

QUEEN MARY, UNIVERSITY OF LONDON

MAS 314

Design of Experiments

Assignment 4

For discussion on 6 February 2007

1 The accompanying plan is the field layout of a 1935 experiment conducted at Rothamsted Experimental Station (at Harpenden, near St Albans). Each plot had a notice on it showing the block number and the plot number. The purpose of the experiment was to compare various types of fumigant, in single and double doses, for their ability to control eelworms in the soil where oats were being grown. A “control” treatment (i.e. no fumigant) was included. In the spring, 400 gm of soil were sampled from each plot, and the number of eelworm cysts in each sample counted and recorded. The oats were sown, fumigated, grown and harvested. After harvest the plots were sampled again in the same way, and the number of cysts recorded.

- (i) How many treatments were there?
- (ii) How were the plots divided into blocks?
- (iii) After sampling soil from plot 4 of block 3, which plot should the scientist sample next?
- (iv) Devise a better way of numbering the plots.
- (v) Why do you think logarithms were used to present the data in the form *logcount*?

2 Ignoring the factorial structure of the treatments, calculate the analysis-of-variance table and the table of means for the data *logcount* in the eelworm experiment. Do this without using a computer.

3 Redo Question 2 of Assignment 1 under the assumption that the professor has 10 pills of Wakey-Wakey and 10 of Zizzaway.

There is only one observation room, so only one pill can be tested per day. Your plan should show which student should take which pill on which day.

What information should you give the professor about the plan?

logcount = log (number of eelworm cysts at harvest) -
log (number of eelworm cysts in spring before treatment)

block	1	1	1	1	2	2	2	2
plot	1	2	3	4	1	2	3	4
fumigant	1	2	2	2	2	2	2	1
dose	0	2	1	1	2	2	2	0
type	Z	K	N	M	M	S	K	Z
logcount	0.549	-0.011	0.457	0.599	0.739	0.268	0.574	1.482

block	1	1	1	1	2	2	2	2
plot	5	6	7	8	5	6	7	8
fumigant	2	1	1	2	2	2	2	1
dose	1	0	0	2	1	1	1	0
type	S	Z	Z	M	K	N	M	Z
logcount	0.341	0.784	0.759	0.365	0.791	1.316	1.457	0.616

block	1	1	1	1	2	2	2	2
plot	9	10	11	12	9	10	11	12
fumigant	2	2	1	2	1	1	2	2
dose	2	1	0	2	0	0	2	1
type	S	K	Z	N	Z	Z	N	S
logcount	0.277	0.107	1.187	0.740	1.398	2.138	1.992	1.271

block	3	3	3	3	4	4	4	4
plot	1	2	3	4	1	2	3	4
fumigant	2	1	2	2	2	1	2	2
dose	1	0	1	2	2	0	1	1
type	K	Z	S	K	K	Z	K	M
logcount	0.771	0.873	0.803	0.609	0.414	0.521	0.191	1.088

block	3	3	3	3	4	4	4	4
plot	5	6	7	8	5	6	7	8
fumigant	1	2	2	2	1	2	2	1
dose	0	2	2	1	0	2	2	0
type	Z	N	S	N	Z	N	S	Z
logcount	1.269	1.067	0.888	1.665	2.170	2.325	0.499	1.719

block	3	3	3	3	4	4	4	4
plot	9	10	11	12	9	10	11	12
fumigant	2	1	2	1	2	2	1	2
dose	2	0	1	0	1	1	0	2
type	M	Z	M	Z	S	N	Z	M
logcount	0.812	1.081	1.355	1.618	1.247	1.792	1.807	1.826