

Supplementary material

The effect of foliar spraying of some nutrients on the yield parameters and components of wheat (*Triticum aestivum* L.) at Alsamawa, Almuthanna, Iraq

<https://doi.org/10.21475/ajcs.26.20.10.pne299>

Supplementary Data 1

Experimental layout

R1		R2		R3	
V1	E0	V3	E1	V2	E2
	E1		E2		E0
	E2		E0		E1
V2	E1	V1	E2	V3	E0
	E0		E1		E2
	E2		E0		E1
V3	E2	V2	E0	V1	E1
	E1		E2		E0
	E0		E1		E2

Varieties: V1, Babylon; V2, Ibaa99; V3, Wafia.

Concentrations: E0, 0; E1, 0.75; E2, 1.5 g L⁻¹.

Supplementary Data 2

GenStat statistical output

GenStat Release 12.1 (PC/Windows Vista) 28 January 2026 11:30:29

Copyright 2009, VSN International Ltd.

Registered to: The NULL Corporation

GenStat Twelfth Edition

GenStat Procedure Library Release PL20.1

1 %CD 'C:/Users/samawa/Documents'

Errors occurred while pasting clipboard data to cells:

```
2 "Data taken from unsaved spreadsheet: New Data;1"
3 DELETE [REDEFINE=yes] C1,C2,C3,C4,C5,C6,C7,C8
4 UNITS [NVALUES=*]
5 FACTOR [MODIFY=yes; NVALUES=27; LEVELS=3; LABELS=!t('v1','v2','v3')\
6 ; REFERENCE=1] C1
7 READ C1; FREPRESENTATION=ordinal
```

Identifier	Values	Missing	Levels
C1	27	0	3

```
9 FACTOR [MODIFY=yes; NVALUES=27; LEVELS=3; LABELS=!t('E0','E1','E2')\
10 ; REFERENCE=1] C2
11 READ C2; FREPRESENTATION=ordinal
```

Identifier	Values	Missing	Levels
C2	27	0	3

```
13 FACTOR [MODIFY=yes; NVALUES=27; LEVELS=3; LABELS=!t('R1','R2','R3')\
14 ; REFERENCE=1] C3
15 READ C3; FREPRESENTATION=ordinal
```

Identifier	Values	Missing	Levels
C3	27	0	3

```
17 VARIATE [NVALUES=27] C4
18 READ C4
```

Identifier	Minimum	Mean	Maximum	Values	Missing
C4	135.0	233.8	336.2	27	0

22 VARIATE [NVALUES=27] C5
23 READ C5

Identifier	Minimum	Mean	Maximum	Values	Missing
C5	47.80	55.57	65.00	27	0

26 VARIATE [NVALUES=27] C6
27 READ C6

Identifier	Minimum	Mean	Maximum	Values	Missing
C6	31.10	37.55	49.06	27	0

31 VARIATE [NVALUES=27] C7
32 READ C7

Identifier	Minimum	Mean	Maximum	Values	Missing
C7	2.036	2.731	3.629	27	0

36 VARIATE [NVALUES=27] C8
37 READ C8

Identifier	Minimum	Mean	Maximum	Values	Missing
C8	22.99	33.65	41.85	27	0

45
46 %PostMessage 1129; 0; 43478080 "Sheet Update Completed"
47 "Split-Plot Design."
48 BLOCK C3/C1/C2
49 TREATMENTS C1*C2
50 COVARIATE "No Covariate"
51 ANOVA [PRINT=aovtable,information,means,%cv; FACT=32; CONTRASTS=7; PCONTRASTS=7; FPROB=yes;\n52 PSE=diff,lsd; LSDLEVEL=5] C4

Analysis of variance

Variate: C4

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
C3 stratum	2	327.4	163.7	0.43	
C3.C1 stratum					
C1	2	17005.6	8502.8	22.26	0.007
Residual	4	1528.1	382.0	2.04	
C3.C1.C2 stratum					
C2	2	14562.0	7281.0	38.91	<.001
C1.C2	4	14841.0	3710.2	19.83	<.001
Residual	12	2245.5	187.1		
Total	26	50509.6			

Message: the following units have large residuals.

C3 R2 C1 V3 C2 E2	22.1	s.e. 9.1
C3 R3 C1 V3 C2 E2	-25.0	s.e. 9.1

Tables of means

Variate: C4

Grand mean 233.8

C1	v1	V2	V3
	247.3	198.6	255.4
C2	E0	E1	E2
	201.5	244.8	255.0

C1	C2	E0	E1	E2
v1		226.2	283.8	231.9
V2		144.4	220.6	230.8
V3		233.7	230.0	302.5

Standard errors of differences of means

Table	C1	C2	C1 C2
rep.	9	9	3
s.e.d.	9.21	6.45	12.96
d.f.	4	12	11.88
<i>Except when comparing means with the same level(s) of</i>			
C1			11.17
d.f.			12

Least significant differences of means (5% level)

Table	C1	C2	C1 C2
rep.	9	9	3
l.s.d.	25.58	14.05	28.28
d.f.	4	12	11.88
<i>Except when comparing means with the same level(s) of</i>			
C1			24.34
d.f.			12

Stratum standard errors and coefficients of variation

Variate: C4

Stratum	d.f.	s.e.	cv%
C3	2	4.26	1.8
C3.C1	4	11.28	4.8
C3.C1.C2	12	13.68	5.9

53 "Split-Plot Design."

54 BLOCK C3/C1/C2

55 TREATMENTS C1*C2

56 COVARIATE "No Covariate"

57 ANOVA [PRINT=aovtable,information,means,%cv; FACT=32; CONTRASTS=7; PCONTRASTS=7; FPROB=yes;\

58 PSE=diff,lsd; LSDLEVEL=5] C5

Analysis of variance

Variate: C5

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
C3 stratum	2	96.277	48.138	1.62	
C3.C1 stratum					
C1	2	82.379	41.190	1.39	0.348
Residual	4	118.500	29.625	3.43	
C3.C1.C2 stratum					
C2	2	48.068	24.034	2.79	0.101
C1.C2	4	51.686	12.922	1.50	0.264
Residual	12	103.525	8.627		
Total	26	500.435			

Tables of means

Variate: C5

Grand mean 55.57

C1		v1	V2	V3
		54.10	58.02	54.59
C2		E0	E1	E2
		53.85	55.76	57.10
C1	C2	E0	E1	E2
v1		53.16	54.00	55.13
V2		53.70	60.00	60.37
V3		54.69	53.28	55.80

Standard errors of differences of means

Table	C1	C2	C1 C2
rep.	9	9	3
s.e.d.	2.566	1.385	3.228
d.f.	4	12	9.00
<i>Except when comparing means with the same level(s) of</i>			
C1			2.398
d.f.			12

Least significant differences of means (5% level)

Table	C1	C2	C1 C2
rep.	9	9	3
l.s.d.	7.124	3.017	7.302
d.f.	4	12	9.00
<i>Except when comparing means with the same level(s) of</i>			
C1			5.225
d.f.			12

Stratum standard errors and coefficients of variation

Variate: C5

Stratum	d.f.	s.e.	cv%
C3	2	2.313	4.2
C3.C1	4	3.142	5.7
C3.C1.C2	12	2.937	5.3

59 "Split-Plot Design."

60 BLOCK C3/C1/C2

61 TREATMENTS C1*C2

62 COVARIATE "No Covariate"

63 ANOVA [PRINT=aovtable,information,means,%cv; FACT=32; CONTRASTS=7; PCONTRASTS=7; FPROB=yes;\

64 PSE=diff,lsd; LSDLEVEL=5] C5

Analysis of variance

Variate: C5

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
C3 stratum	2	96.277	48.138	1.62	
C3.C1 stratum					
C1	2	82.379	41.190	1.39	0.348
Residual	4	118.500	29.625	3.43	

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
C3.C1.C2 stratum					
C2	2	48.068	24.034	2.79	0.101
C1.C2	4	51.686	12.922	1.50	0.264
Residual	12	103.525	8.627		
Total	26	500.435			

Tables of means

Variate: C5

Grand mean 55.57

C1		v1	V2	V3
		54.10	58.02	54.59
C2		E0	E1	E2
		53.85	55.76	57.10
C1	C2	E0	E1	E2
v1		53.16	54.00	55.13
V2		53.70	60.00	60.37
V3		54.69	53.28	55.80

Standard errors of differences of means

Table	C1	C2	C1 C2
rep.	9	9	3
s.e.d.	2.566	1.385	3.228
d.f.	4	12	9.00
<i>Except when comparing means with the same level(s) of</i>			
C1			2.398
d.f.			12

Least significant differences of means (5% level)

Table	C1	C2	C1 C2
rep.	9	9	3
l.s.d.	7.124	3.017	7.302
d.f.	4	12	9.00
<i>Except when comparing means with the same level(s) of</i>			
C1			5.225
d.f.			12

Stratum standard errors and coefficients of variation

Variate: C5

Stratum	d.f.	s.e.	cv%
C3	2	2.313	4.2
C3.C1	4	3.142	5.7
C3.C1.C2	12	2.937	5.3

65 "Split-Plot Design."

66 BLOCK C3/C1/C2

67 TREATMENTS C1*C2

68 COVARIATE "No Covariate"

69 ANOVA [PRINT=aovtable,information,means,%cv; FACT=32; CONTRASTS=7; PCONTRASTS=7; FPROB=yes;\

70 PSE=diff,lsd; LSDLEVEL=5] C6

Analysis of variance

Variate: C6

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
C3 stratum	2	10.84	5.42	0.12	
C3.C1 stratum					
C1	2	26.69	13.34	0.30	0.756
Residual	4	178.19	44.55	2.15	
C3.C1.C2 stratum					
C2	2	213.56	106.78	5.16	0.024
C1.C2	4	145.53	36.38	1.76	0.202
Residual	12	248.11	20.68		
Total	26	822.91			

Tables of means

Variate: C6

Grand mean 37.55

C1		v1	V2	V3
		38.68	37.70	36.26
C2		E0	E1	E2
		36.39	34.83	41.42
C1	C2	E0	E1	E2
v1		34.52	38.75	42.76
V2		40.83	32.19	40.09
V3		33.81	33.55	41.41

Standard errors of differences of means

Table	C1	C2	C1 C2
rep.	9	9	3
s.e.d.	3.146	2.143	4.369
d.f.	4	12	11.55
<i>Except when comparing means with the same level(s) of</i>			
C1			3.713
d.f.			12

Least significant differences of means (5% level)

Table	C1	C2	C1 C2
rep.	9	9	3
l.s.d.	8.735	4.670	9.560
d.f.	4	12	11.55
<i>Except when comparing means with the same level(s) of</i>			
C1			8.089
d.f.			12

Stratum standard errors and coefficients of variation

Variate: C6

Stratum	d.f.	s.e.	cv%
C3	2	0.776	2.1
C3.C1	4	3.853	10.3
C3.C1.C2	12	4.547	12.1

71 "Split-Plot Design."

72 BLOCK C3/C1/C2

73 TREATMENTS C1*C2

74 COVARIATE "No Covariate"

75 ANOVA [PRINT=aovtable,information,means,%cv; FACT=32; CONTRASTS=7; PCONTRASTS=7; FPROB=yes;\

76 PSE=diff,lsd; LSDLEVEL=5] C6

Analysis of variance

Variate: C6

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
C3 stratum	2	10.84	5.42	0.12	
C3.C1 stratum					
C1	2	26.69	13.34	0.30	0.756
Residual	4	178.19	44.55	2.15	
C3.C1.C2 stratum					
C2	2	213.56	106.78	5.16	0.024
C1.C2	4	145.53	36.38	1.76	0.202
Residual	12	248.11	20.68		
Total	26	822.91			

Tables of means

Variate: C6

Grand mean 37.55

C1		v1	V2	V3
		38.68	37.70	36.26
C2		E0	E1	E2
		36.39	34.83	41.42
C1	C2	E0	E1	E2
v1		34.52	38.75	42.76
V2		40.83	32.19	40.09
V3		33.81	33.55	41.41

Standard errors of differences of means

Table	C1	C2	C1 C2
rep.	9	9	3
s.e.d.	3.146	2.143	4.369
d.f.	4	12	11.55
<i>Except when comparing means with the same level(s) of</i>			
C1			3.713
d.f.			12

Least significant differences of means (5% level)

Table	C1	C2	C1 C2
rep.	9	9	3
l.s.d.	8.735	4.670	9.560
d.f.	4	12	11.55
<i>Except when comparing means with the same level(s) of</i>			
C1			8.089
d.f.			12

Stratum standard errors and coefficients of variation

Variate: C6

Stratum	d.f.	s.e.	cv%
C3	2	0.776	2.1
C3.C1	4	3.853	10.3
C3.C1.C2	12	4.547	12.1

```
77 "Split-Plot Design."  
78 BLOCK C3/C1/C2  
79 TREATMENTS C1*C2  
80 COVARIATE "No Covariate"  
81 ANOVA [PRINT=aovtable,information,means,%cv; FACT=32; CONTRASTS=7; PCONTRASTS=7; FPROB=yes;\n  
82 PSE=diff,lsd; LSDLEVEL=5] C7
```

Analysis of variance

Variate: C7

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
C3 stratum	2	0.06786	0.03393	1.18	
C3.C1 stratum					
C1	2	2.34195	1.17098	40.60	0.002
Residual	4	0.11538	0.02884	1.70	
C3.C1.C2 stratum					
C2	2	1.14553	0.57277	33.67	<.001
C1.C2	4	0.39407	0.09852	5.79	0.008
Residual	12	0.20413	0.01701		
Total	26	4.26893			

Tables of means

Variate: C7

Grand mean 2.731

C1	v1		V2		V3			
	3.119		2.669		2.406			
C2	E0		E1		E2			
	2.456		2.786		2.952			
C1	C2		E0		E1		E2	
v1			2.676		3.392		3.288	
V2			2.429		2.679		2.899	
V3			2.263		2.287		2.668	

Standard errors of differences of means

Table	C1	C2	C1 C2
rep.	9	9	3
s.e.d.	0.0801	0.0615	0.1182
d.f.	4	12	12.98
Except when comparing means with the same level(s) of			
C1			0.1065
d.f.			12

Least significant differences of means (5% level)

Table	C1	C2	C1 C2
rep.	9	9	3
l.s.d.	0.2223	0.1340	0.2554
d.f.	4	12	12.98
Except when comparing means with the same level(s) of			
C1			0.2320
d.f.			12

Stratum standard errors and coefficients of variation

Variate: C7

Stratum	d.f.	s.e.	cv%
C3	2	0.0614	2.2
C3.C1	4	0.0981	3.6
C3.C1.C2	12	0.1304	4.8

```
83 "Split-Plot Design."  
84 BLOCK C3/C1/C2  
85 TREATMENTS C1*C2  
86 COVARIATE "No Covariate"  
87 ANOVA [PRINT=aovtable,information,means,%cv; FACT=32; CONTRASTS=7; PCONTRASTS=7; FPROB=yes;\n  
88 PSE=diff,lsd; LSDLEVEL=5] C7
```

Analysis of variance

Variate: C7

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
C3 stratum	2	0.06786	0.03393	1.18	
C3.C1 stratum					
C1	2	2.34195	1.17098	40.60	0.002
Residual	4	0.11538	0.02884	1.70	
C3.C1.C2 stratum					
C2	2	1.14553	0.57277	33.67	<.001
C1.C2	4	0.39407	0.09852	5.79	0.008
Residual	12	0.20413	0.01701		
Total	26	4.26893			

Tables of means

Variate: C7

Grand mean 2.731

C1	v1		V2		V3			
	3.119		2.669		2.406			
C2	E0		E1		E2			
	2.456		2.786		2.952			
C1	C2		E0		E1		E2	
v1			2.676		3.392		3.288	
V2			2.429		2.679		2.899	
V3			2.263		2.287		2.668	

Standard errors of differences of means

Table	C1	C2	C1 C2
rep.	9	9	3
s.e.d.	0.0801	0.0615	0.1182
d.f.	4	12	12.98
Except when comparing means with the same level(s) of			
C1			0.1065
d.f.			12

Least significant differences of means (5% level)

Table	C1	C2	C1 C2
rep.	9	9	3
l.s.d.	0.2223	0.1340	0.2554
d.f.	4	12	12.98
Except when comparing means with the same level(s) of			
C1			0.2320
d.f.			12

Stratum standard errors and coefficients of variation

Variate: C7

Stratum	d.f.	s.e.	cv%
C3	2	0.0614	2.2
C3.C1	4	0.0981	3.6
C3.C1.C2	12	0.1304	4.8

89 "Split-Plot Design."
90 BLOCK C3/C1/C2
91 TREATMENTS C1*C2
92 COVARIATE "No Covariate"
93 ANOVA [PRINT=aovtable,information,means,%cv; FACT=32; CONTRASTS=7; PCONTRASTS=7; FPROB=yes;\n94 PSE=diff,lsd; LSDLEVEL=5] C8

Analysis of variance

Variate: C8

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
C3 stratum	2	29.153	14.576	0.94	
C3.C1 stratum					
C1	2	419.550	209.775	13.46	0.017
Residual	4	62.328	15.582	4.39	
C3.C1.C2 stratum					
C2	2	8.181	4.090	1.15	0.349
C1.C2	4	74.891	18.723	5.27	0.011
Residual	12	42.620	3.552		
Total	26	636.722			

Message: the following units have large residuals.

C3 R2 C1 V3 C2 E2	-3.13	s.e. 1.26
-------------------	-------	-----------

Tables of means

Variate: C8

Grand mean 33.65

C1	v1	V2	V3
	37.81	28.35	34.77

C2	E0		E1	E2
	33.39		33.14	34.41
C1	C2	E0	E1	E2
v1		38.33	37.69	37.41
V2		29.36	28.67	27.03
V3		32.48	33.05	38.79

Standard errors of differences of means

Table	C1	C2	C1 C2
rep.	9	9	3
s.e.d.	1.861	0.888	2.245
d.f.	4	12	7.93
Except when comparing means with the same level(s) of			
C1			1.539
d.f.			12

Least significant differences of means (5% level)

Table	C1	C2	C1 C2
rep.	9	9	3
l.s.d.	5.166	1.936	5.186
d.f.	4	12	7.93
Except when comparing means with the same level(s) of			
C1			3.353
d.f.			12

Stratum standard errors and coefficients of variation

Variate: C8

Stratum	d.f.	s.e.	cv%
C3	2	1.273	3.8
C3.C1	4	2.279	6.8
C3.C1.C2	12	1.885	5.6

95 "Data taken from unsaved spreadsheet: New Data;1"
96 UNITS [NVALUES=*]
97 FACTOR [MODIFY=yes; NVALUES=27; LEVELS=3; LABELS=!t('v1','v2','v3')\
98 ; REFERENCE=1] C1
99 READ C1; FREPRESENTATION=ordinal

Identifier	Values	Missing	Levels
C1	27	0	3

101 FACTOR [MODIFY=yes; NVALUES=27; LEVELS=3; LABELS=!t('E0','E1','E2')\
102 ; REFERENCE=1] C2
103 READ C2; FREPRESENTATION=ordinal

Identifier	Values	Missing	Levels
C2	27	0	3

105 FACTOR [MODIFY=yes; NVALUES=27; LEVELS=3; LABELS=!t('R1','R2','R3')\
106 ; REFERENCE=1] C3
107 READ C3; FREPRESENTATION=ordinal

Identifier	Values	Missing	Levels
C3	27	0	3

109 VARIATE [NVALUES=27] C4
110 READ C4

Identifier	Minimum	Mean	Maximum	Values	Missing
C4	135.0	233.8	336.2	27	0

114 VARIATE [NVALUES=27] C5
115 READ C5

Identifier	Minimum	Mean	Maximum	Values	Missing
C5	47.80	55.57	65.00	27	0

118 VARIATE [NVALUES=27] C6
119 READ C6

Identifier	Minimum	Mean	Maximum	Values	Missing
C6	31.10	37.55	49.06	27	0

123 VARIATE [NVALUES=27] C7
124 READ C7

Identifier	Minimum	Mean	Maximum	Values	Missing
C7	2.036	2.731	3.629	27	0

128 VARIATE [NVALUES=27] C8
129 READ C8

Identifier	Minimum	Mean	Maximum	Values	Missing
C8	22.99	33.65	41.85	27	0

137
138 %PostMessage 1129; 0; 43478080 "Sheet Update Completed"

Analysis of Variance (ANOVA) Table

1- spikes number

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
C3 stratum	2	327.4	163.7	0.43	
C3.C1 stratum C1	2	17005.6	8502.8	22.26	0.007
Residual	4	1528.1	382.0	2.04	
C3.C1.C2 stratum C2	2	14562.0	7281.0	38.91	<.001
C1.C2	4	14841.0	3710.2	19.83	<.001
Residual	12	2245.5	187.1		
Total	26	50509.6			

2- Grains number per spike

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
C3 stratum	2	96.277	48.138	1.62	
C3.C1 stratum C1	2	82.379	41.190	1.39	0.348
Residual	4	118.500	29.625	3.43	
C3.C1.C2 stratum C2	2	48.068	24.034	2.79	0.101
C1.C2	4	51.686	12.922	1.50	0.264
Residual	12	103.525	8.627		
Total	26	500.435			

3- 1000 grains weight (gm)

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
C3 stratum	2	10.84	5.42	0.12	
C3.C1 stratum C1	2	26.69	13.34	0.30	0.756
Residual	4	178.19	44.55	2.15	
C3.C1.C2 stratum C2	2	213.56	106.78	5.16	0.024
C1.C2	4	145.53	36.38	1.76	0.202
Residual	12	248.11	20.68		
Total	26	822.91			

4-grain yield

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
C3 stratum	2	0.06786	0.03393	1.18	
C3.C1 stratum C1	2	2.34195	1.17098	40.60	0.002
Residual	4	0.11538	0.02884	1.70	
C3.C1.C2 stratum C2	2	1.14553	0.57277	33.67	<.001
C1.C2	4	0.39407	0.09852	5.79	0.008
Residual	12	0.20413	0.01701		
Total	26	4.26893			

5- Harvest Index (%)

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
C3 stratum	2	29.153	14.576	0.94	
C3.C1 stratum C1	2	419.550	209.775	13.46	0.017
Residual	4	62.328	15.582	4.39	
C3.C1.C2 stratum C2	2	8.181	4.090	1.15	0.349
C1.C2	4	74.891	18.723	5.27	0.011
Residual	12	42.620	3.552		
Total	26	636.722			

Supplementary Data 3

Table S1. Nutrient composition of the Euro MIX fertilizer used in the experiment.

Nutrient	Concentration (% w/w)
Iron (Fe)	5%
Magnesium (Mg)	5%
Manganese (Mn)	3%
Zinc (Zn)	3%
Copper (Cu)	0.6%
Boron (B)	0.5%
Sodium (Na)	0
Chloride (Cl)	0

Note: The fertilizer was a water-soluble micronutrient mixture (Euro MIX, Jordan) formulated for foliar application.