



MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2012/2013

FIRST YEAR SECOND SEMESTER EXAMINATIONS FOR THE DEGREE OF MASTER OF SCIENCE IN HORTICULTURE (MAIN CAMPUS)

SHC 803: RESEARCH METHODOLOGY

Date: 29th July, 2013

Time: 8.30 – 11.30 a.m.

INSTRUCTIONS:

- ◆ Answer ALL questions in Section A (30 marks) and ANY TWO questions from Section B (30 marks).



MASENO UNIVERSITY
SCHOOL OF AGRICULTURE AND FOOD SECURITY
DEPARTMENT OF APPLIED PLANT SCIENCES

SHC 803 Research Methodology

Instructions: Answer ALL questions in section A (30 mks) and TWO questions from section B (30 mks)

Section A:

1. Define the following terms as used in the research process (1 mk each)
 - i) Research hypothesis
 - ii) Confidence interval
 - iii) Significance level
 - iv) Treatment mean
 - v) Experimental Unit

2. Sections of tomato plant tissues were grown in tissue cultures with differing types of auxin in an experiment with five replications of four treatments in a CRD. The tissue growth of each culture is given in the table below as mm x 10.

Control	3% IAA	3% IBA	3% NAA
45	25	28	31
39	28	31	37
40	30	24	35
45	29	28	33
42	33	27	34

- i) Write the linear statistical model for this study, and explain the model components (2 mks)
- ii) State the assumptions necessary for an ANOVA of the data (3 mks)
- iii) Compute the ANOVA for the data (10 mks)
- iv) Compute the least squares means and their standard errors for each auxin type (4 mks)
- v) Test the hypothesis of no difference among the means of auxin types with the F test at 0.05 level of significance (2 mks)
- vi) This experiment was conducted in a CRD with the field plots in a 4x5 rectangular array of plots. Show a randomization of the four auxin treatments to the 20 plots using a random permutation of the numbers 1 through 20 (4 mks).

Section B: Answer TWO questions from this Section

1. A researcher wanted to determine the change in porosity of a soil medium which is known to be associated with irrigation method and the percent of clay in the medium. She conducted an experiment to evaluate the differences among a set of irrigation methods for their effect on porosity of the medium and to determine to what extent the percent clay affected the comparisons among irrigation types. There were two levels of clay content and four levels of irrigation methods. The experiment was replicated three times. The porosity data were as below:

Pore density after 5 weeks				
Percent clay	Underground	Sprinkler	Rain fed	Drip
High %	68	126	93	56
	63	128	101	59
	65	133	98	57
Low %	71	107	63	40
	66	110	60	41
	66	116	59	44

Assuming that the data consists of all possible levels the students could access, and was normally distributed:

- i) What experimental design was this (3 mks)
- ii) Compute an ANOVA for this experiment (10 mks)
- iii) What level of treatment combinations resulted in significantly low porosity (2 mks).

2. A researcher wanted to evaluate the effect of several different fertilization timing schedules on stem tissue nitrate amounts and wheat production to refine the recommendation procedure. Six different nitrogen applications timing and rate schedules that were thought to provide the range of conditions necessary to evaluate the process were used. A treatment of no nitrogen(N1) was used as a control. The experiment was conducted in an irrigated field with a water gradient along one direction of the experimental plot area as a result of irrigation thus variability of 4 levels of available moisture across the field.

Observed nitrogen content (ppm x 10 ⁻⁴)						
Moisture						
Level 1	N2	N5	N4	N1	N6	N3
	40.89	37.99	37.18	34.98	34.89	42.07
Level 2	N1	N3	N4	N6	N5	N2
	41.22	49.42	45.85	50.15	41.99	46.69
Level 3	N6	N3	N5	N1	N2	N4
	44.57	52.68	37.61	36.94	46.65	40.23
Level 4	N2	N4	N6	N5	N3	N1
	41.90	39.20	43.29	40.45	42.91	39.97

Use the data to answer the following questions:

- i) What experimental design was this? (3 mks)
- ii) Were there any significant differences among nitrogen treatments with respect to stem nitrogen content? (12 mks)

3. An experiment was conducted to test the effects of nitrogen fertilizer on lettuce production. Five rates of ammonium nitrate were applied to four replicate plots in a completely randomized design. The data on the number of heads of lettuce harvested from the plot were as below:

Treatment kgN/ha	Number of heads of lettuce per plot			
0	104	114	90	140
50	134	130	144	174
100	146	142	152	156
150	147	160	160	163
200	131	148	154	163

- i) Compute the ANOVA for the data (8 mks).
- ii) Compute the 95% confidence interval estimates of the nitrogen level means (7 mks)