Colloquium PLP6921

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Outline of the course

- Focus Methods Selection and Critique: experimental design and statistical analysis
- Secondary focus Oral Presentations, but without Powerpoint
- Themes:
 - Planning of experiments: exercise in Network Planning
 - Experimental design: examples of designs and data collection
 - Data analysis: overview of different types of data and the appropriate analyses
 - Analyze and critique papers with respect to design and analysis
 - Discuss papers with similar experiments as students will carry out
- Activities:
 - Read and present papers describing methods, papers with a faulty or correct design or statistical analysis
 - Two students (selected by lottery) will to give their interpretations of the paper in 5-10 minutes.
 - We will critique faulty designs or analyses and discuss alternatives
- Grading:
 - Oral presentations (50% grades by students, 50% grade by teacher)
 - Active participation in discussions (grade by teacher)
 - Final grade: (oral pres. + partic.)/2.

Minimal requirements for analyses

- Some statistical analysis (also for molecular papers)
- Choose proper analysis for continuous versus categorical data
 - Continuous versus discrete functions
- Assumptions of ANOVA:
 - Treatment effects are additive
 - Errors are normally distributed
 - Errors are independent (randomization of units over treatments)
 - Variances are equal
- Don't use multiple comparisons if:
 - Factorial designs
 - Quantitative levels of one variable
- Describe the experimental design, including true reps and pseudoreps, and statistical analysis in the Methods section
- Report the results of the analysis in the Results section (not just the main effects and p-value, but also interaction effects, normality of residuals, etc)
- Don't use too many, insignificant digits (example: 5 ft = 1.524 meters)

Examples of faulty analyses

Table 3. Comparison of greenhouse disease indices from spring and fall soil sampling

Company A (1980)		Comp (19		Comp (19		Company C (1981)		
Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	
64.9	62.7	54.9	57.4	54.9	60.0	70.6	62.7	
64.2	54.3	54.3	55.6	53.7	63.4	66.4	62.0	
60.0	60.0	48.4	58.7	53.7	62.7	63.4	62.7	
43.9	62.0	44.4	62.0	52.5	65.6	62.7	80.0	
53.1	65.6	41.0	58.1	51.4	60.0	62.7	56.8	
50.2	53.7	40.4	62.0	51.4	55.6	59.3	62.7	
46.7	53.7	35.1	30.0	48.4	56.8	59.3	50.8	
43.9	62.0	30.7	51.4	38.6	60.0	58.1	43.3	
30.0	62.7	27.3	56.2	34.4	58.7	51.4	62.0	
27.3	51.4			42.3	60.7	49.0	54.9	
Coef. corr. 0.61°		Coef. co	rr. 0.31	Coef. co	rr. 0.71°	Coef. corr. 0.39		

^{*}Significant at P = 0.01.

Disease index
$$= \frac{\begin{pmatrix} \text{Disease} & \text{Number of plants} \\ \text{class} & \times & \text{in that class} \\ \hline \text{Total number of plants} \times 4 \end{pmatrix}}{\text{Total number of plants}} \times 100$$

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Examples of faulty analyses = 24 DAYS AFTER CHALLENGE INOCULATION = 34 DAYS AFTER CHALLENGE INOCULATION H₂O TREATMENT I CELLS/MLI Fig. 1. Effect of pretreatment of tomato seedlings with water (H, D) or with bud cell suspensions of Fusarium oxysporum 1. sp. dianthi on development of will induced by a subsequent challenge inoculation with water or with a bud-cell suspension of F. oxysporum 1. sp. fixopersici race 1. Population density is given below each form aspecialis. Challenge inoculation was 2 days after pretreatment. But as represent means cartaing (scale 0-04-y) of 10 plants per treatment. On no will symptoms, 4 = all leaves dead. Letters that are common over the same type of bar (solid or stippled) are not significantly different, P = 0.05. Plant Disease/October 1982 909

Examples of faulty analyses

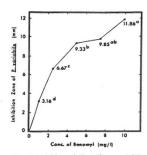


Fig. 2. Inhibition of *Penicillium variabile* (Poland Strain no. 2) by benomyl at 1, 2.5; 5, 7.5, and 10 mg/L. Values not followed by the same letter are significantly different at *P* = 0.05, according to Duncan's multiple range

Table 5. Apple scab, cedar-apple rust, and powdery mildew on four apple cultivars after fungicide applications at ultralow-volume rates

		Percent infection									
Disease	Treatment'	Jonathan	McIntosh	Golden Delicious	Delicious						
Apple scab	1	0.4 b ^z	12.9 b	6.2 b	14.3 b						
	2	0.0 b	8.1 b	3.8 b	9.3 b						
	3	0.6 b	16.3 b	4.5 b	17.6 b						
	4	1.5 a	69.4 a	66.0 a	34.2 a						
Cedar-apple rust	Ī	14.3 b	0.0 a	8.1 a	0.0 a						
	2	6.1 c	0.0 a	4.7 b	0.0 a						
	3	10.0 bc	0.0 a	3.5 b	0.0 a						
	4	20.0 a	0.0 a	9.1 a	0.0 a						
Powdery mildew	1	3.4 c	1.3 €	1.4 c	2.0 b						
,	2	10.4 b	4.7 b	5.9 b	2.3 a						
	3	7.7 bc	3.0 bc	2.4 c	0.5 b						
	4	18.3 a	16.3 a	13.8 a	0.2 b						

'Data are the mean number of foliar infections per 100 leaves per replicate, three replicates per

treatments are formulations in Table 1. 'Within each cultivar and disease, means followed by the same letter are not significantly different at P = 0.05, according to Duncan's multiple range test.

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Examples of faulty analyses

Cultivar or	No. of tests ^a			P		Standard							
selection		0	1	2	3	4	5	6	7	8	9	Rust rating	deviation
lka	6	99	1	0	0	0	0	0	0	0	0	0.0 a	0.0
1969	6	89	7	0	1	0	2	0	0	1	0	0.2 ab	0.9
Ruanui 909	3	70	25	5	0	0	0	0	0	0	0	0.3 abc	0.5
R-39 A	3	78	11	2	7	0	0	. 2	0	0	0	0.5 abc	1.0
oretta	6	78	12	2	3	1	5	0	0	0	0	0.5 abc	1.1
J-103°	3	77	7	7	5	2	2	0	0	0	0	0.6 abcd	0.9
Elliot	3	44	38	15	3 .	0	0	0	0	0	0	0.8 abcde	0.7
Donata	6	50	24	12	3	5	4	2	1	0	0	1.1 abcde	1.5
relude	3	54	15	13	6	2	6	2	2	0	0	1.3 abcde	1.6
printer	6	51	24	6	4	7	4	1	3	0	0	1.3 abcdef	1.0
Cropper	6	50	18	6	12	4	5	6	0	0	0	1.4 abcdefg	1.6
albot	. 6	51	18	7	8	2	6	7	1	0	0	1.5 abcdefg	1.7
remier	6	49	24	2	4	4	7	5	3	2	0	1.5 abcdefg	2.1
RR-I	3	56	8	6	6	9	6	6	2	0	0	1.6 abcdefg	2.1
iesta	6	49	15	12	5	2	7	3	4	2	0	1.7 abcdefg	1.8
Delray	3	48	9	13	9	4	6	11	0	0	0	1.8 abcdefgh	2.1
R-35	6	46	15	3	13	4	6	9	3	1	0	2.0 bcdefgh	2.0
Capper	6	34	24	13	6	5	6	4	7	1	0	2.0 bedefgh	1.7
Pennant	6	35	17	12	9	6	10	9	. 2	0	0	2.1 bedetgh	2.0
Palmer	3	44	17	2	2	13	7	11	2	2	0	2.1 bedefgh	2.5
Pelo	6	31	18	13	9	10	13	1	4	1	0	2.2 cdefgh	1.7
Joalie	3	27	26	7	7	9	11	7	4	2	0	2.4 defghi	2.3
rances	6	23	24	14	10	6	11	4	8	0	0	2.4 defghij	1.9
Birdie	6	35	14	5	7	8	14	12	5	0	0	2.5 defghij	2.5
Dasher	6	31	20	5	7	7	6	15	7	2	0	2.5 efghij	2.4
3-321	6	13	15	22	13	16	13	7	1	0	0	2.7 fghijk	1.5
Grandstand	6	35	10	4	9	7	19	9	6	1	0	2.8 ghijk	2.2
inn	6	17	20	12	10	7	20	9	5	0	0	2.9 ghijk	1.9
Acclaim	6	25	16	6	5	12	11	13	10	3	0	3.1 hijkl	2.5
Blazer	6	19	9	3	17	12	16	17	5	1	0	3.3 hijklm	2.2
Belle	6	18	10	5	13	16	20	7	11	1	0	3.4 hijklmn	2.2
core	6	22	14	8	1	9	14	16	15	2	0	3.5 hijklmno	1.6
Pronto	3	19	8	4	15	13	13	12	15	2	0 .	3.6 hijklmno	2.4
Ranger	6	14	9	4	12	16	22	21	2	1	0	3.7 ijklmno	2.0
Rex	6	16	7	8	9	15	18	15	12	1	. 0	3.8 ijklmno	1.2

Delray 3	FRR-I	3	56	8	6	6	9	6	0	2	0	0	1.6 abcdetg	2.1
Capper 6	Fiesta	6	49	15	12	5	2	7	3	4	2	0	1.7 abcdefg	1.8
Capper		3									0			
Pennant	R-35	6									1			
Palmer 3	Capper	6	34	24		6					1			
Pelo	Pennant	6	35	17	12		6							
Coalie 3	Palmer	3	44	17	2	2			11					2.5
Goalie 3 27 26 7 7 9 9 11 7 4 2 0 2.4 defsphi 2.3 Frances 6 23 24 14 10 6 11 4 8 0 0 0 2.5 defsphi 1.9 Birdie 6 35 14 5 7 8 14 12 5 0 0 0 2.5 defsphi 1.9 C5 Dasher 6 31 20 5 7 7 6 15 7 7 0 0 2.5 defsphi 2.4 S-321 6 13 15 22 13 16 13 7 1 0 0 0 2.7 fsphik 1.5 Grandstand 6 35 10 4 9 7 19 9 6 1 0 0 2.7 fsphik 1.5 Grandstand 6 17 20 12 10 7 20 9 5 0 0 0 2.8 ghijk 2.2 Linn 6 17 20 12 10 7 20 9 5 0 0 0 2.9 ghijk 1.9 Acclaim 6 25 16 6 5 12 11 13 10 3 0 3 1.5 hijklm 2.2 Blazer 6 19 9 3 17 12 16 17 5 1 0 3.3 hijklm 2.2 Blazer 6 19 9 3 17 12 16 17 5 1 0 3.3 hijklm 2.2 Score 6 12 14 8 1 9 14 16 15 2 0 3 1.5 hijklm 2.2 Score 6 14 9 7 19 9 14 16 15 2 0 3.5 hijklm 2.2 Score 6 14 9 9 4 12 16 20 7 11 1 0 3.3 hijklm 2.2 Score 6 14 9 9 4 12 16 22 21 2 1 0 3.5 hijklm 2.4 Ranger 6 14 9 9 4 12 16 22 21 2 1 0 3.5 hijklm 2.4 Ranger 6 16 17 2 1 15 13 16 22 2 1 2 1 0 3.7 ijklmo 2.4 Ranger 6 16 17 2 10 6 16 14 18 10 3 0 3 0 3.9 ijklmo 2.4 Ranger 6 16 16 7 8 9 15 18 15 12 1 0 3 3 0 3.9 ijklmo 2.2 Ensporta 6 16 6 18 1 2 2 10 6 16 14 18 10 3 0 3 0 3.9 ijklmo 1.2 Ensporta 6 13 6 6 16 7 8 9 15 18 15 12 1 0 3.7 ijklmo 1.2 Classion 6 13 14 6 15 13 13 12 15 2 0 0 3.9 ijklmo 1.2 Classion 6 13 14 6 15 13 13 13 12 15 2 0 0 3.9 ijklmo 2.2 Classion 6 13 14 6 13 14 13 13 14 11 13 13 14 15 14 14 14 15 15 13 15 17 14 14 14 15 15 14 15 15 15 15 15 15 14 15 14 15 15 15 15 15 15 15 15 15 15 15 15 15	Pelo	6	31	18	13	9	10	13	1	4	1	0		
Birdie		3	27	26	7	7	9	11	7		2	0	2.4 defghi	
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Rex. 6		3												
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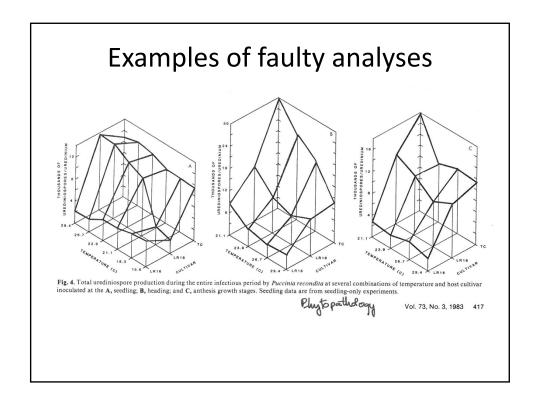
^{*}Sixteen plants were used in each test.

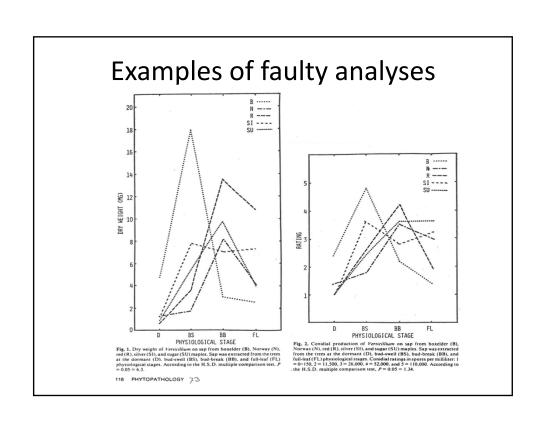
*Scale based on visual estimates approximating area of foliage rusted: 0 = no rust, 1 = trace, 3 = 10%, 5 = 30%, 7 = 50%, 9 = ≥70%.

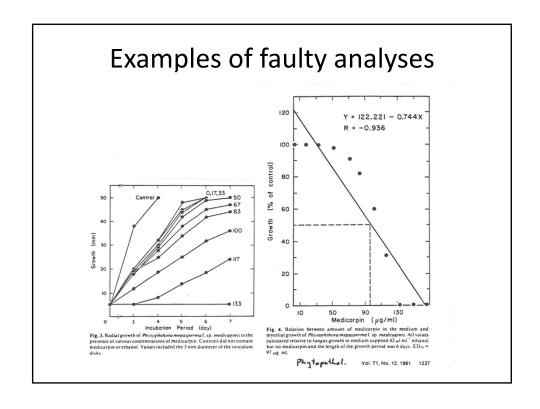
*Means followed by the same letter are not significantly different from each other (Duncan's multiple range test, P = 0.05).

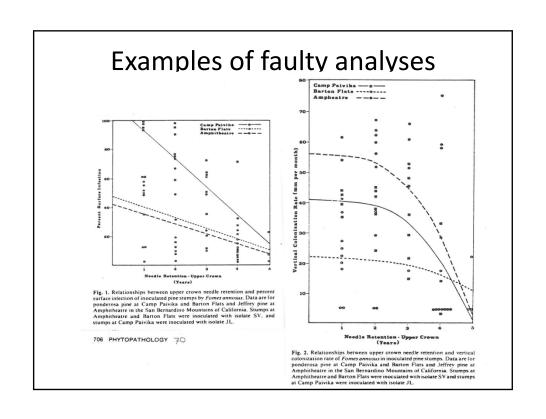
*Standard deviation represents pooled variances from all tests.

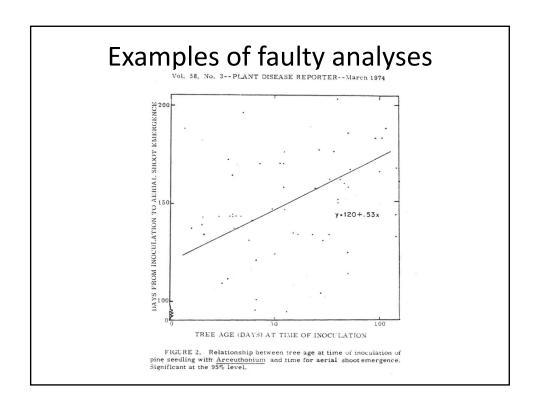
*U-103 is a selection of annual ryegrass. Lolium multiplorum.

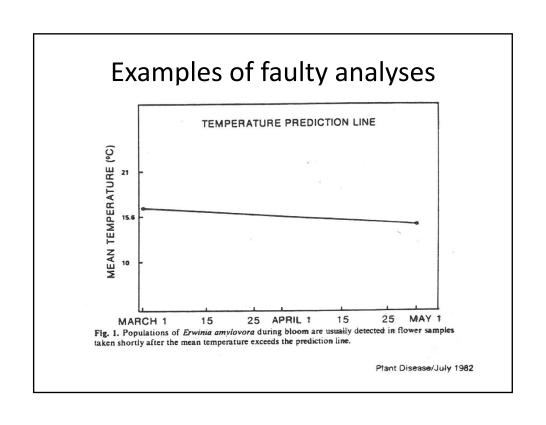












THE END

- Let's have fun!
- Next week: planning of experiments