1. The ANOVA from a randomized complete block experiment output is shown below. In this experiment, 30 experimental units were evaluated.

Source SS DF MS F P-value

Treatment 1010.56 4 \_\_ 29.84 \_\_\_

Block \_\_\_ \_\_\_ 64.765 \_\_\_\_ \_\_\_

Error 169.33 20 \_\_\_

Total 1503.71 \_\_\_

a) Fill in the blanks.

b) How many blocks were used in this experiment?

c) What conclusions can you draw?

1. An experiment with 12 hybrids of Brachiaria spp was carried out in a randomized block design with three replications. The variable measured was the leaf protein content (P %).

|  |  |  |  |
| --- | --- | --- | --- |
| hybrid | block | | |
| block 1 | block 2 | block 3 |
| 1 | 6.8 | 8.9 | 10.0 |
| 2 | 5.8 | 6.4 | 9.0 |
| 3 | 6.8 | 8.9 | 11 |
| 4 | 5.6 | 6.2 | 6.9 |
| 5 | 6.9 | 6.1 | 7.0 |
| 6 | 3.9 | 4.9 | 5.2 |
| 7 | 6.0 | 5.5 | 7.9 |
| 8 | 4.5 | 5.0 | 6.1 |
| 9 | 6.1 | 5.3 | 8.5 |
| 10 | 5.3 | 6.5 | 9.7 |
| 11 | 5.9 | 9.0 | 11.2 |
| 12 | 5.2 | 6.4 | 7.6 |

1. Formulate the statistical hypotheses H0 and H1 related to the hybrids.
2. Check the basic assumptions at 5% probability for the purpose of performing the ANAVA (normality of errors: Q-Q Plot; additivity of effects: Tukey test; homoscedasticity: Anscombe and Tukey test (1963)). Interpret the results.

Perform the analysis of variance (ANAVA).

1. Which hybrid performed best?
2. Create a graph that shows the performance of different hybrids.
3. [Use data set: HW4\_Q3.csv] The investigators (K. Blenk, M. Chen, G. Evans, J. Chen Ibinson, J. Lamack, and E. Scott, 2000) planned an experiment to investigate how rapid-rise yeast and regular yeast differ in terms of their rate of rising. They were also interested in finding out whether temperature had a significant effect on the rising rate. For each observation, 0.3 gm of yeast and 0.45 gm of sugar were mixed and added to a test tube, together with 6 ml of water. The test tube was placed into a water bath of a specified temperature. The level (height) of the mixture in the test tube was recorded immediately and then again after 15 minutes. Each response is the percentage gain in the height of the mixture in the test tube after 15 minutes. There were three treatment factors:

Factor C: Initial temperature of water mixed with the yeast and flour (3 levels: 100◦F, 115◦F, 130◦F)

Factor D: Type of yeast (2 levels: Rapid rise, Regular)

Factor E: Temperature of water bath (2 levels: 70◦F, 85◦F)

1. Explain in at most two sentences why the treatment combinations should be randomly ordered in each block before measurements.
2. Obtain the analysis of variance table and explain what conclusions you can draw from it.
3. Create a figure that illustrates the effect of the factor “water”.
4. The data set presented in HW4\_Q4.csv comes from an experiment that aimed to evaluate the effect of three doses of herbicide and four different fertilizers on yield. It is a factorial CRD. Run the proper analysis and make interpretations.
5. A researcher wants to conduct an experiment to evaluate the effect of irrigation and cover crops on rice yield. Three levels of irrigation were selected (1, 2, and 3 irrigations/per week). Four cover crops were selected (A, B, C, D). They would like to use three replicates. There is a gradient of fertility in the field making it slightly heterogeneous. With the information above, design the proper experiment. Made up some data to analyze this experiment and present the design and the analysis below.