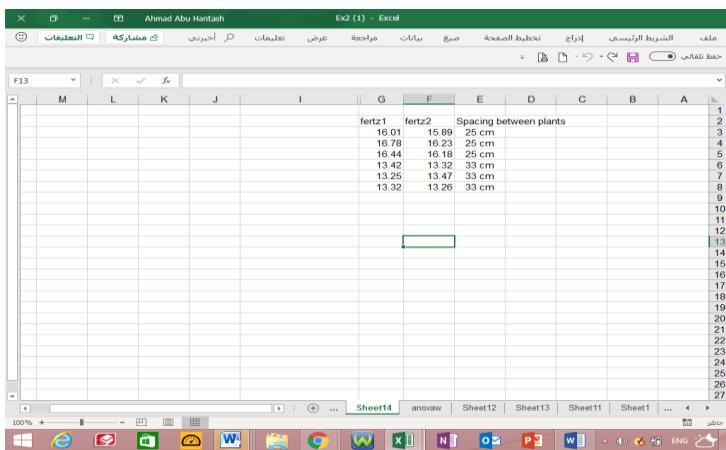


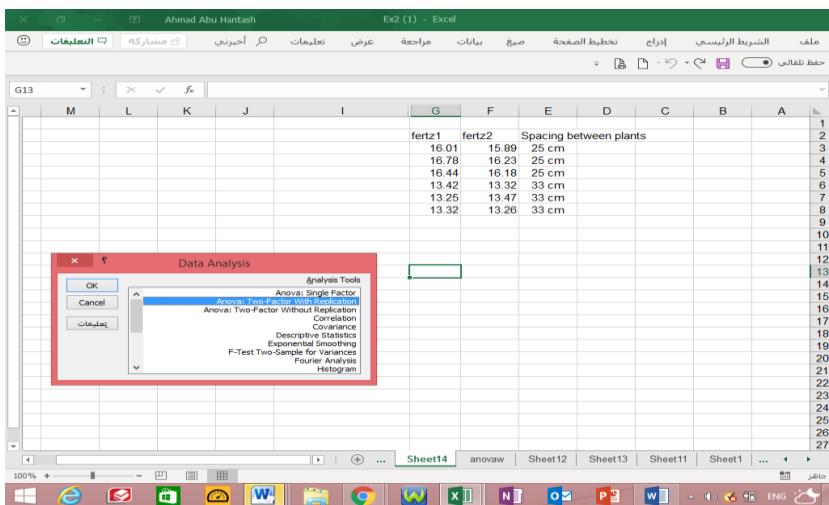
In a study on fertilizer levels and spacing between plants, plots were assigned to combinations and the yield of potatoes (in kg/plot) was measured

Spacing between plants	Fertilizer level (in tons/ha)	
	1	2
25 cm	16.01	15.89
	16.78	16.23
	16.44	16.18
33 cm	13.42	13.32
	13.25	13.47
	13.32	13.26

Make all appropriate tests ($\alpha=0.05$)



*Data analyze Anova :Two factor with replication



A screenshot of Microsoft Excel showing a data table and an open dialog box.

The data table (Sheet14) contains the following data:

	Fertilizer	Plant Spacing	Value
1	fertilizer1	25 cm	16.01
2	fertilizer2	25 cm	16.78
3	fertilizer1	25 cm	16.44
4	fertilizer2	25 cm	13.42
5	fertilizer1	33 cm	13.25
6	fertilizer2	33 cm	13.32
7	fertilizer1	33 cm	13.47
8	fertilizer2	33 cm	13.26

The "Anova: Two-Factor With Replication" dialog box is open, with the following settings:

- Input Range: G2:\$G\$8
- Rows per sample: 3
- Alpha: 0.05
- Output options: anovaw (selected)
- Output Range: Output Range (unchecked)
- New Worksheet Ply: New Worksheet Ply (selected)
- New Workbook: New Workbook (unchecked)

A screenshot of Microsoft Excel showing the results of the ANOVA analysis.

The results are displayed in the following sections:

- Anova: Two-Factor With Replication**
- SUMMARY** (Fertilizer level, Spacing between plants)
- Spacing between plants** (Summary statistics for each fertilizer level)
- Total** (Overall summary statistics)
- ANOVA** (Source of Variation, SS, df, MS, F, P-value, F crit)

Key data from the ANOVA table:

Source of Variation	SS	df	MS	F	P-value	F crit
Spacing between plants	25.4917	1	25.4917	505.787	1.6E-08	5.31766
Fertilizer level	0.06308	1	0.06308	1.25149	0.29573	5.31766
Interaction	0.08167	1	0.08167	1.62054	0.23876	5.31766
Within	0.4032	8	0.0504			
Total	26.0396	11				

1) Test for Spacing between plants:

H_0 : The spacing having same effect

H_1 : at least one of the spacing having different effect

Then,

$H_0: \alpha_{25cm} = \alpha_{35cm}$

H_1 : at least one of the means is different

Results:

$F = 505.787$

$F\text{-critical} = 5.317$

$p\text{-value} = 1.6E-8$

Conclusion :

Since $P\text{-value} < \alpha$, ($0 < 0.05$) , then we
reject H_0 (Accept H_1 : There is at least one of the means is different)

2) Test for Spacing between plants:

H_0 : The fertilizer having same effect

H_1 : at least one of the fertilizer having different effect

Then,

$H_0: \beta_1 = \beta_2$

H_1 : at least one of the means is different

Results:

$F = 1.25149$

$F\text{-critical} = 5.317$

$p\text{-value} = 0.29573$

Conclusion :

Since $P\text{-value} > \alpha$, ($0.29573 > 0.05$) , then we
accept H_0 : There is no significant different between fertilizer

3) Test interaction :

H_0 : There is no interaction between spacing and fertilizer

H_1 : There is interaction between spacing and fertilizer

Then ,

$$H_0: \alpha\beta_{25,1} = \alpha\beta_{35,2} = \alpha\beta_{25,2} = \alpha\beta_{35,1}$$

H_1 : at least one of the means is different

Results:

$$F = 1.62054$$

$$F\text{-critical}=5.317$$

$$p\text{-value} = 0.23785$$

Conclusion :

Since $P\text{-value} > \alpha$, ($0.23785 > 0.05$) ,then we accept H_0 : There is no interaction between spacing and fertilizer