

**Comparison of Seedling
Germination in Pathogen-Infected
Browntop Millet [*Urochloa ramosa*]
Seed Lots with Tetrazolium
Viability Test**

Southern (V) Region Referee
2009

Referee Objectives

- 1) Collect TZ, germination and infection data
- 2) Compare germination and TZ
- 3) Compare lab-to-lab results

Materials and Methods

3 seed lots

A, B and C

TZ test (100 seeds in 4 x 25)

Germination (400 seeds in 8 x 50)

4d and 14d counts

Questionnaire

Results

17 participants

Range of experience (<25, 25-50, 50-100, >100)

7 test permutations (13 permitted)

TZ, Germ and Infection

Sample/Lab significant effects

TZ Test Results

Sample		Tetrazolium Test		
		Viable	Abnormal	Dead
A	Range (%)	56 - 97	1 - 43	0 - 8
	Mean (%)	87	11	2
	ANOVA F	19.78	23.39	2.64
B	Range (%)	60 - 99	0 - 40	0 - 11
	Mean (%)	87	11	2
	ANOVA F	16.12	17.48	3.21
C	Range (%)	44 - 98	0 - 53	0 - 7
	Mean (%)	85	13	2
	ANOVA F	30.29	37.61	3.28

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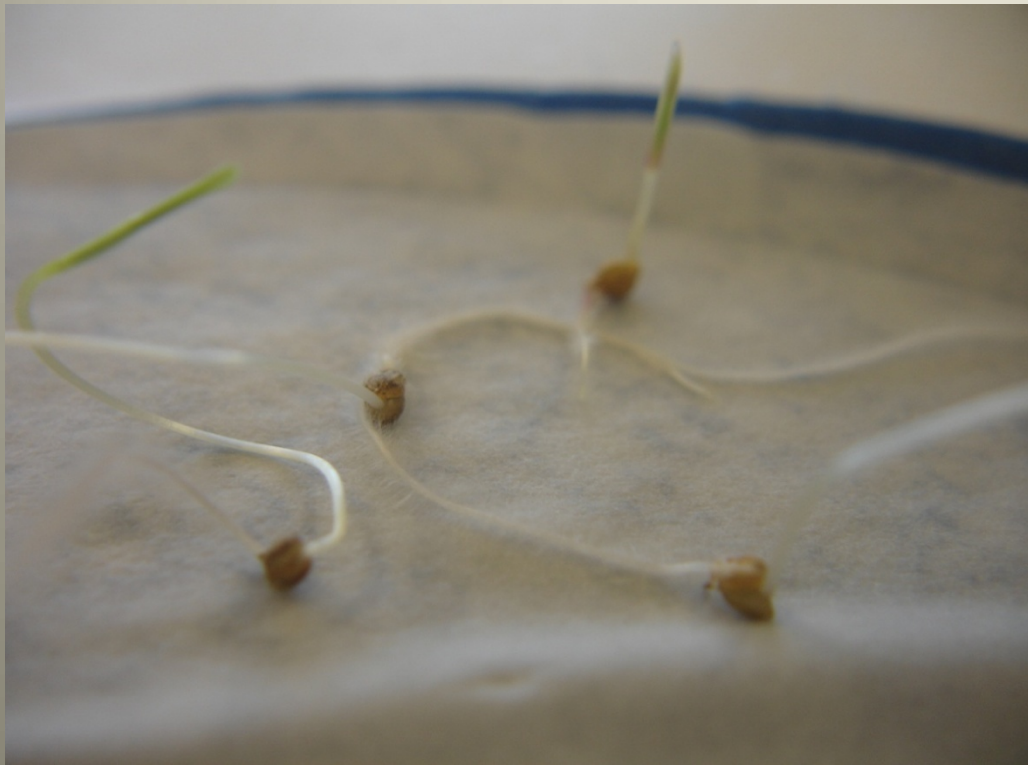
Germination Test Results

		Germination Test				
		Early 4d	Final 14d	Abn.	Firm	Dead
A	Range (%)	52 - 80	54 - 84	0 - 32	0 - 2	0 - 16
	Mean (%)	67	69	9	1	6
	ANOVA F	12.37	12.35	59.89	5.28	24.23
B	Range (%)	65 - 92	66 - 92	0 - 12	0 - 3	0 - 15
	Mean (%)	82	84	4	1	6
	ANOVA F	11.91	13.68	18.45	8.61	13.12
C	Range (%)	27 - 72	28 - 80	0 - 59	0 - 4	0 - 21
	Mean (%)	44	47	14	1	8
	ANOVA F	24.80	24.36	153.98	7.24	42.4

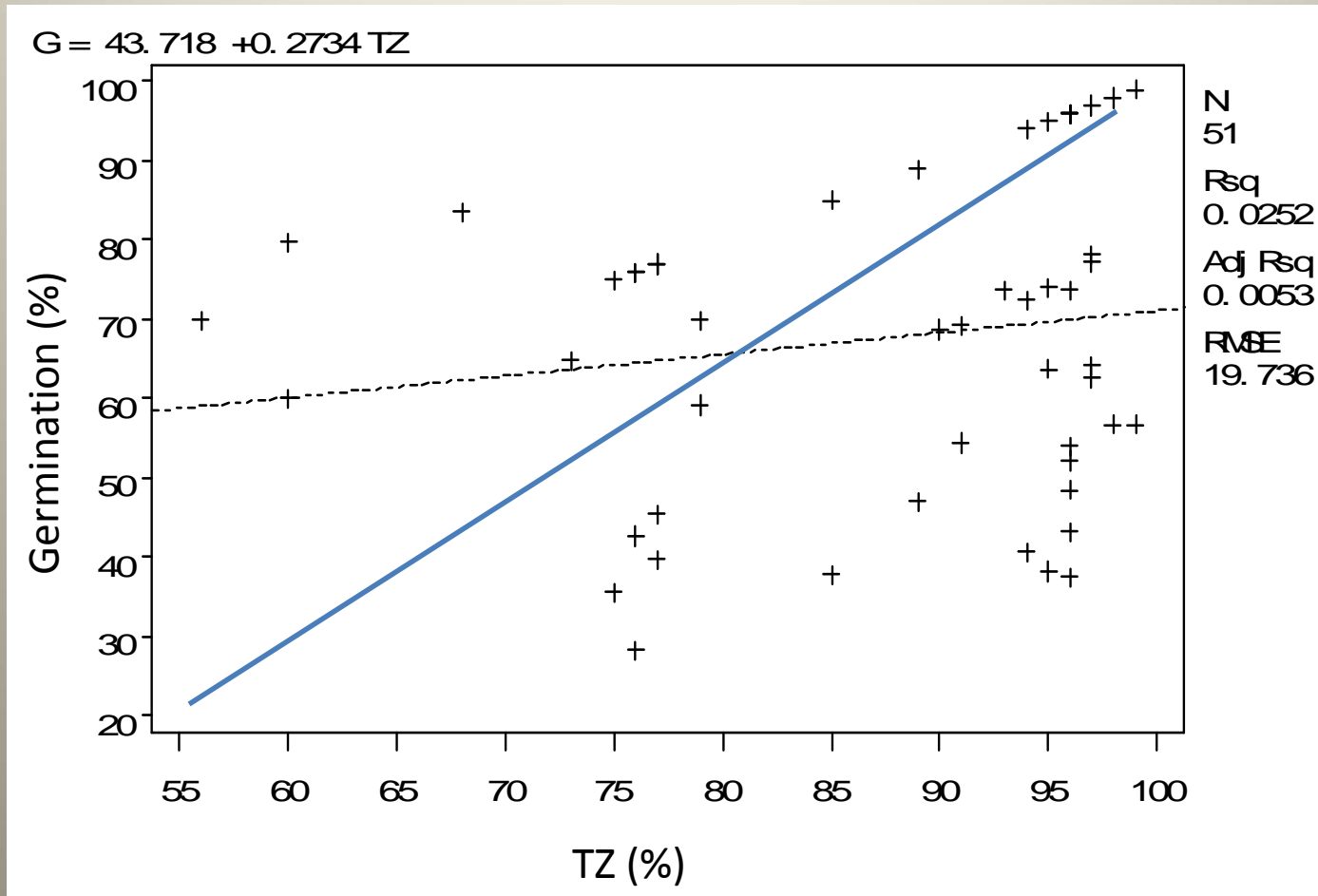
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	ANOVA F	24.80	24.36	153.98	7.24	42.4

Normal Seedlings



Germ. vs. TZ



r^2 for individual samples

$A = 0.0088, B = 0.2651, C = 0.0061$

Germination Test Results

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		Early 4d	Final 14d	Abn.	Firm	Dead
A	Range (%)	52 - 80	54 - 84	0 - 32	0 - 2	0 - 16
	Mean (%)	67	69	9	1	6
	ANOVA F	12.37	12.35	59.89	5.28	24.23
B	Range (%)	65 - 92	66 - 92	0 - 12	0 - 3	0 - 15
	Mean (%)	82	84	4	1	6
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	Mean (%)	44	47	14	1	8
	ANOVA F	24.80	24.36	153.98	7.24	42.4

Germination Test Results

Sample		Seedling Infection	
		Early (4 d)	Final (14 d)
A	Range (%)	0 - 25	4 - 31
	Mean (%)	8	19
	ANOVA F	47.15	23.71
B	Range (%)	0 - 6	0 - 17
	Mean (%)	2	7
	ANOVA F	7.32	15.06
C	Range (%)	0 - 45	13 - 52
	Mean (%)	13	33
	ANOVA F	47.49	38.01

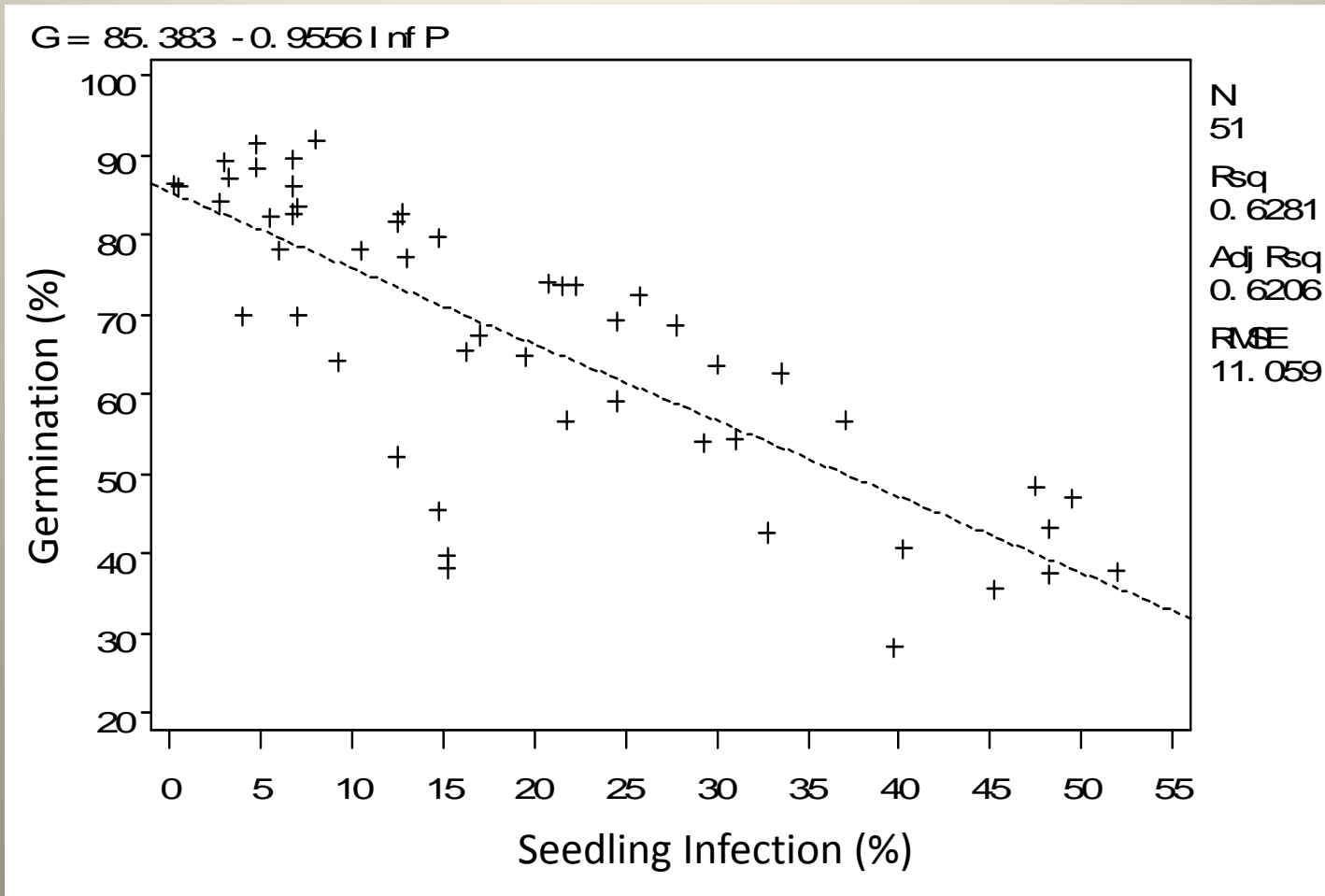
Germination Test Results

Sample		Seedling Infection	
		Early (4 d)	Final (14 d)
A	Range (%)	0 - 25	4 - 31
	Mean (%)	8	19
	ANOVA F	47.15	23.71
B	Range (%)	0 - 6	0 - 17
	Mean (%)	2	7
	ANOVA F	7.32	15.06
C	Range (%)	0 - 45	13 - 52
	Mean (%)	13	33
	ANOVA F	47.49	38.01

Infected Seedlings



Germ. vs. Infection



Test Conditions by Sample

Sample	Temp. Regime	Substrate	Early	Final	Abnormal	Dead	Infected
			Germination	Germination	%		Seedlings
A	20-30	B	64.6 ± 2.0 ²	65.4 ± 1.9	0	9.8 ± 1.2	24.4 ± 1.2
		P	64.1 ± 2.8	67.3 ± 2.9	3.1 ± 0.4	10.2 ± 1.0	18.6 ± 2.1
		T	67.3 ± 1.2	70.7 ± 0.9	13.6 ± 1.7	2.9 ± 0.4	18.0 ± 1.5
	30	P	71.0 ± 3.0	71.0 ± 2.0	15.4 ± 2.8	1.2 ± 0.4	14.3 ± 2.2
ANOVA	Temp.		5.13	1.77 ns	18.09	50.64	2.21 ns
F-value		Sub.	0.85 ns	3.02	19.33	25.94	6.56
B	20-30	B	81.3 ± 1.2	81.5 ± 1.9	0.3 ± 0.2	9.4 ± 0.8	8.1 ± 1.0
		P	70.0 ± 1.9	73.0 ± 2.3	2.8 ± 0.3	10.2 ± 1.6	13.3 ± 1.3
		T	85.0 ± 0.9	87.3 ± 0.7	5.1 ± 0.6	4.0 ± 0.4	4.5 ± 0.6
	30	P	88.2 ± 1.5	88.2 ± 1.5	4.8 ± 1.0	2.9 ± 0.7	6.3 ± 1.0
ANOVA	Temp.		67.16	52.65	3.24 ns	27.77	21.20
F-value		Sub.	8.35	13.68	16.92	13.41	14.75
C	20-30	B	45.4 ± 3.0	45.8 ± 3.0	0	15.1 ± 2.2	38.9 ± 1.6
		P	49.6 ± 3.5	54.4 ± 3.9	3.2 ± 0.4	12.8 ± 1.9	29.3 ± 2.4
		T	40.6 ± 1.3	44.0 ± 1.2	26.7 ± 3.0	3.7 ± 0.5	35.3 ± 2.3
	30	P	46.3 ± 1.9	46.3 ± 1.9	16.5 ± 4.9	2.4 ± 0.7	25.7 ± 3.9
ANOVA	Temp.		0.71 ns	4.34 ns	6.66 ns	21.75	0.68 ns
F-value		Sub.	4.16	3.18 ns	25.83	22.58	6.22

Test Conditions by Sample

Sample	Temp. Regime	Substrate	Early Germination	Final Germination	Abnormal	Dead	Infected Seedlings
			%				
A	20-30	B	64.6 ± 2.0 ²	65.4 ± 1.9	0	9.8 ± 1.2	24.4 ± 1.2
		P	64.1 ± 2.8	67.3 ± 2.9	3.1 ± 0.4	10.2 ± 1.0	18.6 ± 2.1
		T	67.3 ± 1.2	70.7 ± 0.9	13.6 ± 1.7	2.9 ± 0.4	18.0 ± 1.5
	30	P	71.0 ± 3.0	71.0 ± 2.0	15.4 ± 2.8	1.2 ± 0.4	14.3 ± 2.2
ANOVA F-value	Temp.	Sub.	5.13	1.77 ns	18.09	50.64	2.21 ns
B	20-30	B	81.3 ± 1.2	81.5 ± 1.9	0.3 ± 0.2	9.4 ± 0.8	8.1 ± 1.0
		P	70.0 ± 1.9	73.0 ± 2.3	2.8 ± 0.3	10.2 ± 1.6	13.3 ± 1.3
		T	85.0 ± 0.9	87.3 ± 0.7	5.1 ± 0.6	4.0 ± 0.4	4.5 ± 0.6
	30	P	88.2 ± 1.5	88.2 ± 1.5	4.8 ± 1.0	2.9 ± 0.7	6.3 ± 1.0
ANOVA F-value	Temp.	Sub.	67.16	52.65	3.24 ns	27.77	21.20
C	20-30	B	45.4 ± 3.0	45.8 ± 3.0	0	15.1 ± 2.2	38.9 ± 1.6
		P	49.6 ± 3.5	54.4 ± 3.9	3.2 ± 0.4	12.8 ± 1.9	29.3 ± 2.4
		T	40.6 ± 1.3	44.0 ± 1.2	26.7 ± 3.0	3.7 ± 0.5	35.3 ± 2.3
	30	P	46.3 ± 1.9	46.3 ± 1.9	16.5 ± 4.9	2.4 ± 0.7	25.7 ± 3.9
ANOVA F-value	Temp.	Sub.	0.71 ns	4.34 ns	6.66 ns	21.75	0.68 ns
			4.16	3.18 ns	25.83	22.58	6.22

Conclusions

Differential Sample Quality

(B > A > C)

Variable Results

Test Conditions

Familiarity

Evaluation criteria

Reporting

TZ ≠ Germ

Test Duration

Acknowledgements

Thank you region V participants!

Referee reports available
(C. Finneseth or A. Galarza)