Q. A farmer applies three types of fertilizers on four separate plots. The figures on yield per acre are tabulated below.

Fertilizer	**Plots**			
	A	**B**	**C**	**D**
Nitrogen	6	4	8	6
Potash	7	6	6	9
Phosphate	8	5	10	9

Test whether there is any significant difference among mean yields of different plots and among different fertilizers. (Answer H_o is rejected/not rejected).

Ans.

H_o: μ1=μ2=μ3

H_1: The Means are not equal.

Plots/ Fertilizers	A	B	C	D
NITROGEN	6	4	8	6
POTASSIUM	7	6	6	9
PHOSPHATES	8	5	10	9
	$(X1)_{\bar{x}=7}$	$(X2)_{\bar{x}=5}$	$(X3)_{\bar{x}=8}$	$(X4)_{\bar{x}=8}$

1. Total Mean, $\bar{x}=(7+5+8+8)/4$

   $\therefore (X)_{\bar{x}} = 7.00$

2. No. of Observations in each group: n1=n2=n3=n4=3

3. No. of Groups: K=4

A. **S**um of **S**quares **B**etween groups **[SSB]**= $\Sigma(Xi-X)^2*ni$

$\therefore SSB=18$

4. Degree of Freedom: df1= K-1

$\therefore df1=4-1$

$\therefore df1=3$

B. **S**um of **S**quares of **E**rrors **[SSE]**= $\sum_K\sum(X_i-X)^2$

Where X is Each Data point in the ith Group.

A	**$(X-7)^2$**	**B**	**$(X-5)^2$**	**C**	**$(X-8)^2$**	**D**	**$(X-7)^2$**
6	1	4	1	8	0	6	4
7	0	6	1	6	4	9	1
8	1	5	0	10	4	9	1
$\bar{x}=7$	**2**	**$\bar{x}=5$**	**2**	**$\bar{x}=8$**	**8**	**$\bar{x}=8$**	**6**

$\therefore$ **SSE = 2+2+8+6= 18**

Total count of Obs, **N** = 12
df2 = N-K
∴ df2 =8

C. Mean Squares Between groups:
MSB= SSB/ (K-1), where (K-1) is df1
MSB= 18/3
∴ **MSB = 6**

Mean Squares of Errors:

MSE = SSE/(N-K), where (N-K) is df2

∴ **MSB =18/8**
∴ **MSB = 2.25**

D. ANOVA Test Statistics, f(Calculated)
f(Calculated) = MSB/ MSE
f(Calculated) = 6/2.25
f(Calculated)= 2.66

E. Critical Value @ α = 0.05
f(actual)= f(df1,df2) @ α = 0.05
∴ f(actual)= 4.07

∵ f(Calculated) < f(actual)

∴ We are Unable to reject the Null Hypothesis.

Hence, it is concluded that there is not enough evidence to prove that plots are significantly different in fertility.