

QUEEN MARY, UNIVERSITY OF LONDON

MAS 314

Design of Experiments

Assignment 5

For discussion on 13 February 2007

1 Use the data in Question 1 of Assignment 4. 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.

2 These data are based on a genuine agricultural experiment, but have been slightly modified for confidentiality. A completely randomized experiment was conducted with three treatment factors:

type of nitrogen fertilizer — Dutch or English;

method of fertilizer application — applied as a single dressing, or split into two halves and applied half at the normal time and half one month later;

quantity of nitrogen applied — 80 to 280 kg/ha, in increments of 40 kg/ha.

The response measured on each plot was the yield of wheat in tonnes per hectare.

The following sheets show the data, the analysis-of-variance table and the tables of means. Interpret this analysis for the benefit of an agronomist who may not understand statistical jargon.

plot	1	2	3	4	5	6	7
method	split	split	split	single	single	single	single
type	Dutch	Dutch	Dutch	English	English	English	Dutch
nitrogen	280	120	160	160	120	280	80
yield	6.6	4.8	5.3	4.7	4.8	4.6	3.3
plot	8	9	10	11	12	13	14
method	single	single	split	split	split	single	split
type	Dutch	Dutch	English	English	English	English	Dutch
nitrogen	200	240	240	200	80	80	240
yield	3.7	4.5	5.9	6.1	4.8	3.9	5.4
plot	15	16	17	18	19	20	21
method	single	split	split	single	single	single	split
type	English	English	English	Dutch	Dutch	English	Dutch
nitrogen	240	160	280	120	280	200	200
yield	4.4	5.8	5.8	4.1	3.8	4.1	5.2
plot	22	23	24	25	26	27	28
method	split	single	split	split	split	single	split
type	Dutch	Dutch	English	Dutch	Dutch	Dutch	English
nitrogen	80	160	120	120	280	80	80
yield	4.3	3.9	4.9	4.7	5.2	3.9	3.8
plot	29	30	31	32	33	34	35
method	single	single	split	single	split	split	single
type	Dutch	English	Dutch	English	English	English	Dutch
nitrogen	200	160	160	280	200	240	240
yield	4.2	4.4	5.1	4.6	5.7	5.8	4.4
plot	36	37	38	39	40	41	42
method	single	single	split	single	split	single	split
type	English	Dutch	Dutch	Dutch	Dutch	English	English
nitrogen	120	160	240	280	80	240	120
yield	3.5	4.2	5.0	4.6	4.4	4.1	4.6
plot	43	44	45	46	47	48	
method	split	single	single	split	single	split	
type	English	English	Dutch	English	English	Dutch	
nitrogen	160	80	120	280	200	200	
yield	4.9	3.7	3.7	5.5	5.0	5.4	

***** Analysis of variance *****

Variate: yield

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
method	1	12.9169	12.9169	72.01	<.001
type	1	0.6769	0.6769	3.77	0.064
nitrogen	5	6.6760	1.3352	7.44	<.001
method.type	1	0.0352	0.0352	0.20	0.662
method.nitrogen	5	1.0044	0.2009	1.12	0.376
type.nitrogen	5	0.4094	0.0819	0.46	0.804
method.type.nitrogen	5	0.6610	0.1322	0.74	0.603
Residual	24	4.3050	0.1794		
Total	47	26.6848			

***** Tables of means *****

Variate: yield

Grand mean 4.690

method	single	split					
	4.171	5.208					
type	Dutch	English					
	4.571	4.808					
nitrogen	80	120	160	200	240	280	
	4.012	4.387	4.787	4.925	4.937	5.087	
method	type	Dutch	English				
single		4.025	4.317				
split		5.117	5.300				
method nitrogen	80	120	160	200	240	280	
single		3.700	4.025	4.300	4.250	4.350	4.400
split		4.325	4.750	5.275	5.600	5.525	5.775
type nitrogen	80	120	160	200	240	280	
Dutch		3.975	4.325	4.625	4.625	4.825	5.050
English		4.050	4.450	4.950	5.225	5.050	5.125

method	type	nitrogen	80	120	160	200	240
single	Dutch		3.600	3.900	4.050	3.950	4.450
	English		3.800	4.150	4.550	4.550	4.250
split	Dutch		4.350	4.750	5.200	5.300	5.200
	English		4.300	4.750	5.350	5.900	5.850
method	type	nitrogen	280				
single	Dutch		4.200				
	English		4.600				
split	Dutch		5.900				
	English		5.650				

*** Standard errors of differences of means ***

Table	method	type	nitrogen	method type
rep.	24	24	8	12
d.f.	24	24	24	24
s.e.d.	0.1223	0.1223	0.2118	0.1729

Table	method nitrogen	type nitrogen	method type nitrogen
rep.	4	4	2
d.f.	24	24	24
s.e.d.	0.2995	0.2995	0.4235