

Germination of Coriander Seed in 15C and 20-30C Temperatures

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Southwest IV- Coriander Referee

- AOSA Rules allow for only 15C as the germination temperature for Coriander (*Coriandrum sativum* L.)
- ISTA allows for both 15C and 20-30C temperatures
- This referee is to see how 20-30C germination results compare to 15C germination results
- Will results support adding 20-30C as an alternative temperature in AOSA Rules for germination of Coriander seed

Participants (19 Labs):

Agri Seed Testing

BioDiagnostics, Inc.

Eurofins STS Laboratories

Harris Seeds

Kent Agri Lab

Monsanto Seed Lab Tech. Assoc.

Monsanto Seed Tech. Center

SGS, Brookings

Univ. of Kentucky-Regulatory

Utah Dept. of Ag. And Food Seed Lab

Alf Christianson Seed Lab

Calwest Seeds

Harris Moran Seed Co.

J.G. Boswell

MD Seed Analysis

Ransom Seed Lab

Sakata Seed America, Inc.

Turf Tech Inc.

US Agriseeds Seed Lab

Materials and Methods:

- 3 lots (Sample A, Sample B, Sample C) with original germination results ranging from 82% to 92% were sent to 19 labs with one dropping out due to fungus problems
- Instructions -germinate 400 seeds each in 15C and 20-30C temperatures
- Count days -7,10,14,21 days (7 day 1st count was for convenience of scheduling plant days- AOSA rules use 6 day 1st count)
- Labs were allowed to use their own standard media,# of light hours and # of seeds per rep

Germination methods used for 20-30 C temp (Same for 15C)

Lab #	Temp C	# Light hours	Medium	Count Days	# Seeds/rep	# Days in Test
1	20-30	8	T	7,10,14,21	50	21
2	20-30	8	PP	7,10,14,21	100	21
3	20-30	0	T	7,14,21	50	21
4	20-30	8	T	3,10,14,21	100	21
5	20-30	8	T	7,10,14,21	100	21
6	20-30	8	T	7,10,14,21	50	21
7	20-30	8	T	7,10,14,21	50	21
8	20-30	8	B	7,10,14,21	100	21
9	20-30	24	T	7,10,14,21	100	21
10	20-30	8	PP	7,10,14,21	100	21
11	20-30	8	T	7,10,14,21	50	21
12	20-30	0	T	7,10,14,21	100	21
13	20-30	8	T	7,10,14,21	100	21
14	20-30	8	T	7,10,14,21	50	21
15	20-30	8	TP	7,10,14,21	100	21
16	20-30	8	B	7,10,14,21	100	21
17	20-30	8	T	7,10,14,21	50	21
18	20-30	8	T	7,10,14,21	100	21

Observations About Germination Methods

- Most labs use rolled towels
- The choice of media did not seem to make a difference as much as technique or maybe experience:

		Sample A- Final		Sample B- Final		Sample C- Final	
Lab #	Medium	20-30C	15C	20-30C	15C	20-30C	15C
2	PP	72	81	86	85	85	81
10	PP	70	83	52	87	65	76
8	B	88	76	94	88	96	85
16	B	71	72	79	72	80	78
15	TP	66	66	85	87	84	76

20-30C results were fine in one lab but not another using the same medium for both PP (pleated paper) and B (between blotters)

- Most labs used 8 hours of light during germination testing
- The number of light hours did not seem to affect the germination results: Overall- Mean A=75.4, Mean B=85.8, Mean C=81.9

		Sample A- Final		Sample B- Final		Sample C- Final	
Lab #	# light hours	20-30C	15C	20-30C	15C	20-30C	15C
3	0	77	80	89	90	87	85
12	0	72	71	91	86	86	77
9	24	80	82	91	88	88	86

- One lab had an early 1st count (3-day)- resulting germs were better in 20-30C (maybe due to more vigorous seedlings early in test in 20-30C temp):

		Sample A- Final		Sample B- Final		Sample C- Final	
Lab #	Count days	20-30C	15C	20-30C	15C	20-30C	15C
4	3,10,14,21	79	65	88	82	73	68

Germination Results for Sample A, Sample B and Sample C

- Included next-
 - Data sheets comparing 1st, intermediate and final germination results for each of test samples done in 20-30C and 15C temps.
 - 20-30C and 15C charts comparing 1st, intermediate and final germination results from each lab to the Mean and Standard Deviation results
 - Charts comparing final germination results for both temps from each lab to the over-all Mean and Standard Deviation results
 - Chart showing which temp had the higher germination result for each lab

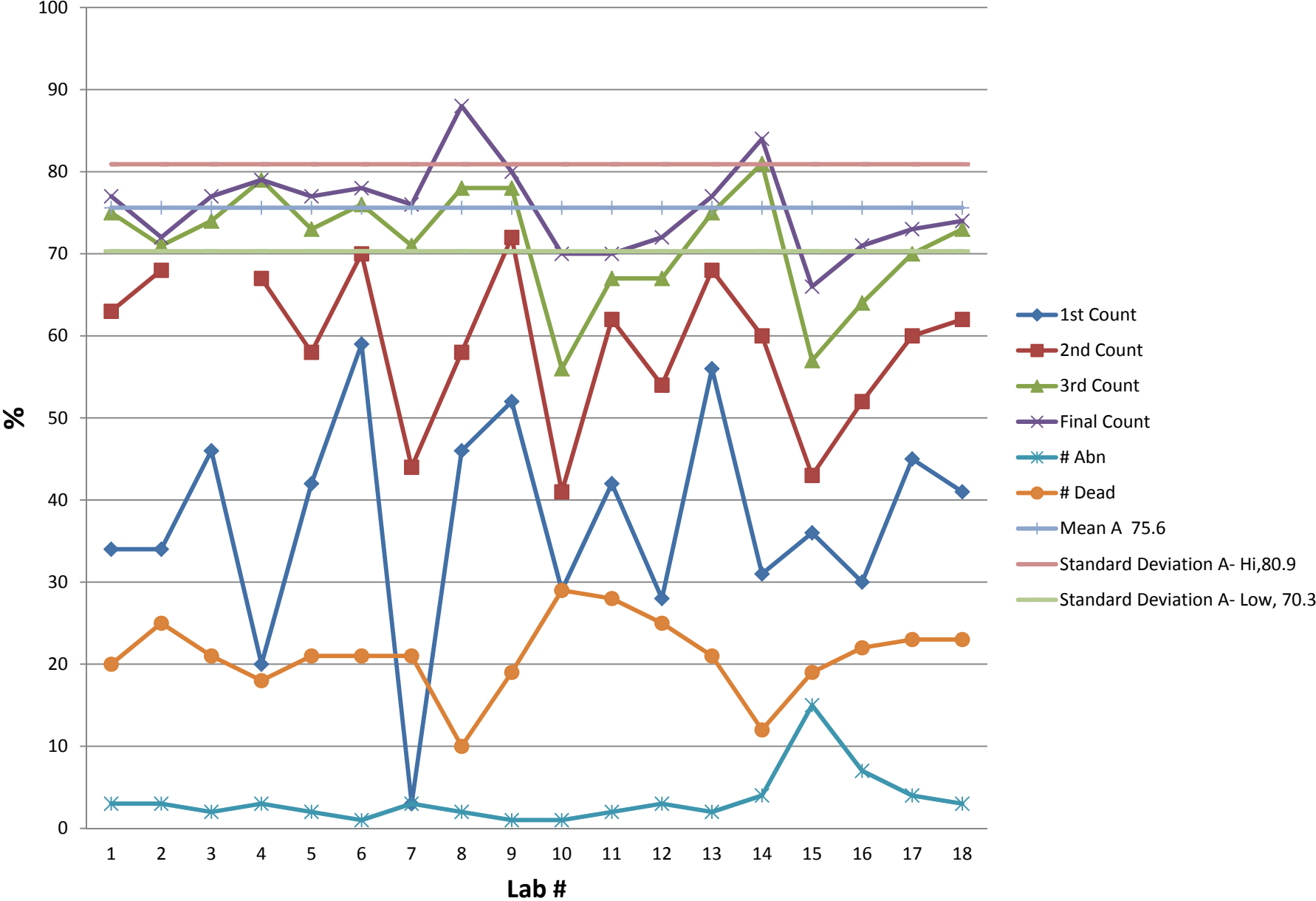
Observations about Germination Charts

- There was a wide range in first count (7-day) from one lab to another
- There was a wide range in second counts (10-day) from one lab to another
- The range of germination percents narrowed for the third count (14-day)
- The final counts (21-day) were mostly within one standard deviation from the mean with only a few exceptions

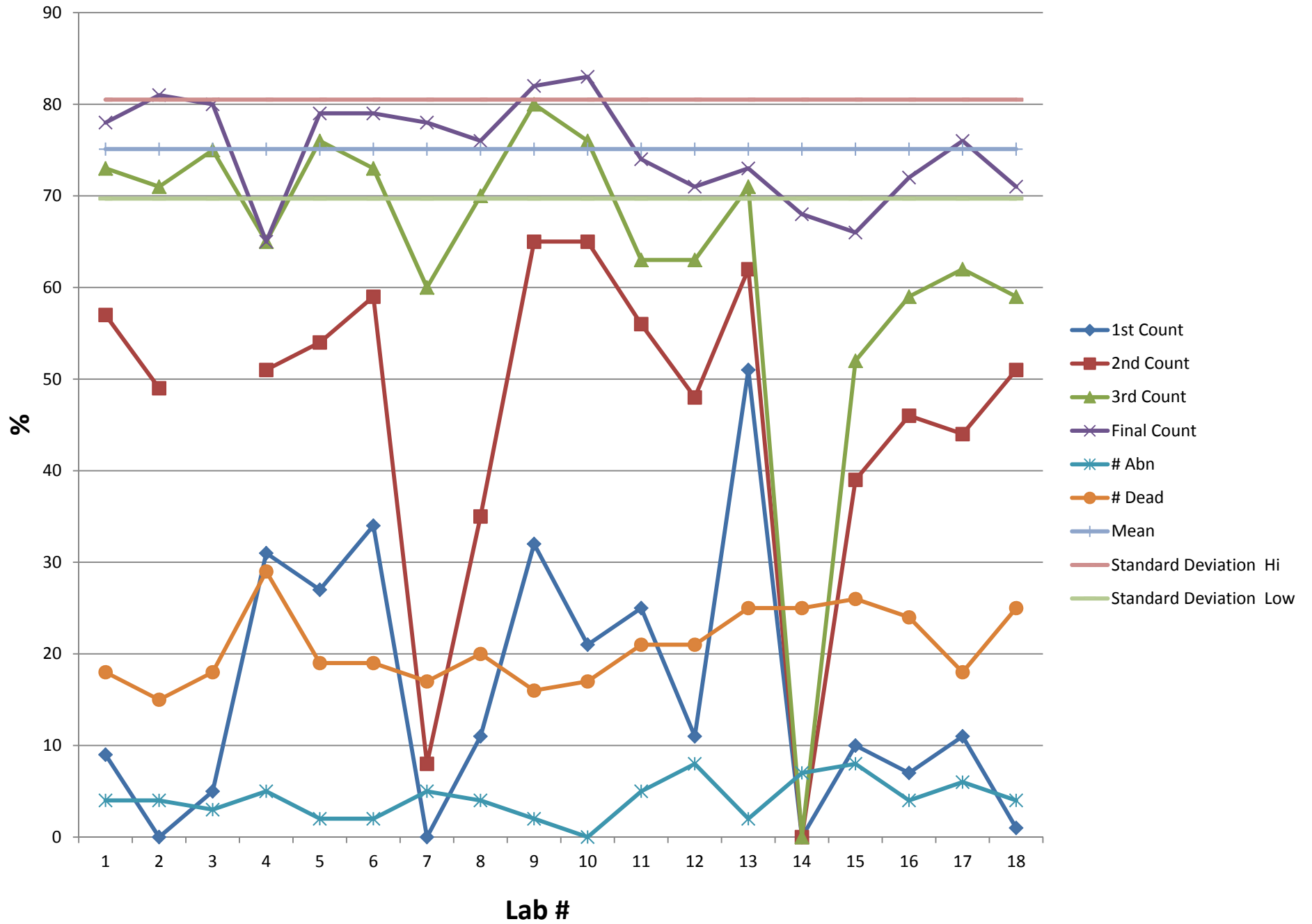
Sample-A

Lab #	20-30C				# Abn	# Dead	15C				# Abn	# Dead	Comments
	1st Count	2nd Count	3rd Count	Final Count			1st Count	2nd Count	3rd Count	Final Count			
1	34	63	75	77	3	20	9	57	73	78	4	18	
2	34	68	71	72	3	25	0	49	71	81	4	15	Sclerotia, Abn-primary infection, insuff. root
3	46		74	77	2	21	5		75	80	3	18	Recommend 15C for new crop. 10 day count missing
4	20	67	79	79	3	18	31	51	65	65	5	29	3 day 1st count
5	42	58	73	77	2	21	27	54	76	79	2	19	
6	59	70	76	78	1	21	34	59	73	79	2	19	Seedlings more vigorous at 7 day in 20-30C than 15C
7	3	44	71	76	3	21	0	8	60	78	5	17	
8	46	58	78	88	2	10	11	35	70	76	4	20	Prefers 20-30C
9	52	72	78	80	1	19	32	65	80	82	2	16	
10	29	41	56	70	1	29	21	65	76	83	0	17	Prefers 15C.
11	42	62	67	70	2	28	25	56	63	74	5	21	Hopes 20-30C is added to Rules. Abn-missing roots
12	28	54	67	72	3	25	11	48	63	71	8	21	Abn-missing roots
13	56	68	75	77	2	21	51	62	71	73	2	25	
14	31	60	81	84	4	12	0	0	0	68	7	25	(Doubles)
15	36	43	57	66	15	19	10	39	52	66	8	26	Mold & primary infection
16	30	52	64	71	7	22	7	46	59	72	4	24	Trouble with seedlings separating from seedball between counts. Roots browning & decaying
17	45	60	70	73	4	23	11	44	62	76	6	18	
18	41	62	73	74	3	23	1	51	59	71	4	25	Abn-missing roots
	Mean: 75.6				SD: 5.3		Mean: 75.1				SD: 5.4		

Sample A 20-30C



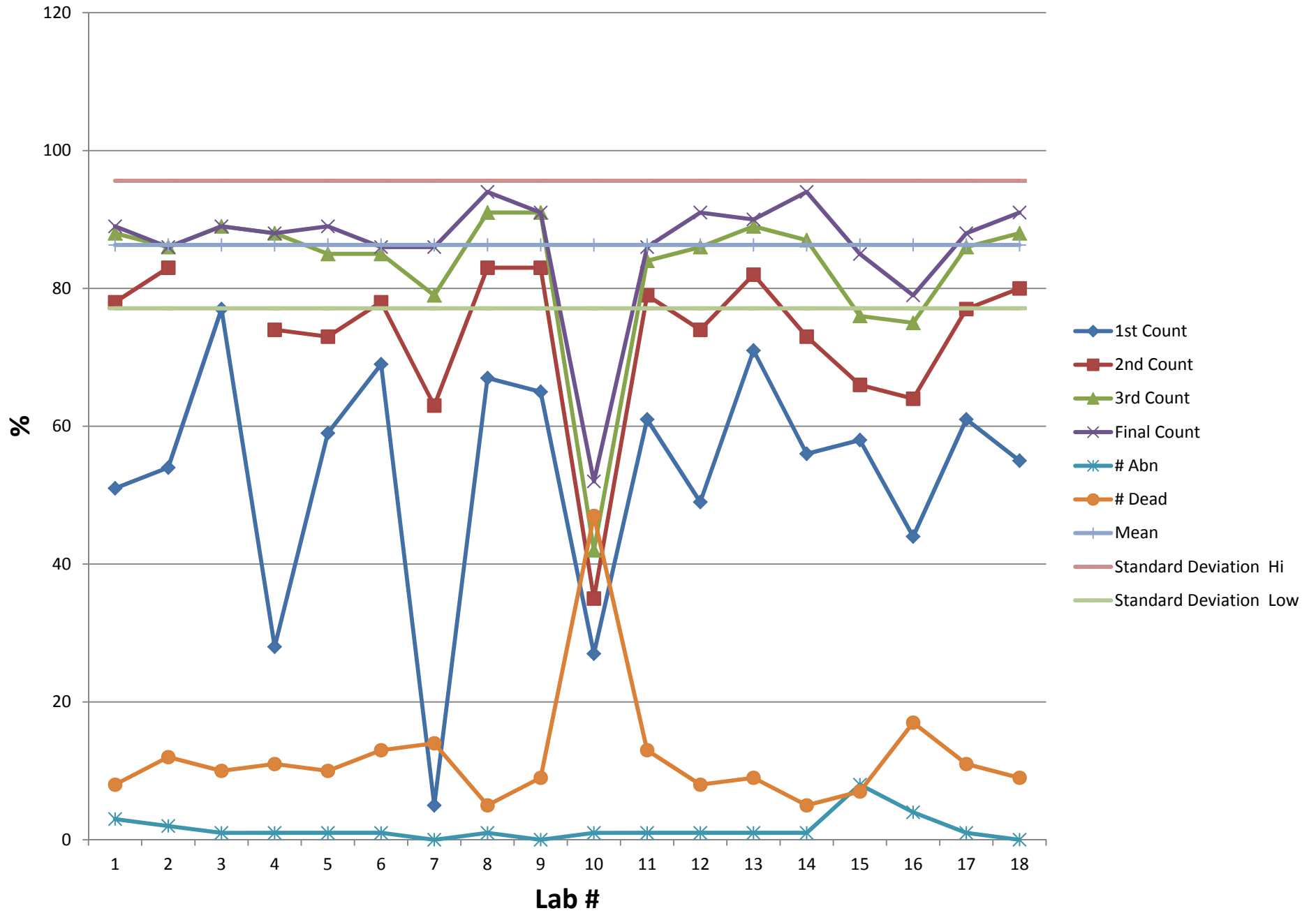
Sample A 15C



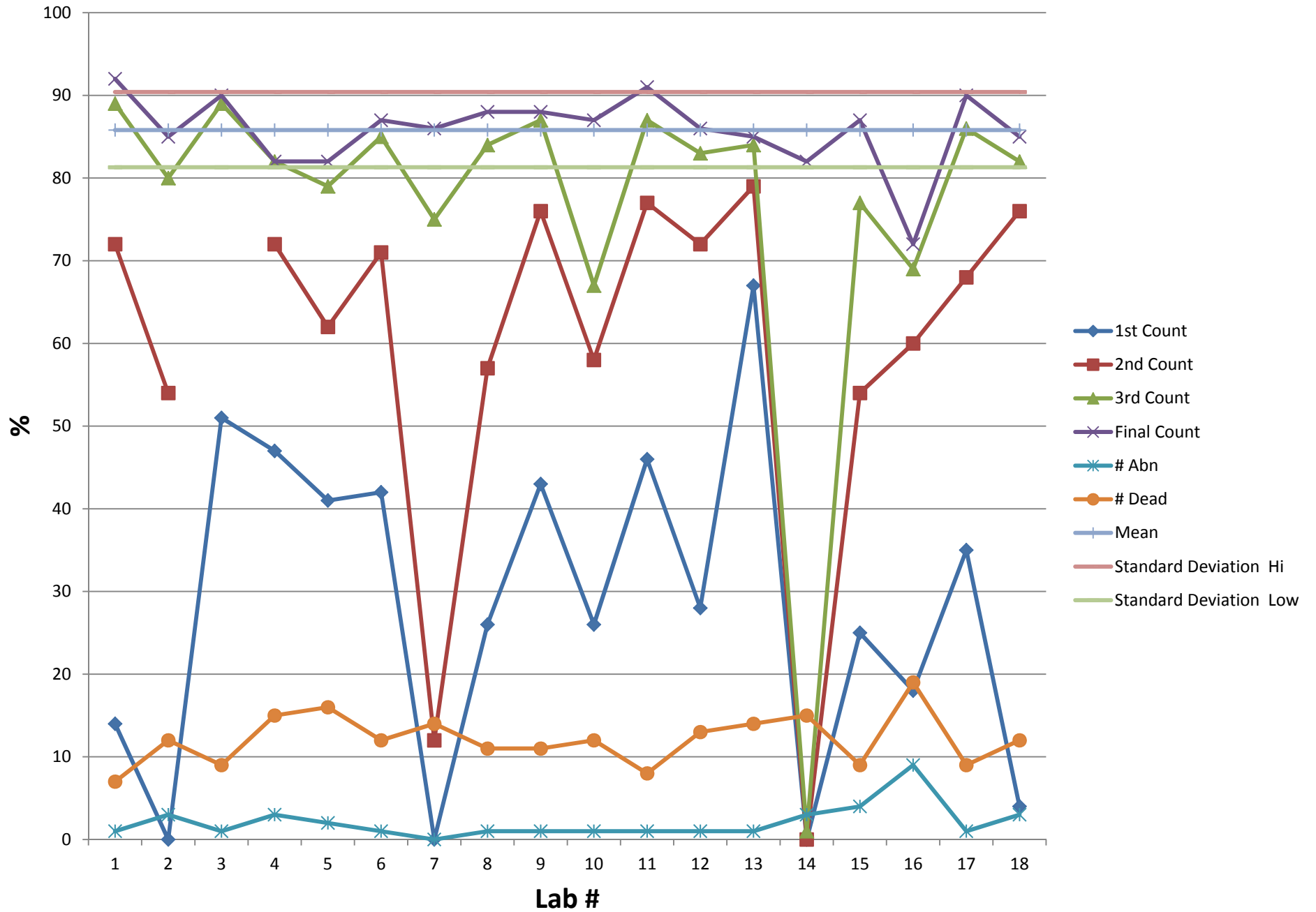
Sample-B

Lab #	20-30C					15C					# Abn	# Dead	Comments	
	<u>1st</u> Count	<u>2nd</u> Count	<u>3rd</u> Count	<u>Final</u> Count	<u>1st</u> Count	<u>2nd</u> Count	<u>3rd</u> Count	<u>Final</u> Count						
1	51	78	88	89	3	8	14	72	89	92	1	7		
2	54	83	86	86	2	12	0	54	80	85	3	12	Abn- primary infection	
3	77		89	89	1	10	51		89	90	1	9	10-day count missing	
4	28	74	88	88	1	11	47	72	82	82	3	15	3-day 1st count	
5	59	73	85	89	1	10	41	62	79	82	2	16		
6	69	78	85	86	1	13	42	71	85	87	1	12		
7	5	63	79	86	0	14	0	12	75	86	0	14		
8	67	83	91	94	1	5	26	57	84	88	1	11		
9	65	83	91	91	0	9	43	76	87	88	1	11		
10	27	35	42	52	1	47	26	58	67	87	1	12		
11	61	79	84	86	1	13	46	77	87	91	1	8		
12	49	74	86	91	1	8	28	72	83	86	1	13		
13	71	82	89	90	1	9	67	79	84	85	1	14		
14	56	73	87	94	1	5	0	0	1	82	3	15	(Doubles) 10-day 50% roots showing, 14-day almost all roots emerge	
15	58	66	76	85	8	7	25	54	77	87	4	9		
16	44	64	75	79	4	17	18	60	69	72	9	19	Trouble with seedlings separating from seedball between counts. Roots browning & decaying	
17	61	77	86	88	1	11	35	68	86	90	1	9		
18	55	80	88	91	0	9	4	76	82	85	3	12		
				Mean: 86.3	SD: 9.3						Mean: 85.8	SD: 4.5		

Sample B 20-30C



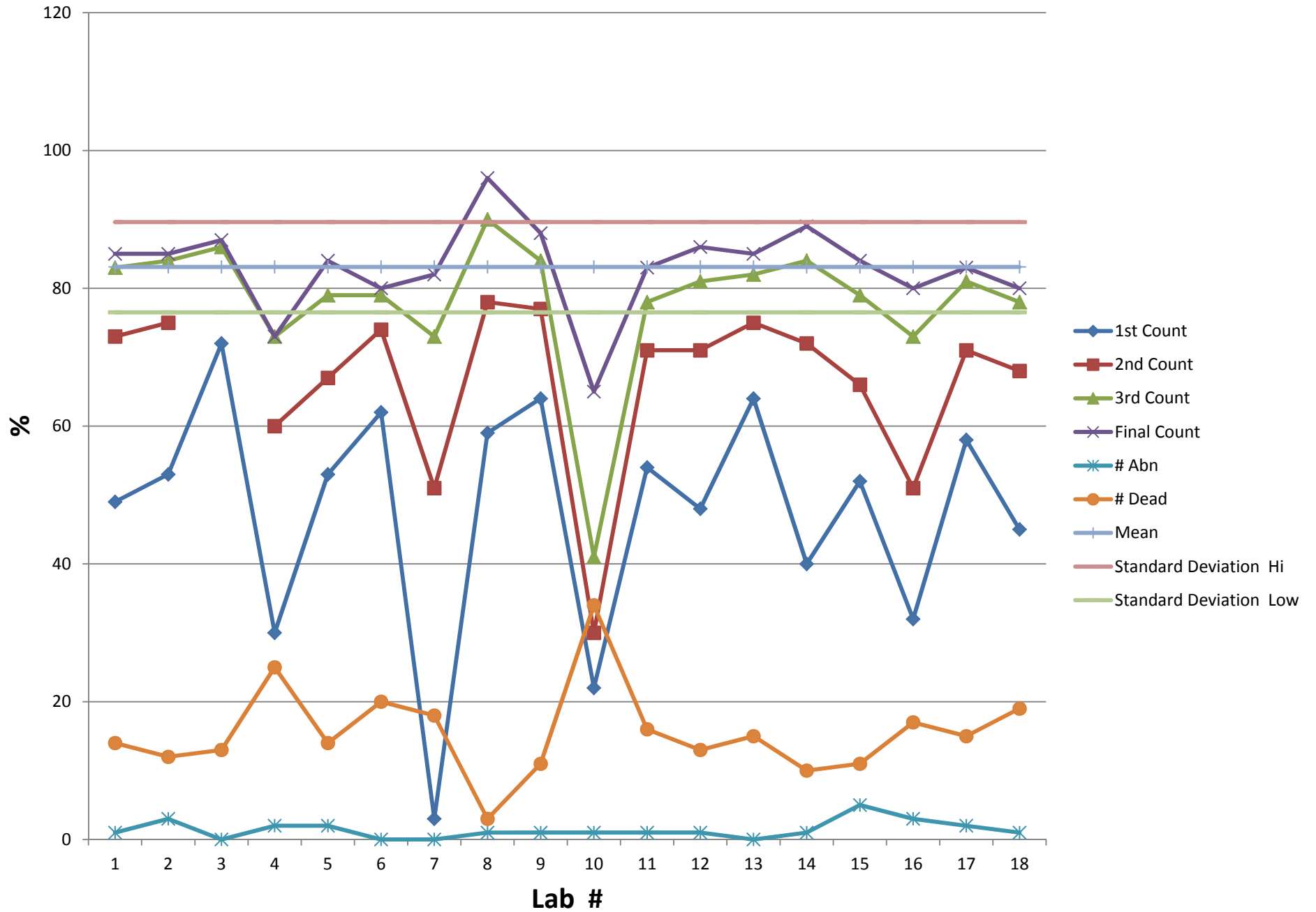
Sample B 15C



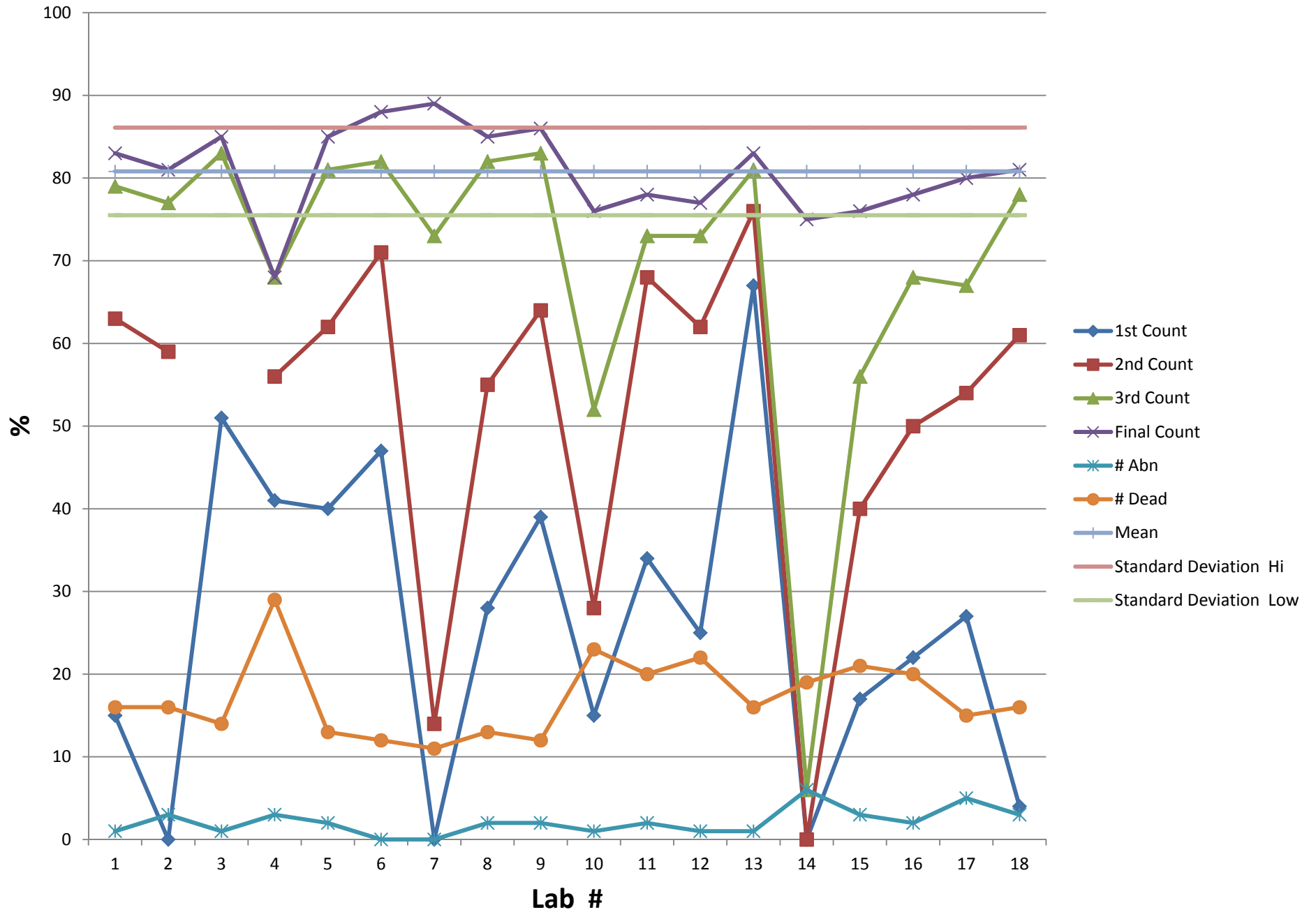
Sample-C

Lab #	20-30C					15C					Comments		
	<u>1st</u> Count	<u>2nd</u> Count	<u>3rd</u> Count	<u>Final</u> Coun t	# Abn	# Dead	<u>1st</u> Count	<u>2nd</u> Count	<u>3rd</u> Count	<u>Final</u> Coun t		# Abn	# Dead
1	49	73	83	85	1	14	15	63	79	83	1	16	
2	53	75	84	85	3	12	0	59	77	81	3	16	Sclerotia
3	72		86	87	0	13	51		83	85	1	14	10-day count missing
4	30	60	73	73	2	25	41	56	68	68	3	29	
5	53	67	79	84	2	14	40	62	81	85	2	13	
6	62	74	79	80	0	20	47	71	82	88	0	12	
7	3	51	73	82	0	18	0	14	73	89	0	11	
8	59	78	90	96	1	3	28	55	82	85	2	13	
9	64	77	84	88	1	11	39	64	83	86	2	12	
10	22	30	41	65	1	34	15	28	52	76	1	23	
11	54	71	78	83	1	16	34	68	73	78	2	20	Abn- Insufficient roots
12	48	71	81	86	1	13	25	62	73	77	1	22	
13	64	75	82	85	0	15	67	76	81	83	1	16	
14	40	72	84	89	1	10	0	0	6	75	6	19	(Doubles) 10-day 50% roots showing, 14-day almost all roots emerge
15	52	66	79	84	5	11	17	40	56	76	3	21	
16	32	51	73	80	3	17	22	50	68	78	2	20	Trouble with seedlings separating from seedball between counts.
17	58	71	81	83	2	15	27	54	67	80	5	15	
18	45	68	78	80	1	19	4	61	78	81	3	16	
				Mean: 83.1	SD: 6.5					Mean: 80.8	SD: 5.3		

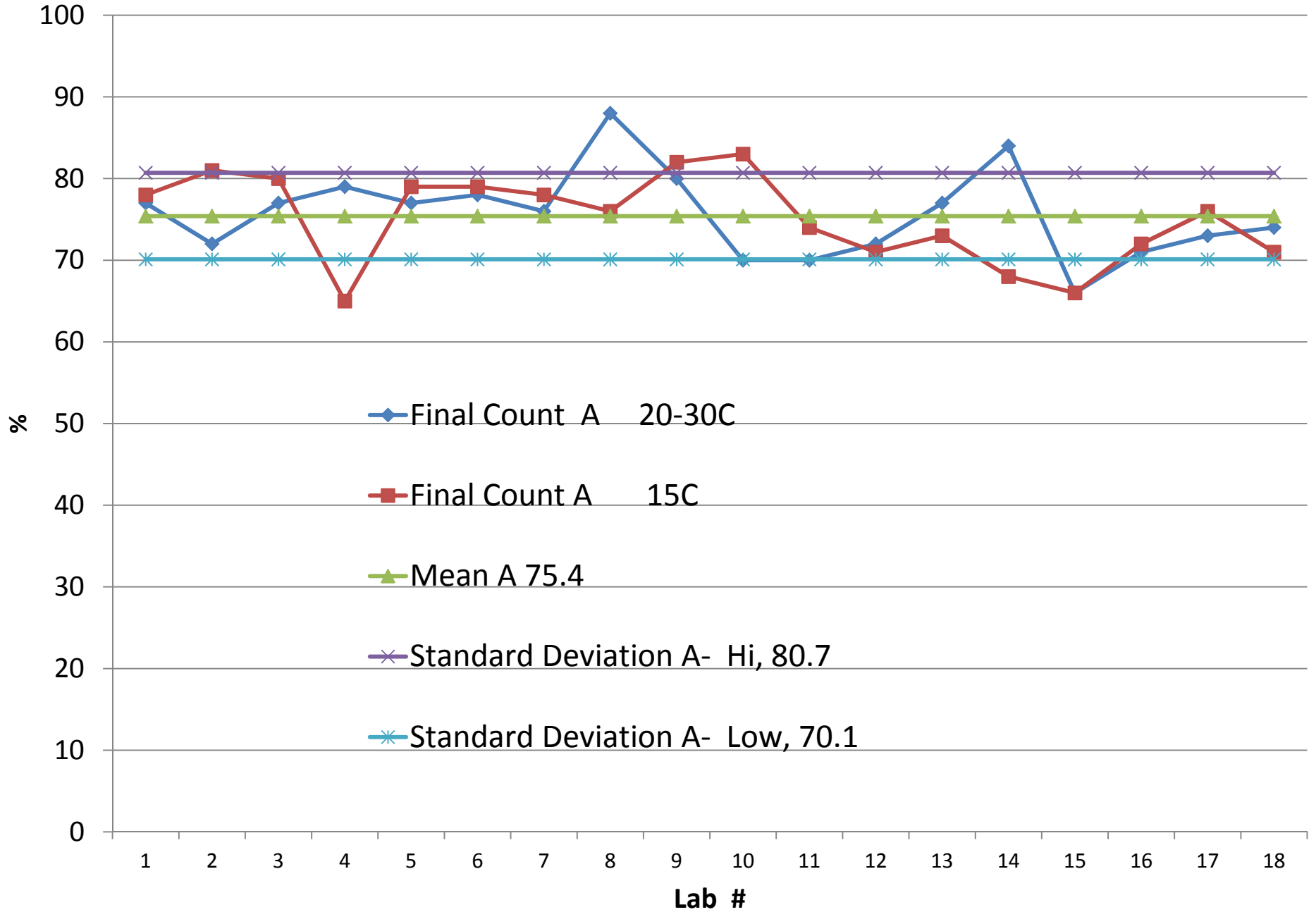
Sample C 20-30C



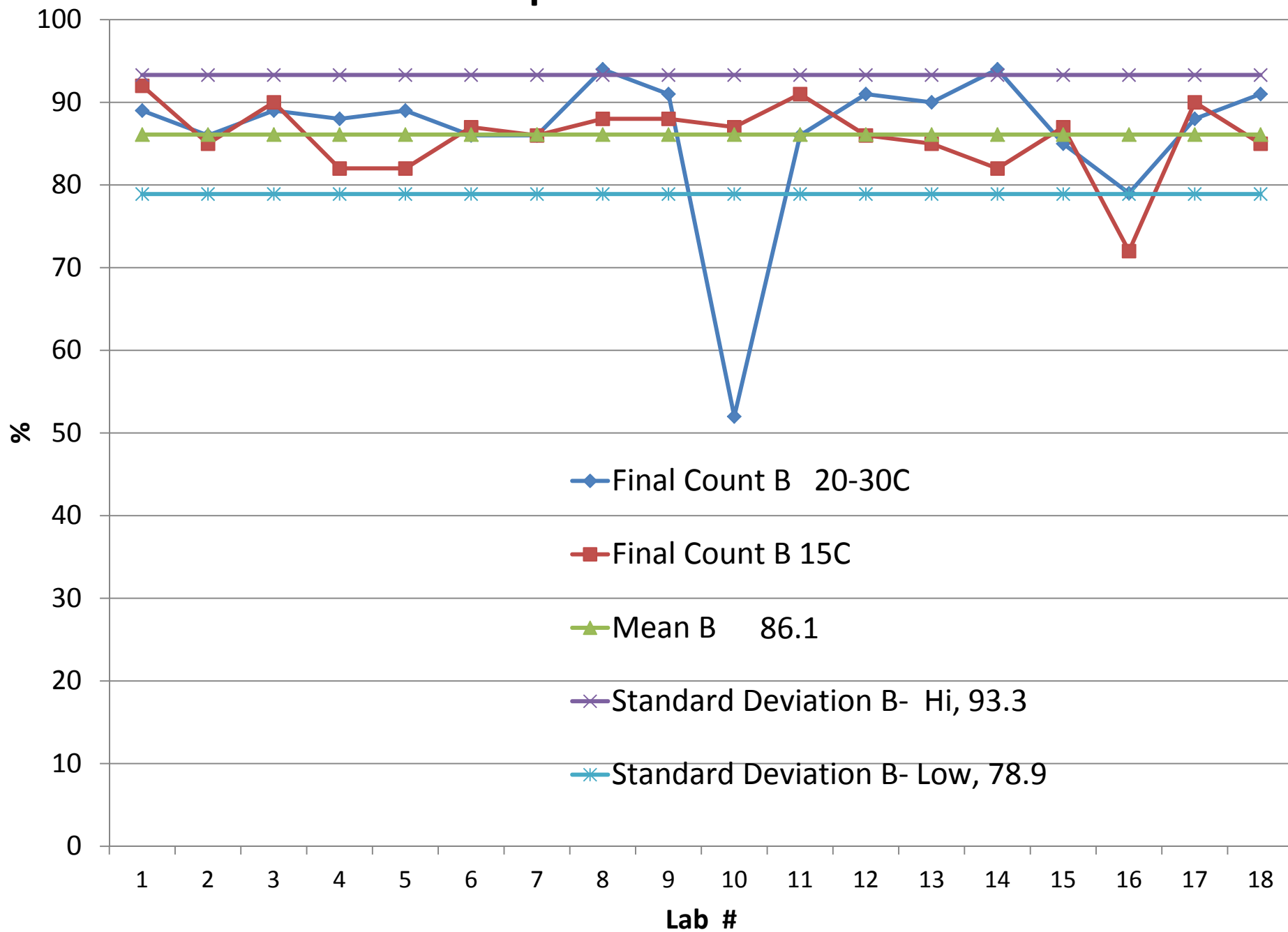
Sample C 15C



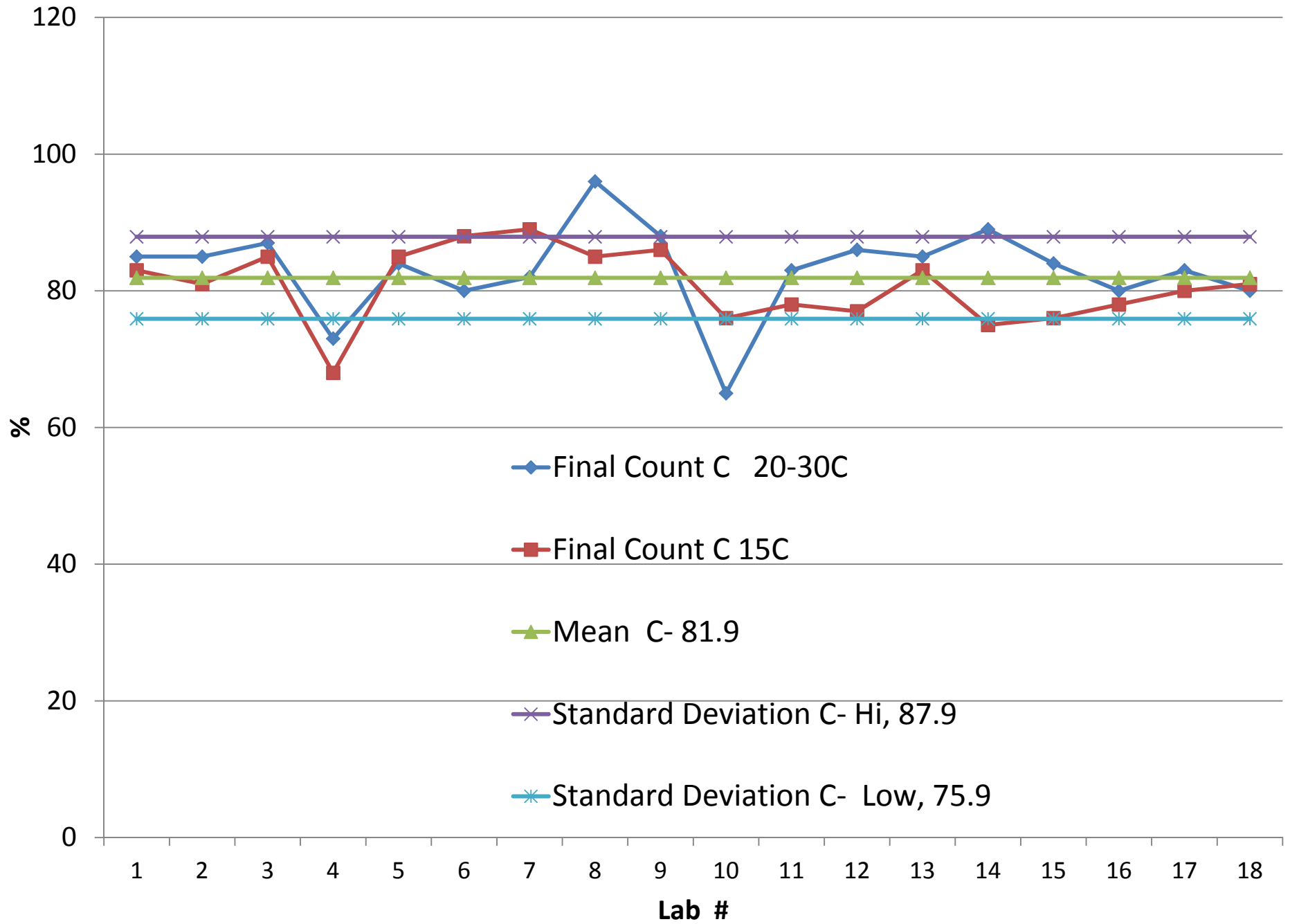
Sample A 20-30C vs 15C



Sample B 20-30C vs 15C



Sample C 20-30C vs 15C



20-30C Temp had a greater number of tests with higher germination rates

Lab #	<u>Final Count A</u>		<u>Final Count B</u>		<u>Final Count C</u>	
	<u>20-30C</u>	<u>15C</u>	<u>20-30C</u>	<u>B 15C</u>	<u>20-30C</u>	<u>15C</u>
1	77	78	89	92	85	83
2	72	81	86	85	85	81
3	77	80	89	90	87	85
4	79	65	88	82	73	68
5	77	79	89	82	84	85
6	78	79	86	87	80	88
7	76	78	86	86	82	89
8	88	76	94	88	96	85
9	80	82	91	88	88	86
10	70	83	52	87	65	76
11	70	74	86	91	83	78
12	72	71	91	86	86	77
13	77	73	90	85	85	83
14	84	68	94	82	89	75
15	66	66	85	87	84	76
16	71	72	79	72	80	78
17	73	76	88	90	83	80
18	74	71	91	85	80	81
% Tests with Higher germ:	33.33%	61.11%	55.56%	38.89%	72.22%	27.78%

Observations about Results

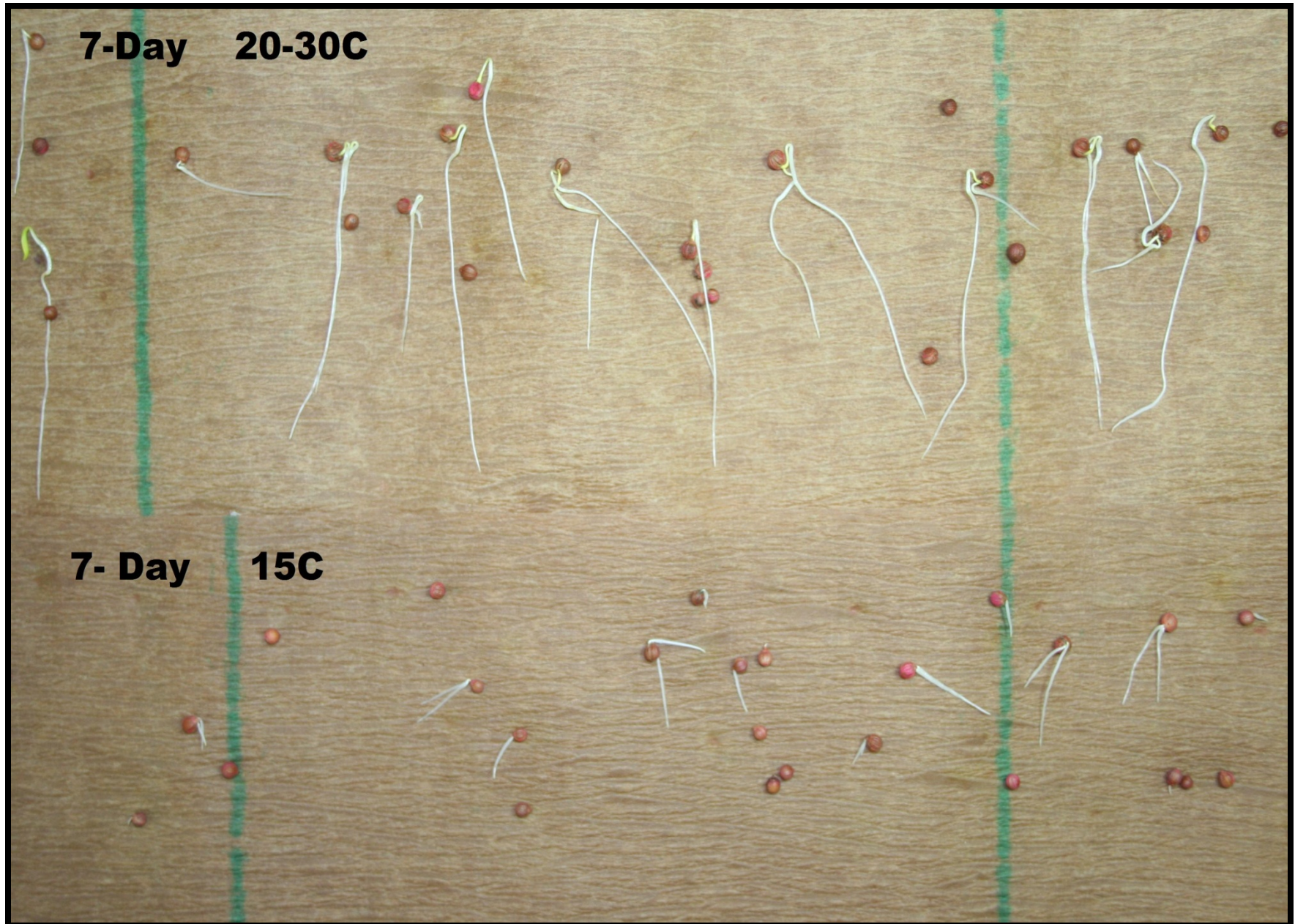
- The 20-30C Temp had a greater % of higher germination rates among all 18 labs for samples B and C:
 - Sample A 20-30C (33.33%), 15C (61.11%)
 - Sample B 20-30C (55.56%), 15C (38.89%)
 - Sample C 20-30C (72.22%) 15C (27.78%)
- The 20-30C Temp had a slightly higher average germination (Mean) for all three samples:
 - Sample A 20-30C (75.6%), 15C (75.1%)
 - Sample B 20-30C (86.3%), 15C (85.8%)
 - Sample C 20-30C (83.1%), 15C (80.8%)

- Seedlings in 20-30C temp seem to be more vigorous at 1st count than seedlings in the 15C temp.
- A 5 or 6 day first count is essential for 20-30C germination- The vigorous seedlings may separate from seedball
- Fungus needs to be controlled for 20-30C germination, more so than for 15C germination

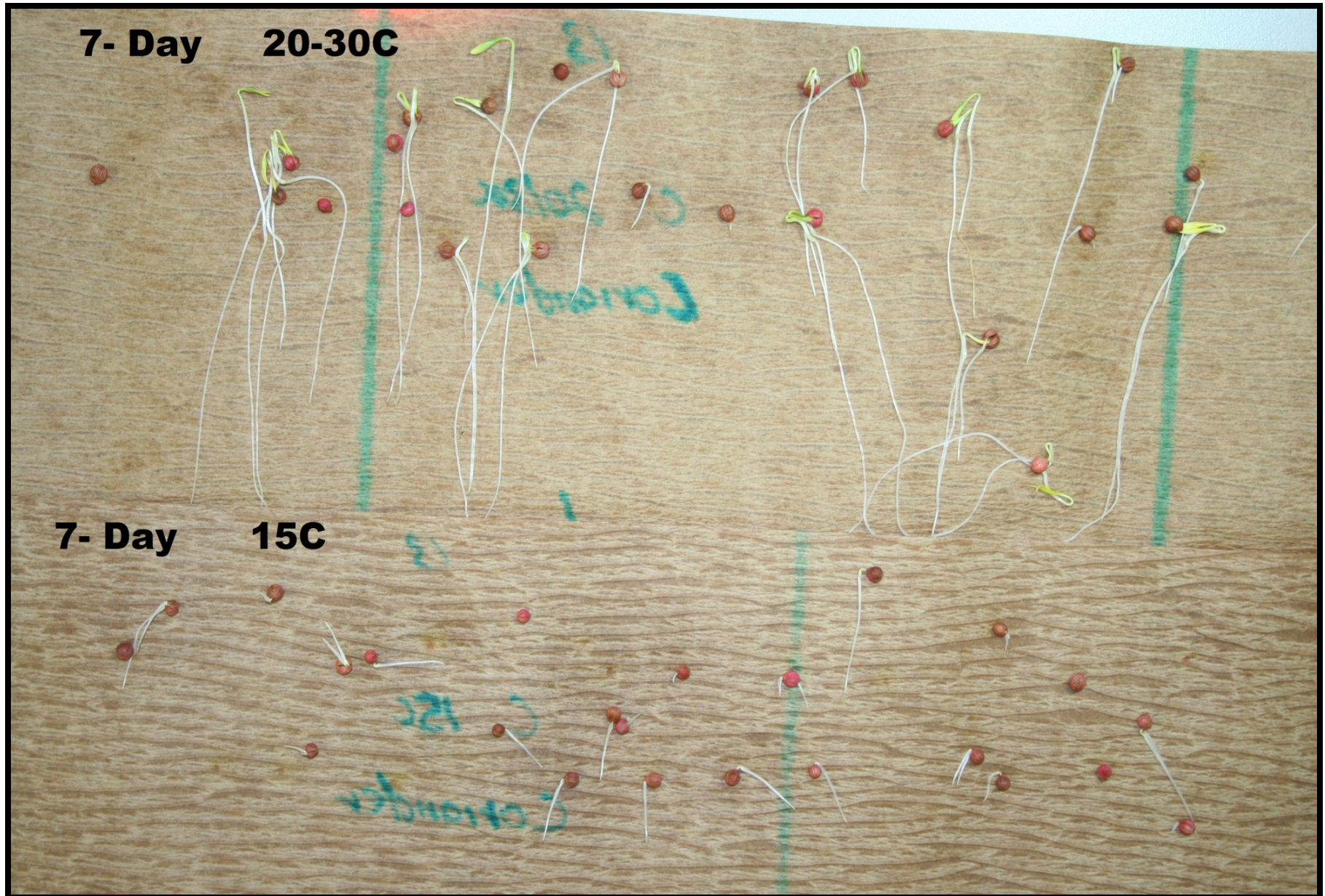
Coriander testing technique can be the difference in attaining the maximum germination potential of a seed lot.

- Technique factors include:
 - Moisture level: High moisture leads to decay, low moisture may lead to non-germ seed
 - Aeration level: low air flow leads to decay
 - Experience in evaluations-
 - How to un-roll towels
 - How to Lift off top blotters for between blotter tests
 - How to account for seedlings stuck in folds of PP or towels
 - How to evaluate coriander seedlings- too young vs normal
 - How to evaluate multi-germ seed units- remove entire seed ball when counting

20-30C compared to 15C First Count



20-30C compared to 15C First Count



Decayed Seedlings, Seedlings Separated from Seedball



Typical Abnormal Seedlings



Abnormals



Abnormals

Conclusion

20-30C germination results were comparable to 15C results

Recommendation

The 20-30C temp should be added as an alternative temp to AOSA Rules for germination testing of *Coriandrum sativum* L. (Coriander)

Thank You
to all Participants!

Special Thanks to Harris Moran Seed Co
for supplying the seed