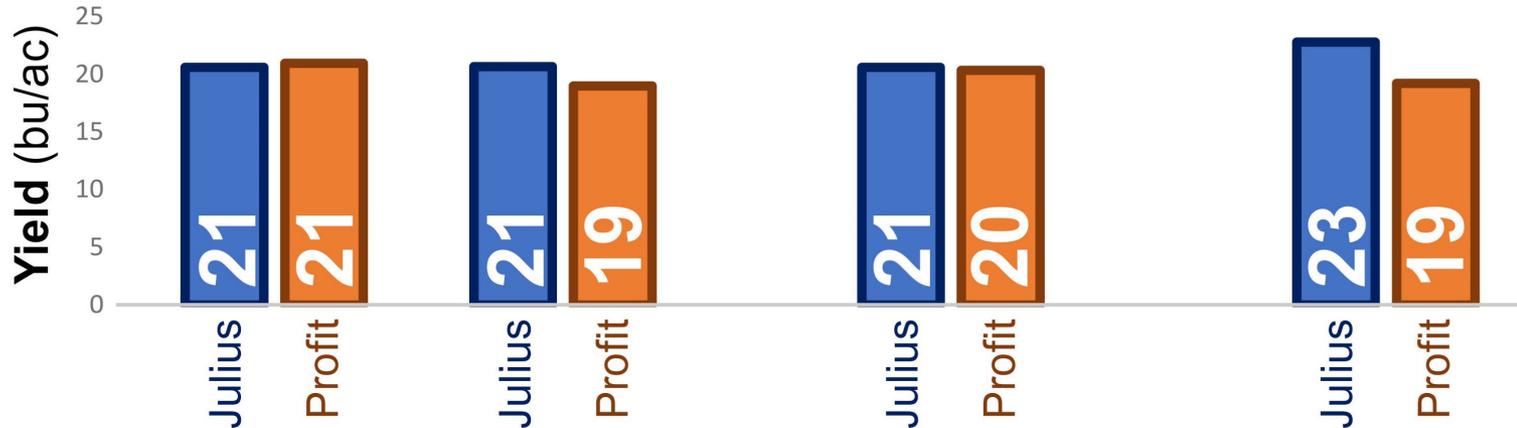
Plant date #1: 5-7 nodes
 Plant date #2: 5-8 nodes
 Plant date #3: 5-8 nodes
 Plant date #4: 5-8 nodes

Sample size = 50 plants per plot x 6 replicates

Soil temperature (average, day and night) at 2-inch seeding depth, first 7 days after planting.

Fusarium and Aphanomyces root rot of field peas: **Impact of variety selection**

Williston, ND (2023): studies conducted under very low root rot pressure



Results across 3 studies, 4 plant dates/study (April 25 – May 17)
Seeding rate: 330,000 viable seeds/ac
Row spacing = 7.0 inches

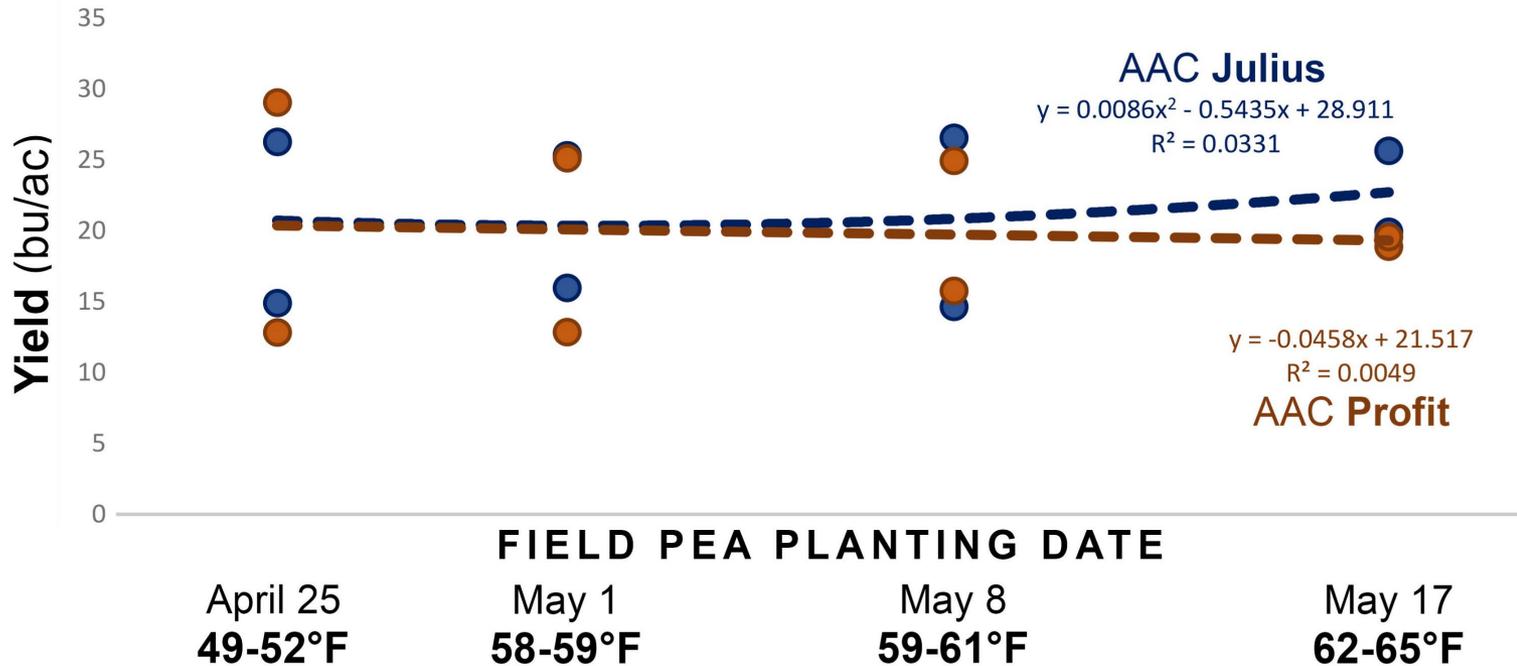
NS = not significantly different
 * significantly different, $P < 0.05$
 ** significantly different, $P < 0.01$
 *** significantly diff., $P < 0.001$

Root rot severity was very low across all planting dates and both varieties: average 3-4% at early/mid vegetative growth in all planting dates and both varieties (see previous slide).

Percent of the epicotyl plus first 2.5 cm of the tap root exhibiting yellow-brown cortical decay characteristic of Aphanomyces root rot and necrosis characteristic of Fusarium root rot

Plant date #1: 5-7 nodes
 Plant date #2: 5-8 nodes
 Plant date #3: 5-8 nodes
 Plant date #4: 5-8 nodes

Sample size = 50 plants per plot x 6 replicates



Soil temperature (average, day and night) at 2-inch seeding depth, first 7 days after planting.

Conclusions:

The results suggest that there may be strong differences in tolerance to *Aphanomyces* and *Fusarium* root rot across field pea varieties.

The results also suggest that it may be possible to achieve excellent management of *Aphanomyces* and *Fusarium* root rot in field peas through the integrated use of tolerant varieties, planting date and fungicide seed treatment.

These results need to be confirmed at on-farm sites.

The strains of *Aphanomyces euteiches*, the *Fusarium* species, and the relative importance of *Aphanomyces* versus *Fusarium* can differ across fields.

In 2025, field testing will be expanded to on-farm sites in western North Dakota.



Integrated management of **Aphanomyces and Fusarium root rot** in field peas: (1) Impact of variety selection

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in collaboration with Edson Ncube and Audrey Kalil, NDSU Williston Research Extension Center

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