Answer on Question #55137, Math Statistics and Probability

The following table gives the yield of a hybrid variety of wheat, in quintals per acre from 17 trial plots of land treated with four types of fertilizers

Treatment with fertilizer

A B C D

24 31 39 38

39 25 41 32

35 26 33 35

21 40 34

45 26

Estimate the number of orchards in the district.

Solution

A	B	C	D
24	31	39	38
39	25	41	32
35	26	33	35
	21	40	34
		45	26

We have to test H_o: $\mu_A = \mu_B = \mu_C = \mu_D$, where $\mu_A, \mu_B, \mu_C, \mu_D$ denote the mean yield per acre due to fertilizer A,B,C and respectively.

$$\mu = \frac{1}{17}\sum_{i=1}^{17} X_i = 33.$$

On subtracting 333 from every observation, the given table can be written as

Treatment with fertiliser			
A	**B**	**C**	**D**
-9	-2	6	5
6	-8	8	-1
2	-7	0	2
	-12	7	1
		12	-7
T_1=-1	**T_2=-29**	**T_3=33**	T_4=0

From the above table, we can write

$$\sum\sum X_{ij}^2 = 755; \frac{T_1^2}{n_1} = \frac{1}{3}; \frac{T_2^2}{n_2} = \frac{841}{4}; \frac{T_3^2}{n_3} = \frac{1089}{5}; \frac{T_4^2}{n_4} = 0; \frac{T^2}{n} = \frac{9}{17}$$

Thus, we have

$$TSS = 755 - 9/17 = 754.47$$

$$TRSS = 1/3 + 841/4 - 9/17 = 472.85$$

$$ESS = TSS - TRSS = 754.47 - 427.85 = 326.62$$

Analysis of Variance Table

Source of Variation	S.S.	d.f.	M.S.S.
Between Treatment	**427.85**	**3**	$S_t^2 = 427.85/3 = 142.62$
Within Treatment	**326.62**	**13**	$S_t^2 = 326.62/13 = 25.12$
Total	**754.47**	**16**	

From the above table, we have

$$F = 142.62/25.12 = 5.68 > 3.41$$

The critical value of F for 3, 13 d.f. and $\alpha = 0.05$. Thus, H_0 is rejected at 5% level of significance.