Identifying Breeder-friendly INDELS that Co-segregate with SNPs Associated with QTL for Resistance to *Fusarium solani* Root Rot in *Snap Bean (Phaseolus vulgaris)*

JOSEPH A SCHMIDT

DR. JAMES MYERS, DEPARTMENT OF HORTICULTURE

JOEL DAVIS

Fusarium solani Root Rot in *Phaseolus vulgaris*

Root Rot is a Limiting Factor in Bean Production Worldwide

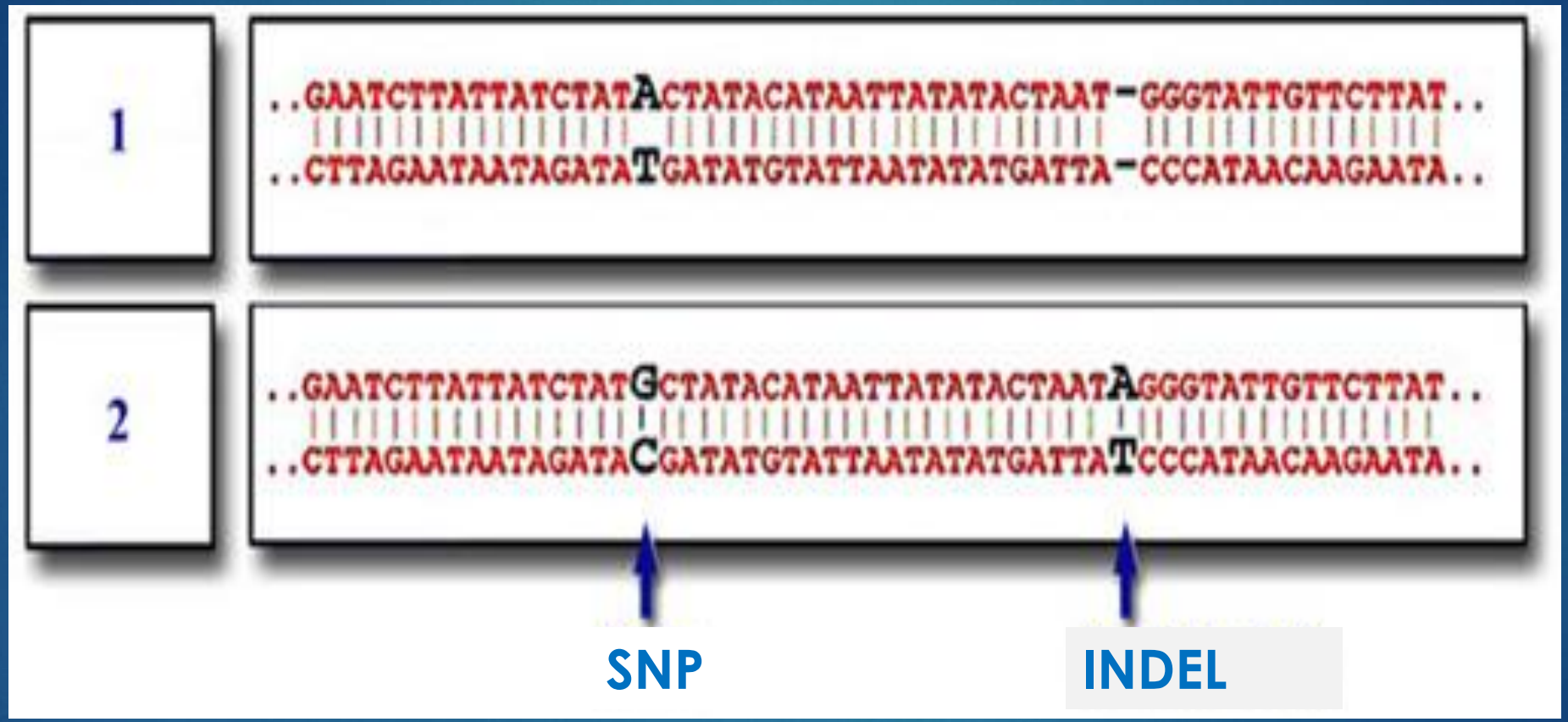
100% Reported Yield Loss in Uganda, 70% Reported in Rwanda.

15-30% of daily caloric intake is beans.

$27 Million Lost Annually, in the US Alone

Healthy Bean Field

Infected Field


1
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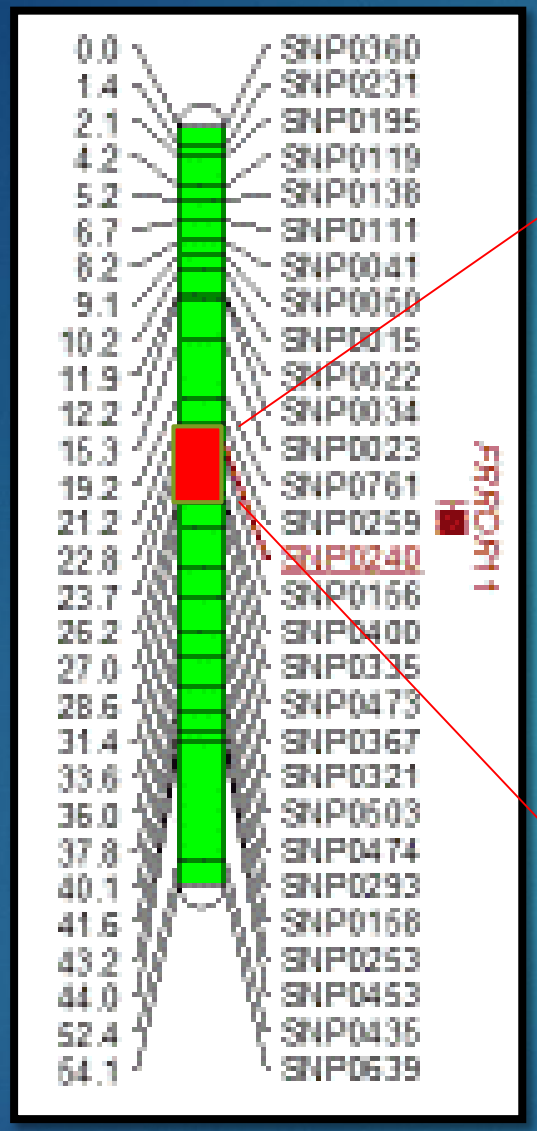
..CTTAGAATAATAGATATGATATGTATTAATATATGATTA-CCCATAACAAGAATA..
2
..GAATCTTATTATCTATGCTATACATAATTATATACTAATAGGGTATTGTTCTTAT..
..CTTAGAATAATAGATACGATATGTATTAATATATGATTATCCCATAACAAGAATA..
SNP
INDEL

Christina Hagerty MS Thesis:

Mapping QTLs for Root Rot Resistance, Root Traits, and Morphological Traits in Common Bean Recombinant Inbred Population

Pv03



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ss715644379	31,393,828			
ss715639512	31,438,864			
ss715639511	31,589,064			
ss715643803	31,752,390			
ss715642813	31,787,375			
ss715642631	32,016,978			
ss715648169	32,295,076			
ss715639807	32,304,721			
ss715650616	32,369,163	SNP0761	23.0	
ss715647431	32,753,137			
ss715647432	32,787,282			
ss715647754	32,959,486			
NDSU_IND_3_32.9664	32,966,365			
NDSU_IND_3_32.9665	32,966,529			
ss715647753	32,971,322			
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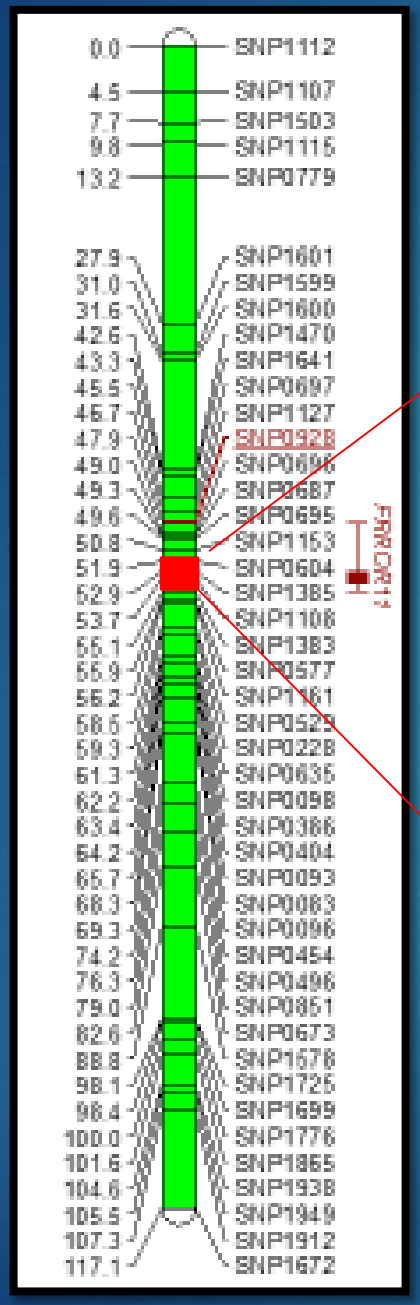
NDSU_IND_3_33.1872	33,187,213			
ss715647848	33,503,791			
ss715647849	33,546,228			
ss715647850	33,557,280			
ss715639608	33,874,386			
ss715639606	33,910,281	SNP0259	25.0	
ss715649832	33,994,213			
NDSU_IND_3_34.1919	34,191,928			
NDSU_IND_3_34.2352	34,235,235			
NDSU_IND_3_34.2676	34,267,639			
NDSU_IND_3_34.2738	34,273,795			
ss715641537	34,717,709	SNP0240	26.6	FRROR11
ss715639864	34,860,382			
ss715639865	34,973,096			
ss715639854	35,181,956			
ss715639853	35,379,615			
ss715649363	35,509,497			
NDSU_IND_3_35.8829	35,882,920			

Pv07



NDSU_IND_7_6.6340	6,633,953			
NDSU_IND_7_6.8130	6,813,020			
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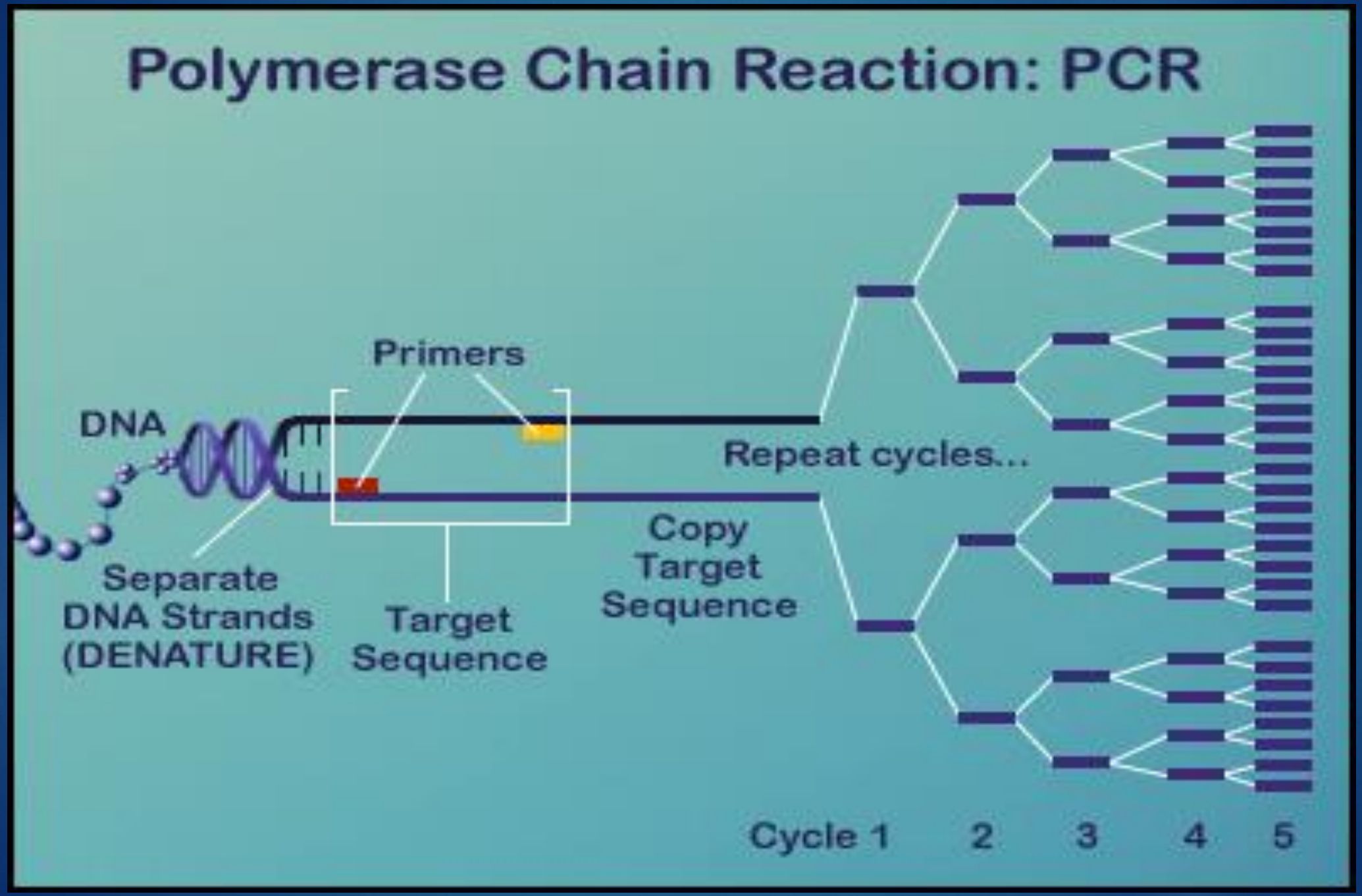
ss715640748	6,949,243			
NDSU_IND_7_6.9601	6,960,054			
NDSU_IND_7_7.1227	7,122,696			
ss715650843	7,157,210			
NDSU_IND_7_7.2225	7,222,454			
ss715647159	7,244,423			
ss715647158	7,343,812			
NDSU_IND_7_7.7349	7,734,915			
NDSU_IND_7_7.7397	7,739,675			
ss715649512	7,741,543			
ss715649511	7,759,866			
NDSU_IND_7_7.7639	7,763,873			
NDSU_IND_7_8.0043	8,004,250			
NDSU_IND_7_8.1543	8,154,326			
ss715647218	8,396,541			
ss715647219	8,439,206			
NDSU_IND_7_8.4724	8,472,357			
NDSU_IND_7_8.4798	8,479,767			
NDSU_IND_7_8.5201	8,520,068			
ss715639538	8,849,733	SNP0928	64.8	FRROR11
NDSU_IND_7_9.1059	9,105,914			
NDSU_IND_7_9.1228	9,122,767			

Recombinant Inbred Population

Progeny of OSU 5446 and RR6950

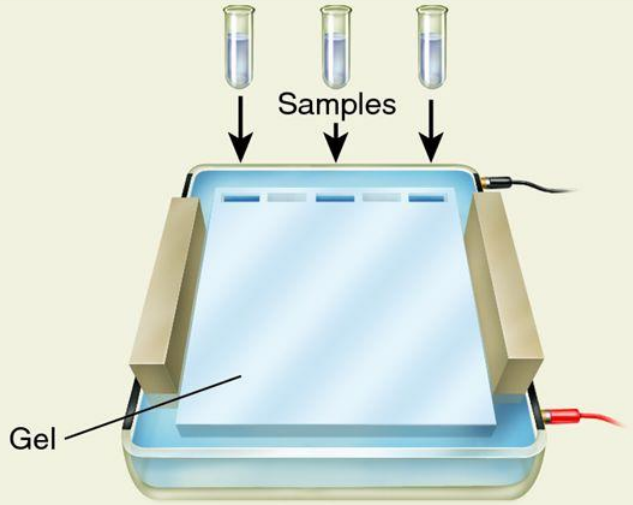
Parents chosen for their contrasting root rot characteristics


Polymerase Chain Reaction: PCR
Primers
DNA
Repeat cycles...
Copy
Target
Sequence
Separate
DNA Strands
(DENATURE)
Target
Sequence
Cycle 1
2
3
4
5

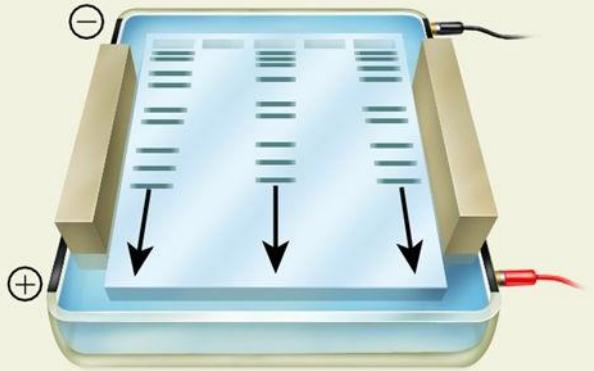
Agarose Gel Electrophoresis

Visual Identification of Polymorphisms between the parents with each INDEL of interest

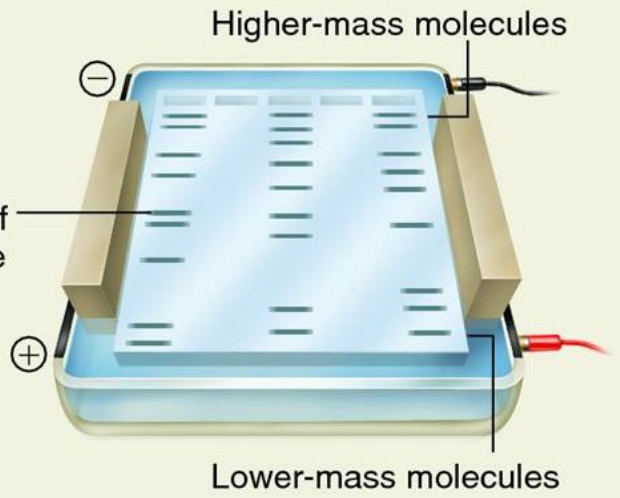
1 Load samples of DNA fragments into wells at the top of the gel.



2 Apply an electric field.

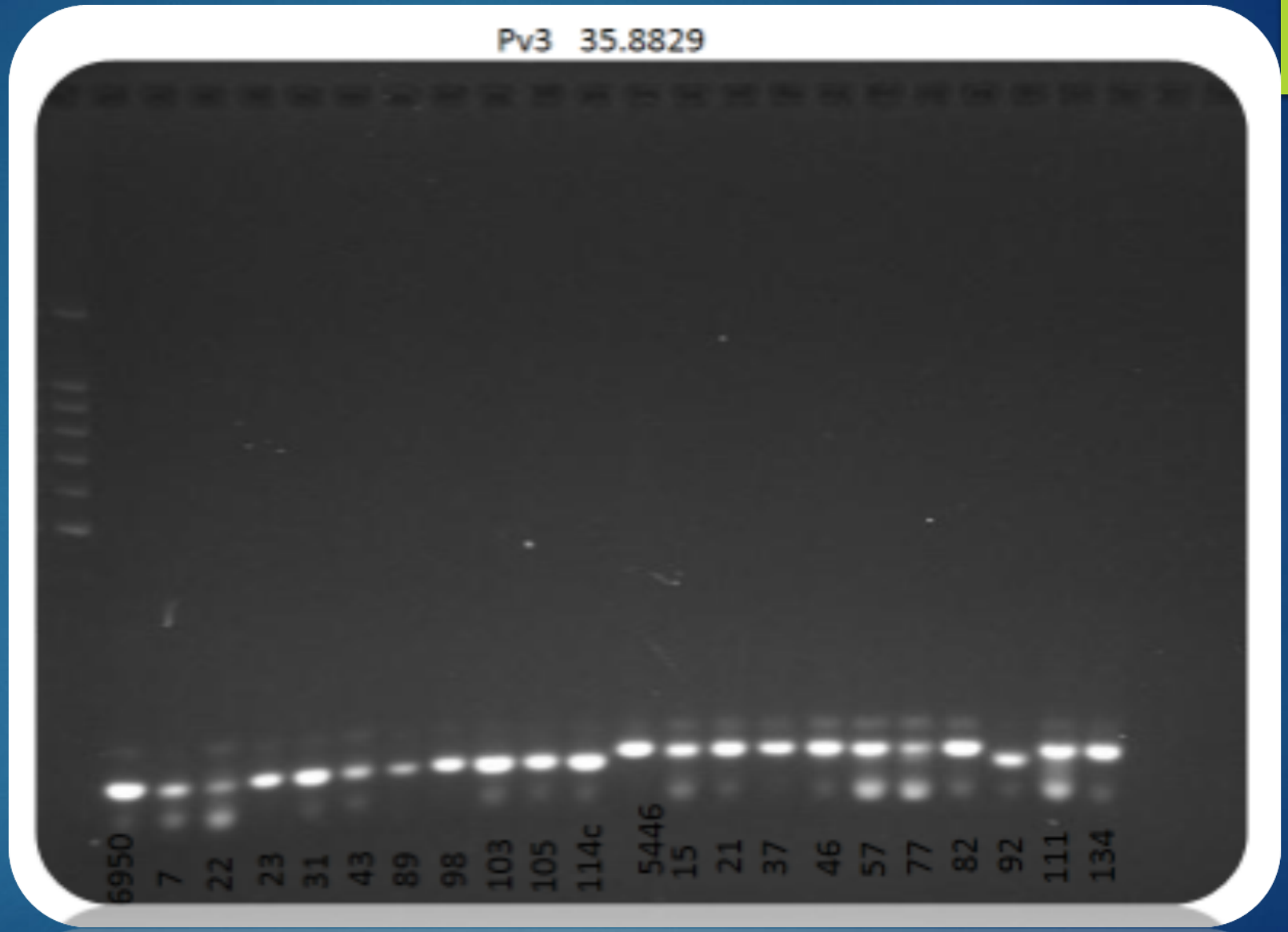


3 Wait additional time.




Pv3 32.9665
Pv3 35.9632
Pv3 31.2184
Pv7 08.4798
Pv7 06.6340
Pv7 12.0240


Pv3 35.8829


Pv3 35.8829
6950
7
22
23
31
43
89
98
103
105
114c
5446
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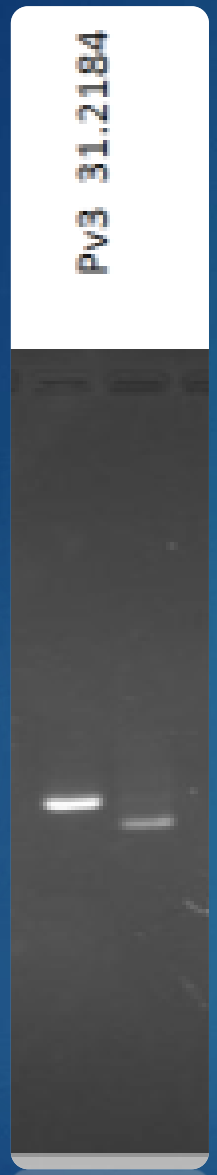
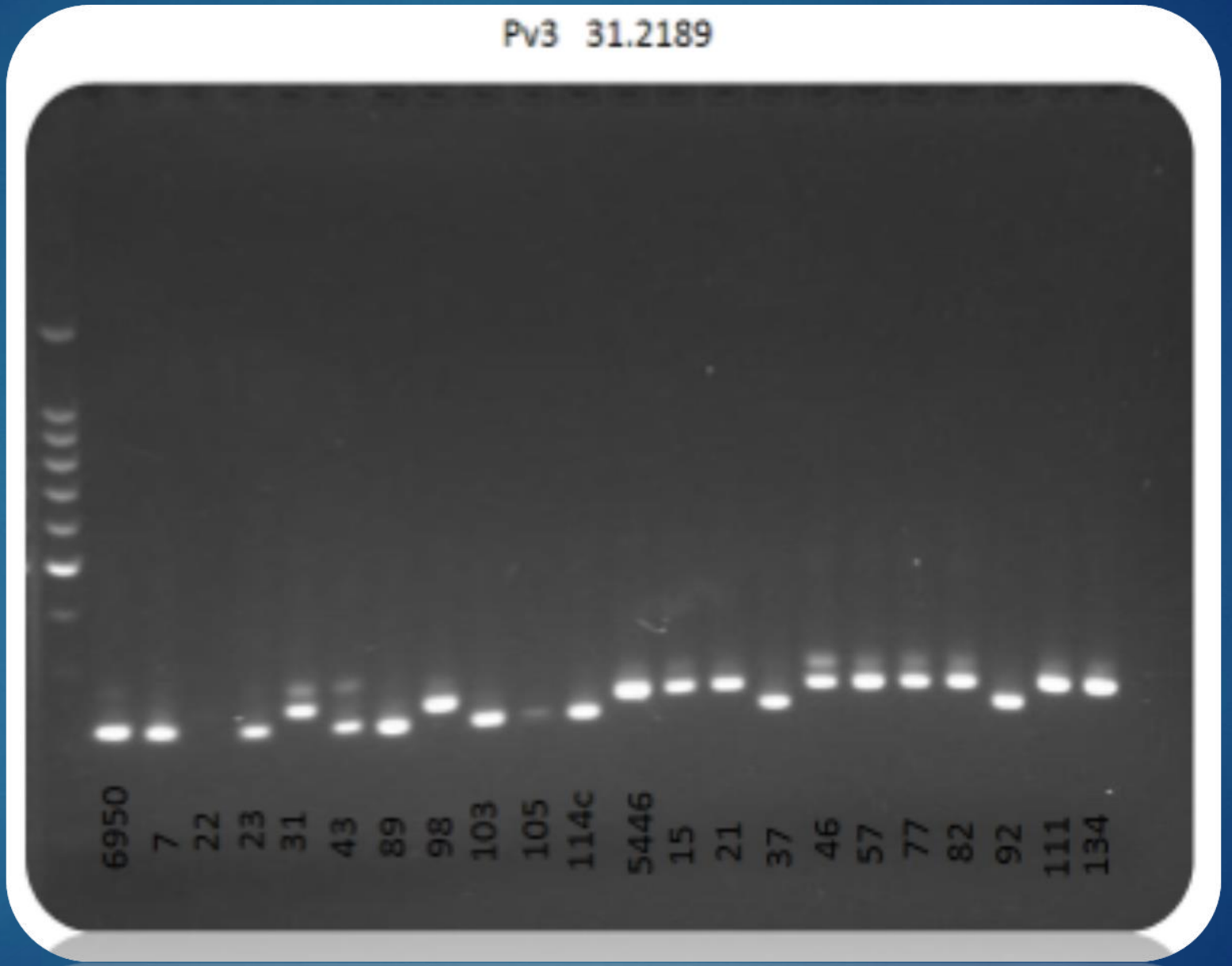
21
37
46
57
77
82
92
111
134


Pv3 31.2184


Pv3 31.2189
6950
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23
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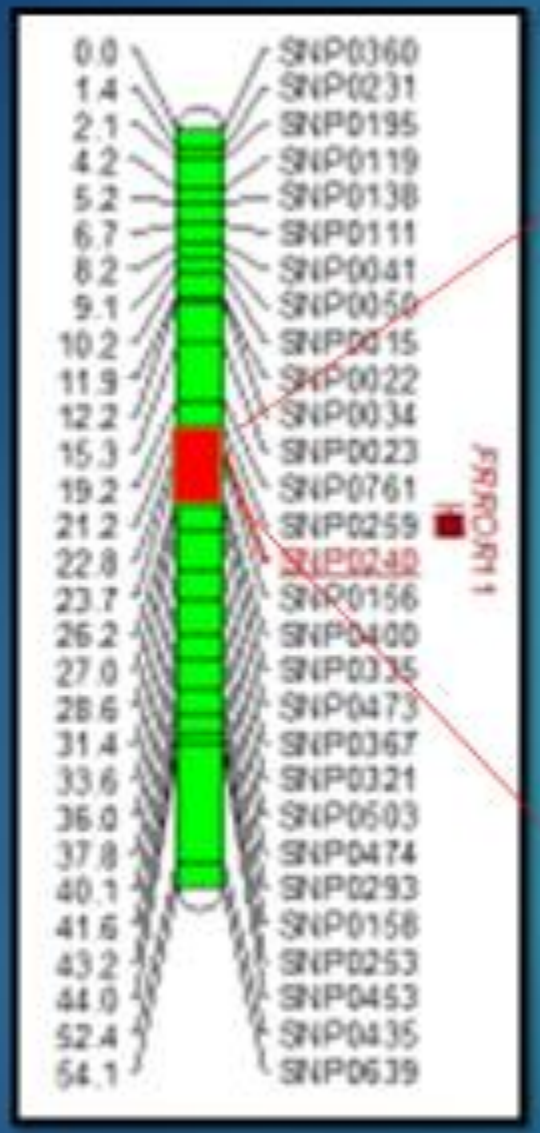
43
89
98
103
105
114c
5446
15
21
37
46
57
77
82
92
111
134

Identified and Validated INDELS which co-segregate with SNPs associated with QTLs for *Fusarium solani*.

- NDSU_IND_3_35.8829
- NDSU_IND_3_31.2189
- NDSU_IND_7_06.6340
- NDSU_IND_7_12.0240
- NDSU_IND_7_09.1228
- NDSU_IND_7_08.1543
- NDSU_IND_7_09.1059

Pv03



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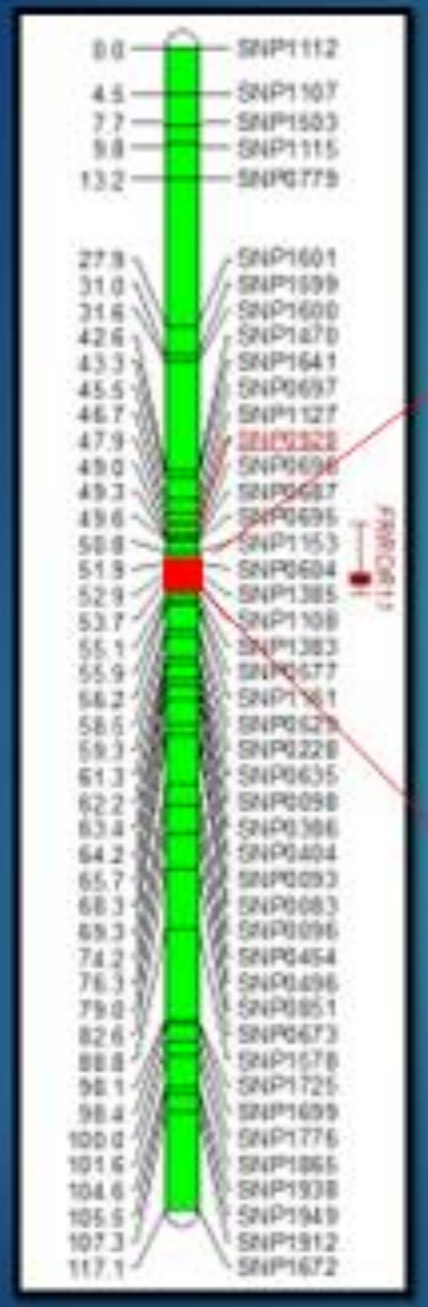
tr719644756	31,287,497		
tr719644376	31,293,825		
tr719639512	31,438,864		
tr719639511	31,586,064		
tr719643833	31,752,930		
tr719642813	31,787,375		
tr719642651	32,016,978		
tr719648189	32,295,076		
tr719639807	32,304,721		
tr719650618	32,386,161	SNP0761	23.0
tr719647431	32,753,137		
tr719647432	32,787,282		
tr719647754	32,959,486		
NDSU_IND_3_32.9664	32,966,365		
NDSU_IND_3_32.9685	32,986,529		
tr719647753	32,971,322		
tr719647751	33,046,575		
tr719647757	33,069,842		
tr719647756	33,130,648		
tr719651181	33,189,798		
NDSU_IND_3_33.1872	33,187,213		
tr719647848	33,503,781		
tr719647849	33,546,228		
tr719647850	33,557,280		
tr719639638	33,674,386		
tr719639606	33,910,281	SNP0259	25.0
tr719649832	33,994,213		
NDSU_IND_3_34.1319	34,191,928		
NDSU_IND_3_34.2352	34,236,236		
NDSU_IND_3_34.2678	34,287,639		
NDSU_IND_3_34.2738	34,273,795		
tr719641537	34,717,709	SNP0240	26.6 FRROR1
tr719639884	34,880,382		
tr719639665	34,973,096		
tr719639854	35,181,998		
tr719639653	35,379,615		
tr719649363	35,509,497		
NDSU_IND_3_35.8819	35,882,920		

Pv07



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ss715640748	6,949,243			
NDSU_IND_7_6.9601	6,960,054			
NDSU_IND_7_7.1227	7,122,696			
ss715650843	7,157,210			
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NDSU_IND_7_7.7397	7,739,675			
ss715649512	7,741,543			
ss715649511	7,759,866			
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NDSU_IND_7_8.1543	8,154,326			
ss715647218	8,396,541			
ss715647219	8,439,206			
NDSU_IND_7_8.4724	8,472,357			
NDSU_IND_7_8.4798	8,479,767			
NDSU_IND_7_8.5201	8,520,068			
ss715639538	8,849,733	SNP0328	64.8	FRRC011
NDSU_IND_7_9.1059	9,105,914			
NDSU_IND_7_9.1228	9,122,767			

Future Work

It would be optimal to confirm markers in other populations.

Apply markers to selecting for resistance in segregating populations.

Acknowledgements

Earnest and Pauline Jaworski

Dr. Jim Myers

Joel Davis

Christina Hagerty

Dr. Kevin Ahern