

## HW 04 Due 10/18/2022

- a)  $H_0: M_{\text{NaCl}} = M_{\text{FA}} = M_{\text{BP}} = M_{\text{control}}$   $\rightarrow$  Mean moisture content of silage is equal  
 $H_A: M_{\text{NaCl}} \neq M_{\text{FA}} \neq M_{\text{BP}} \neq M_{\text{control}}$   $\rightarrow$  One or more means is different from each other

$$M_{\text{NaCl}} = 79.6, M_{\text{Formic Acid}} = 82.0, M_{\text{Beef pulp}} = 78.1, M_{\text{control}} = 77.5$$

$$\text{Overall mean} = 79.3$$

$$\begin{aligned} \text{SSR} &= (n \sum (x_k - \bar{x})^2) = 3(79.6 - 79.3)^2 + 3(82.0 - 79.3)^2 + 3(78.1 - 79.3)^2 + 3(77.5 - 79.3)^2 \\ &= 0.27 + 21.87 + 4.32 + 9.72 = \boxed{36.18} \end{aligned}$$

$$\begin{aligned} \text{SSE} &= (\sum (x_{ik} - \bar{x}_k)^2) = ((80.5 - 79.6)^2 + (79.3 - 79.6)^2 + (79.0 - 79.6)^2) \\ &\quad + ((89.1 - 82.0)^2 + (75.7 - 82.0)^2 + (81.2 - 82.0)^2) \\ &\quad + ((77.8 - 78.1)^2 + (79.5 - 78.1)^2 + (77.0 - 78.1)^2) \\ &\quad + ((76.7 - 77.5)^2 + (77.2 - 77.5)^2 + (78.6 - 77.5)^2) \\ &= 1.26 + 90.74 + 3.26 + 1.94 = \boxed{97.2} \end{aligned}$$

$$df_{\text{treatments}} = k - 1 = 4 - 1 = 3, df_{\text{error}} = n - k = 12 - 4 = 8$$

$$MST_{\text{treatment}} = 36.18 / 3 = 12.06 \approx 44.46$$

$$MSE_{\text{error}} = 97.2 / 8 = 12.15$$

$$F_{\text{statistic}} = 12.06 / 12.15 = 0.9926$$

$P = 0.44 \rightarrow 0.44 > 0.05$ , thus, we fail to reject the null that all mean moisture content of silage is equal at a 0.05 level of significance; in other words, all treatments yield the same mean moisture content.

b)  $M_{\text{Treatment (not control)}} = 79.9, M_{\text{control}} = 77.5$

$$LD = 79.9 - 77.5 \pm (2.977) \sqrt{\frac{12.06}{9} + \frac{12.06}{3}}$$

$$2.4 \pm 6.89$$

$$LD (-4.49, 9.29)$$

$$c) M_{\text{NaCl}} - M_{\text{control}} = -21.1, \quad M_{\text{Formic Acid}} - M_{\text{control}} = -4.5, \quad M_{\text{beef}} - M_{\text{control}} = -0.6$$

$$\text{Using } x_1 - x_2 \pm q \left( \sqrt{\frac{MSE}{2} \left( \frac{1}{n_1} + \frac{1}{n_2} \right)} \right)$$

$$\therefore 9.005, 4.8 \approx 4.529$$

$$\therefore x_1 - x_2 \pm 4.529 \sqrt{\frac{12.15}{2} \left( \frac{1}{n_1} + \frac{1}{n_2} \right)} \rightarrow x_1 - x_2 \pm 11.1624 \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

$$\therefore C_1 \text{ of NaCl and Control} = (-11.214, 7.014)$$

$$\therefore C_1 \text{ of Acid and Control} = (-13.614, 4.614)$$

$$\therefore C_1 \text{ of beef and Control} = (-9.714, 8.514)$$

$$2) df_{\text{resid}} = k(N-1), \text{ where } k = \text{number of treatments and } N = \text{number of samples}$$

$$\therefore 25 = k(N-1)$$

$$25 = 5(N-1)$$

$$5 = N-1$$

$$6 = N$$