Contribution to the study of effect of (Glycyrrhiza glabra L.) in region M'LILI (South of Algeria) on some chemical parameters of two varieties of date palms (*Phoenix dactylifera L.*)

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ABSTRACT

The objective of our work was to determine the nutritional status of date palms with the presence of licorice.

For this we have tried to assess the impact of licorice (Glycyrrhiza glabra L.) on the mineral nutrition of two varieties of date palms(*Phoenix dactylifera* L.) in the region M'lili (W. Biskra south of Algeria) by the method of foliar diagnosis completed and the determination of total sugars.

Mineral nutrition of date palm requires availability in contact with roots, sufficient amounts of nutrients can be absorbed at a rate corresponding to the current needs of the plant. However, many processes in the soil and the effect of climate and the presence of competing plants can alter the availability of these nutrients and their levels in the plant.

The conclusions that we can make with regard to the results obtained are as follows :

A low total sugars in fruits and leaves in varieties of dates with the presence of licorice.

A light foliar results and their interpretations, we can conclude that nitrogen nutrition is high for both varieties of dates especially with the presence of licorice (Rhizobium).

High foliar concentrations of Calcium, magnesium and sodium for both varieties of dates, especially with the presence of licorice.

Low foliar iron content in varieties of dates with the presence of licorice.
Low foliar concentrations of potassium, phosphorus, boron, copper and zinc for both varieties of dates with and without licorice .

Key words: *Phoenix dactylifera* L., *Glycyrrhiza glabra* L, Mineral nutrition, total sugars, varieties

INTRODUCTION

The date palm is both the symbol and the backbone of the oasis ecosystem. It creates a microclimate promote the development of underlying cultures. The date palm is for the people of the Sahara that the olive tree For the Mediterranean: a source of a providential fruit. Algerian palm hosts a rich and diverse germplasm with more than 13 million palm trees and 940 cultivars identified [1].

Dates are subject to significant business activity in particular the famous Deglet Nour which occupies 52.87% of the national production. In Algeria production exceeded 7 million quintals for the 2010 agricultural companion [2], 65% of the national production was done by two wilayas, Biskra with 35% and El Oued with 30% [3].

Licorice (*Glycyrrhiza glabra* L.) is a perennial plant of the family Fabaceae under: family Fabaceae, aromatic roots. It is native to southern Europe and Asia.

Only the roots and stolons are used in industry (pharmaceutical and food) because they are the richest bodies in active principles. Licorice can be used either in kind or in the form of crude extract. It is also used in confectionery and dermopharmacy [4].

And as licorice exists and dispersed in the Algerian oasis and plots dates, the aim of this study examines the effects of licorice (*Glycyrrhiza glabra*) on the growth and quality of production of the two varieties of dates (*Phoenix dactylifera*) "Deglet Nour" and "Mech-Degla" area M'lili, through dosages of total sugars in the pulp of dates, leaves and also the determination of minerals in the leaves of the two varieties of a part, and the comparison of these results with the results representing the date palms witnesses (without licorice) on the same region of another part.

MATERIALS AND METHODS

Were selected in each area three palm of each variety, and was ready to consider the homogeneity of age, length, and vegetative growth through assays of total sugars in the pulp of dates, leaves and also the determination of mineral elements in the leaves of both varieties on the one hand, and comparing these results with the results of palm trees that represent the controls (without licorice) on the same area on the other hand.

1.Introduction of the study area:

M'lili: Extends over an area of 371.80 km2.

Limits:

-North: the town of El Hadjeb

-North-West: the common Bouchagroune

-South: (Steel) wilaya of El Oued.

-to the West: common Ourlal

-to the east: the common Oumache.

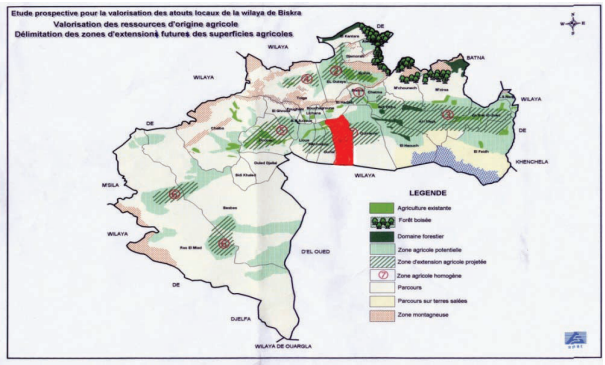

Figure 1: Location of the Common M'lili in the wilaya Of Biskra (ANAT)

2. Dosage the total sugars

The method of Dubois et al (1956) used to assay the oses using phenol and concentrated sulfuric acid and a solution mother glucose as standard, in the presence of these two reactants, oses give a yellow-orange color, the intensity is proportional to the carbohydrate concentration, the optical density was determined between 450 and 550 nm [5].

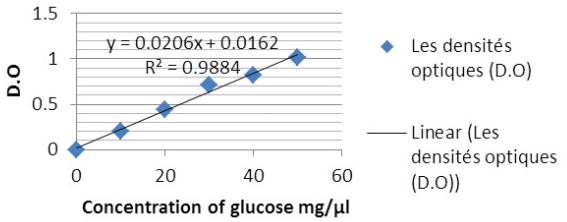

Figure 2: Calibration Curve of dosage the total sugars

The concentrations of total sugars in dates and leaves are determined from calibration curve.

3. Dosages of mineral elements in the leaves

Prior to mineral analyzes of plant samples were dried at 60 ° C to constant weight and then crushed to the average of a planetary mill to obtain a fine grind.

3.1Principe

Mineralization by acid attack leaves powders with heating by microwave, closed system.

3.2. Mode operative:

1. Weigh about exactly 0.001g near 0.4 g of powdered leaf comminuted to 500 microns.
2. Record the exact weight on the worksheet
3. The plant previously dried must be crushed with a grinder capable of reducing the sample in its entirety to a fineness of less than 500 µm.
1. Transfer to a Teflon tube numbered.

2. Add 5 ml of HNO3 at 56% by using a dispenser
3. Add 5 ml of 30% H2O2 with a distributor
4. Close tubes hermetically with a screw cap.
5. Book a without sample tube which is engaged the thermal probe apparatus for controlling the heating temperature.
6. Place the tubes on the plate supporting the samples (never put less than 10 tubes) and place the tray in the oven. Close and secure.
7. Start the microwave oven and the heating cycle.

Table 01: Steps of the mineralization cycle I

Step	Time in min	Power Watts	Temperature ° C
1	10	1000	110
2	15	1200	160
3	10	1200	180
4	25	0	50

At the end of the cycle of mineralization:

1. Once the cooled tubes.
2. Remove the tray from the oven.
3. Unclogging tubes for each sample, using a wash bottle of demineralized water.
4. Get the contents of the tube through a filter without cinder previously washed and dried.
5. The filter is placed on a very clean glass funnel with a long shaft.
6. Collect the filtrate in a 50 ml volumetric flask.
7. Wash well inside the tube with jets of spray, then rinse 2 times the filter.
8. Gauge to 50 ml with demineralized water.
9. If there remains no deposit at the bottom of the tube, making the mineralisate pass directly into the flask by rinsing well inside the tube with jets wash bottle and gauge 50 ml with demineralized water.
10. Stopper the flasks.

3.3. Oven programming:

Decontaminate tubes mineralization practicing mineralization cycle as follows and added with 10 ml in each tube only (2 x 5 ml) of 56% nitric acid.

Table 02: cycle stages of mineralization II

Step	Time in min	Power Watts	Temperature ° C
1	10	1000	110
2	15	1200	160
4	25	0	50

Rinse each tube with deionized water. Let drain the tubes.

3.4. Dosage

Be assayed elements: P, K, Ca, Mg, Na, S, Fe, Mn, Cu, Zn and B in plasma emission spectrometry.

3.5. Analysis of nitrogen in plants

Take a test sample approximately 0.5 g, well hidden in a piece of aluminum foil and making the injection into the furnace of elementary analyzer LECO nitrogen.

The LECO analyzer is a device that gives the content of nitrogen contained in the sample injected into the furnace by infrared rays, the detection is by a thermal conductivity detector.

The apparatus is supported by calculation software and the result is displayed directly on the screen of the PC% nitrogen (agronomic laboratory Fertial, 2013).

4. Statistical analysis:

The results obtained are expressed as the mean plus or minus standard deviation (m ± s). Statistical analysis was performed using the Mini tab (WEISBERG, 1985) software, and present the results in the form of histograms and curves (EXEL).

RESULTS AND DISCUSSION

1. Results

1.1. Determination of total sugars

1.1.1 Assay of total sugars in dates

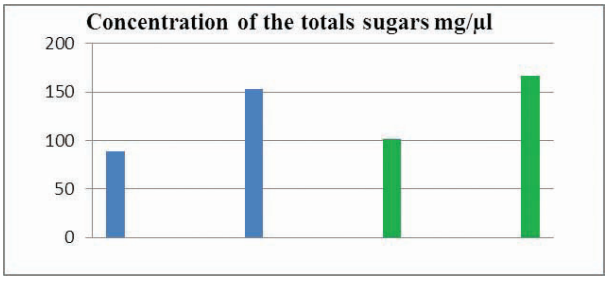

Figure 3: Histogram concentrations of total sugars in dates

The results obtained under the conditions of this experiment showed significant effects of licorice on total sugars in the dates of the two varieties of date palm.

According the ANOVA with two factors (Annex 1) we has classified date palms according to the means into two groups which are:

- Date palms without licorice are represented by the highest average (160.115 mg / µl).
- Date palms with licorice are represented by the average low monk (95.290 mg / µl).
- Among our results shown in the Annex 1, the varieties were classified according to the means of two groups are:
- The Mech-Degla variety is represented by the highest average (133.92 mg / µl).
- Deglet Nour variety is represented by the average low monk than Mech-Degla variety (121.485 mg / µl).

1.1.2. Dosages of sugars in the leaves

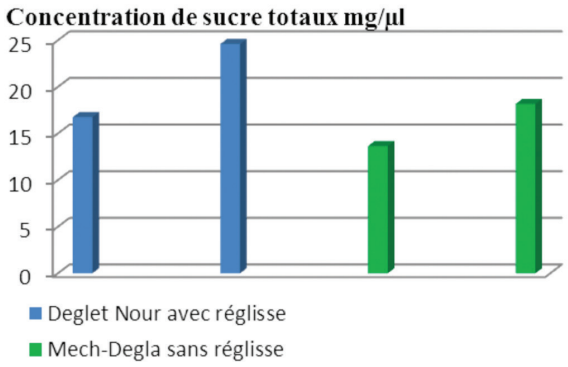

Figure 4: Histogram the concentrations of total sugars in the leaves

The results obtained under the conditions of this experiment showed significant effects of licorice on total sugars in the leaves of two varieties of date palm.

According the ANOVA with two factors (Annex 2) were classified date palms according to the means in two groups are:

- Date palms without licorice are represented by the highest average (21.39 mg µl).
- Date palms with licorice are represented by the average the low monk (15.20 mg / µl).

Among our results shown in the Annex 2, the varieties were classified according to the means of two groups are:

- Deglet Nour variety is represented by the highest average (20.67 mg / µl).
- The Mech-Degla variety is represented by the average the low monk than Deglet Nour (15.91 mg / µl).

1.2 Dosages of mineral elements in the leaves

1.2.1 N (nitrogen) in% (1% = 10g/kg)

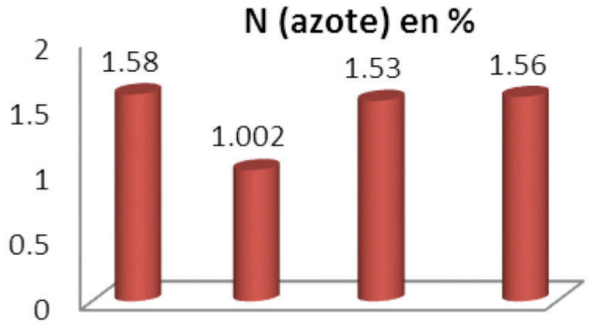

Figure 5: Concentrations of nitrogen in two varieties of date palm

The results obtained under the conditions of this experiment showed significant effects of licorice on the nitrogen in the leaves of two varieties of date palm.

According ANOVA with two factors (Annex 3) were classified date palms according to the means in two groups are:

Date palms with licorice are represented by the highest average (1.555%).

- Date palms without licorice are represented by the average the low monk (1.28%).

Among our results shown in the Annex 3, the varieties were classified according to the means of two groups are:

- The Mech-Degla variety is represented by the highest average (1.545%).
- Deglet Nour variety is represented by the average the low monk than Mech-Degla variety (1.291%).

1.2.2 Ca (calcium) in % (1%= 10g/kg)

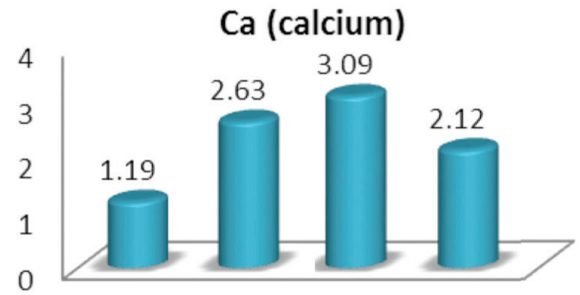

Figure 6: Calcium concentrations in the two varieties of date palm

The results obtained under the conditions of this experiment showed significant effects of licorice on the Calcium in the leaves of two varieties of date palm.

According to the ANOVA with two factors (Annex 4) were classified date palms according to the means in two groups are:

Date palms without licorice are represented by the highest average (2.38%).

- Date palms with licorice are represented by the average the low monk (2.14%).

Among our results shown in the Annex 4, the varieties were classified according to the means in two groups are:

- ü The Mech-Degla variety is represented by the highest average (2.61%).
- ü Deglet Nour variety is represented by the average the low monk than Mech-Degla variety (1.91%).

1.2.3 Mg (magnesium) in % (1%= 10g/kg)

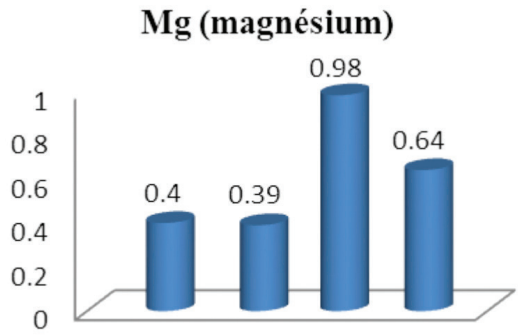

Figure 7: Magnesium concentrations in the two varieties of date palm

The results obtained under the conditions of this experiment showed significant effects of licorice on Magnesium in the leaves of two varieties of date palm.

According to the ANOVA with two factors (Annex 5) were classified date palms according to the means in two groups which are:

- Date palms with licorice are represented by the highest average (0.690%).
- Date palms without licorice are represented by the average the low monk (0.515%).

Among our results shown in the Annex No. 5, were classified according to the means varieties into two groups which are:

- The Mech-Degla variety is represented by the highest average (0.810%).
- Deglet Nour variety is represented by the average the low monk than Mech-Degla variety (0.395%).

1.2.4. P (phosphor) in % (1%= 10g/kg)

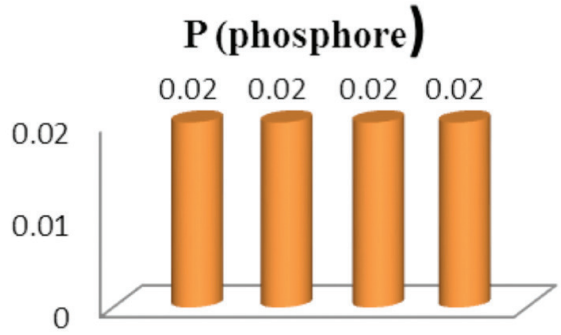

Figure 8: Phosphor concentrations in the two varieties of date palm

The results obtained under the conditions of this experiment showed no effect of licorice on the Phosphor in the leaves of two varieties of date palm.

According to the ANOVA with two factors (Annex 6) and Figure No. 28, it was found that there's not a significant effect of licorice whatever the variety studied.

1.2.5 K (potassium) in% (1% = 10g/kg)

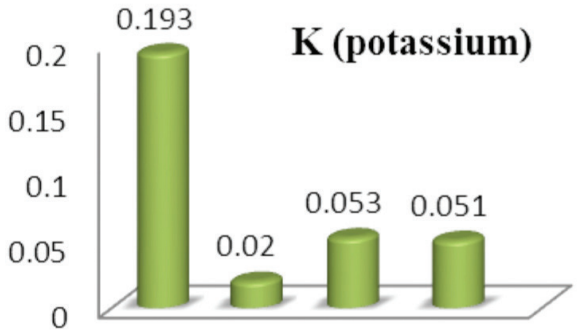

Figure 9: Potassium concentrations in the two varieties of date palm

The results obtained under the conditions of this experiment showed significant effects of licorice on Potassium in the leaves of two varieties of date palm.

According to the ANOVA with two factors (Annex 7) were classified date palms according to the means in two groups which are:

- Date palms with licorice are represented by the highest average (0.123%).
- Date palms without licorice are represented by the average the low monk (0.035%).

Among our results shown in the Annex No. 7, a class e varieties according to the means in two groups which are:

- Deglet Nour variety is represented by the highest average (0.106%).
- The Mech-Degla variety is represented by the average the low monk than Deglet Nour (0.052%).

1.2.6. Na (Sodium) in ppm (1ppm = 1mg/kg)

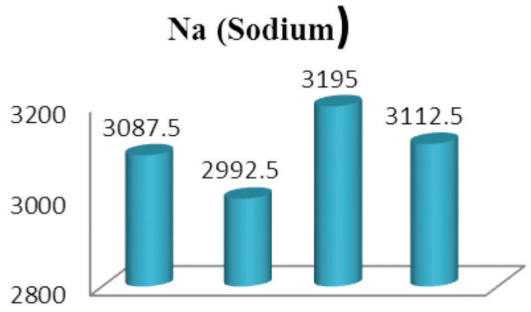

Figure 10: Sodium concentrations in the two varieties of date palm

The results obtained under the conditions of this experiment showed significant effects of licorice on the sodium in the leaves of two varieties of date palm.

According ANOVA with two factors (Annex 8) was ranked date palms according to means in two groups which are:

- Date palms with licorice are represented by the highest average (3141.3 mg / kg).
- Date palms without licorice are represented by the average the low monk (3052.5 mg/ kg).

Among our results shown in Annex No. 8 varieties were classified according to the means in two groups are:

- The Mech-Degla variety is represented by the highest average (3153.8 mg / kg).
- Deglet Nour variety is represented by the average the low monk than the Mech-Degla variety (3040.0 mg / kg).

1.2.7. Fe (Fer) in ppm (1ppm = 1mg/kg)

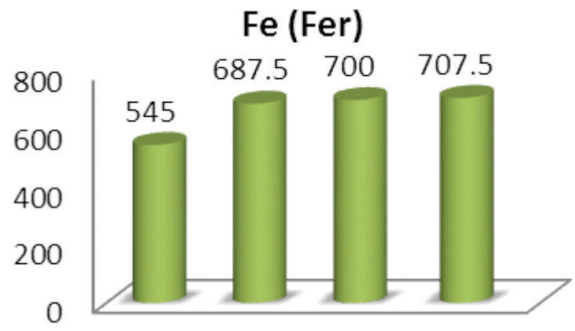

Figure 11: Fer concentrations in the two varieties of date palm

The results obtained under the conditions of this experiment showed significant effects of licorice on the Fer in the leaves of two varieties of date palm.

According to the ANOVA with two factors (Annex 9), were classified according to the average date palms into two groups which are:

- Date palms without licorice are represented by the highest average (698mg/kg).
- Date palms with licorice are represented by the average the low monk (623mg/kg).

Among our results shown in Annex No. 9 varieties were classified according to the means in two groups are:

- The Mech-Degla variety is represented by the highest average (704 mg / kg).
- Deglet Nour variety is represented by the average the low monk than Mech-Degla variety (616 mg / kg).

2. DISCUSSIONS

The levels of total sugars in the leaves and dates for both varieties Deglet Nour and Mech-Degla are low with the presence of licorice by contribution to the witness because the compound is of licorice glycyrrhizin with flavor 50-60 times as sweet as sugar crystallized and hydroxyglycyrrhizine (about 100 times as sweet as cane sugar), and sugars such as glucose (up to 4%), fructose, maltose, sucrose (2,4:6,5%) and polysaccharides (about 10%) [6].

The foliar nitrogen levels high in varieties of dates with licorice (norm composition of plant Annex 15) can be explained by the presence of rhizobia which are soil bacteria capable of inducing the roots of legumes (beans, peas, lens, peanut, soy, licorice, alfalfa, clover, lupine, glycine, rosewood ...) Only cyanobacteria and symbiotic Rhizobium bacteria [7] can use the nitrous air. Physiological studies have shown that there are three active transport systems for nitrate ions among these:

A system with high affinity constitutive (CHATS for "constitutive High Affinity Transport System") which absorbs nitrate when it is present in low concentrations in the rhizosphere (between 1µM and 1Mm) is the case of our study area (low soil nitrogen and organic matter).

The foliar sodium levels are high for both varieties with or without licorice, can be explained by: most has absorbed ions will be cross the wall and the cytoplasmic membrane but sodium is retained in significant amounts at these barriers. Other ions such as K^{+}, Cl^{-}, NO^{3-}or-PO_4O^{2-} migrate inwards [8].

Liquorice plant is a basophil and such as plants basophils consume a large amount of nutrients such as calcium and

magnesium which are strongly absorbed at higher pH values and higher than 7 [9], and in addition a saponoside glycyrrhizin is present as a mixture of salts: salts of calcium, magnesium and potassium, with a content of 3 to 5% of the mass of the dry drug [6], that clearly explains contents foliar calcium and magnesium are low in the Deglet Nour with liquorice and normal for the Mech-Degla variety. In Algeria, calcium deficiency has not been reported because soils generally contain sufficient quantities to meet the needs of plants [10].

The decreased cell permeability calcium and brakes thus the penetration of the water and most of the ions (K +, Fe) [8], what explains the low content of iron in varieties of dates with one hand liquorice and selective absorption de Fer by liquorice (intense chlorophyll activity in relation to dates). The results of leaf phosphorus contents and copper for both varieties with and without low and licorice are identical. That is to say there is no impact of the licorice plant phosphate nutrition on date palm but we can judge this case by:

Low leaf phosphorus levels also confirm the low levels of soil depth (in level the active roots) despite its high surface. [11] notes that this element is known for its very low depth migration and remains localized to the surface where it was brought. Alkaline soil pH (7.5 to 8.5) is frequently correlated bioavailability of difficulty by the plants of certain elements which there are essential such as phosphorus [12].

Low foliar potassium levels for both varieties of dates with and without licorice is explained by potassium fertilization of date palms in most of our arid regions has not answered. [13]

CONCLUSION

The results that we have put in evidence all the interest of foliar diagnosis and analysis of total sugars as tools of control of the nutrition of date palms. However, its reliability would increase with his work for several consecutive years.

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ANNEXES

Annex: 01

Two-factor ANOVA tested: HP depending Variety; Liquorice

Analysis of variance for TSD

Source	DL	SC	CM	F	P
Variety	1	463,89	463,89	8080,49	0,000
Liquorice	1	12606,84	12606,84	2,2E+05	0,000
Erreur	9	0,52	0,06		
Total	11	13071,25			

Confidence interval 95%

VAR	Moyenne	----------+----------+----------+----------+----------				
DEGLA	121,485	(*)				
MECHD	133,920					(*
		----------+----------+----------+----------+----------				
		122,500	126,000	129,500		

Confidence interval 95%

RIG	Moyenne	-+----------+----------+----------+----------+----------+				
AVEC R	95,290	(*				
SANS R	160,115					*
		-+----------+----------+----------+----------+----------+				
		96,000	112,000	128,000	144,000	160,000

Annex: 02

Two-factor ANOVA tested: TSF depending Variety; Liquorice

Analysis of variance for TSD

Source	DL	SC	CM	F	P
VAR	1	68,116	68,116	73,71	0,000
RIG	1	114,763	114,763	124,19	0,000
Erreur	9	8,317	0,924		
Total	11	191,195			

Confidence interval 95%

VAR	Moyenne	----------+----------+----------+----------+----------			
DEGLA	20,67			(----*-----)	
MECHD	15,91	(----*-----)			

		----------+----------+----------+----------+----------			
		16,00	17,60	19,20	20,80

Confidence interval 95%

RIG	Moyenne				
AVEC R	15,20	(---*---)			
SANS R	21,39				(----*---)
		----------+----------+----------+----------+----------			
		16,00	18,00	20,00	22,00

Annexe: 03

Two-factor ANOVA tested: N depending Variety; Liquorice

Analysis of variance for N

Source	DL	SC	CM	F	P
VAR	1	0,1935	0,1935	6,28	0,033
RIG	1	0,2252	0,2252	7,31	0,024
Erreur	9	0,2772	0,0308		
Total	11	0,6960			

Confidence interval 95%

VAR	Moyenne				
DEGLA	1,291	(----------*----------)			
MECHD	1,545		(----------*----------)		
		----------+----------+----------+----------+----------			
		1,200	1,350	1,500	1,650

Confidence interval 95%

RIG	Moyenne				
AVEC R	1,555			(----------*----------)	
SANS R	1,281	(----------*----------)			
		----------+----------+----------+----------+----------			
		1,200	1,350	1,500	1,650

Annexe: 04

Two-factor ANOVA tested: CA depending Variety; Liquorice

Analysis of variance for CA

Source	DL	SC	CM	F	P
VAR	1	1,449	1,449	2,99	0,118
RIG	1	0,166	0,166	0,34	0,573
Erreur	9	4,356	0,484		
Total	11	5,971			

Confidence interval 95%

VAR	Moyenne	----------+----------+----------+----------+----------			
DEGLA	1,91	(----------*----------)			
MECHD	2,61		(----------*----------)		
		----------+----------+----------+----------+----------			
		1,50	2,00	2,50	3,00

Confidence interval 95%

RIG	Moyenne	---+---------+---------+---------+--------			
AVEC R	2,14	(----------*----------)			
SANS R	2,38			(----------*----------)	
		----------+----------+----------+----------+----------			
		1,60	2,00	2,40	2,80

Annexe: 05

Two-factor ANOVA tested: MG depending Variety; Liquorice

Analysis of variance for MG

Source	DL	SC	CM	F	P
VAR	1	0,51668	0,51668	56,93	0,000
RIG	1	0,09188	0,09188	10,12	0,011
Erreur	9	0,08167	0,00907		
Total	11	0,69023			

Confidence interval 95%

VAR	Moyenne	----------+----------+----------+----------+-			
DEGLA	0,395	(--------*--------)			
MECHD	0,810				(--------*-------)

		----------+----------+----------+----------+-			
		0,450	0,600	0,750	0,900

Confidence interval 95%

RIG	Moyenne			
AVEC R	0,690		(----------*----------)	
SANS R	0,515	(----------*----------)		
		----------+----------+----------+----------+------		
	0,500	0,600	0,700	0,800

Annexe: 06

Two-factor ANOVA tested: P depending Variety; Liquorice

Analysis of variance for P

Source	DL	SC	CM	F	P
VAR	1	0,0000000	0,0000000	*	*
RIG	1	0,0000000	0,0000000	*	*
Erreur	9	0,0000000	0,0000000		
Total	11	0,0000000			

Confidence interval 95%

VAR	Moyenne				
DEGLA	0,0200000	*			
MECHD	0,0200000	*			
		----------+----------+----------+----------+-			
		2,00E-02	2,00E-02	2,00E-02	2,00E-02

Confidence interval 95%

RIG	Moyenne				
AVEC R	0,0200000	*			
SANS R	0,0200000	*			
		----------+----------+----------+----------+-			
		2,00E-02	2,00E-02	2,00E-02	2,00E-02

Annexe: 07

Two-factor ANOVA tested: K depending Variety; Liquorice

Analysis of variance for K

Source	DL	SC	CM	F	P
VAR	1	0,00891	0,00891	3,66	0,088
RIG	1	0,02297	0,02297	9,43	0,013
Erreur	9	0,02193	0,00244		
Total	11	0,05381			

Confidence interval 95%

VAR	Moyenne	----------+----------+----------+----------+--			
DEGLA	0,106			(----------*----------)	
MECHD	0,052	(----------*----------)			
		----------+----------+----------+----------+--			
		0,035	0,070	0,105	0,140

Confidence interval 95%

RIG	Moyenne	------+----------+----------+----------+----------			
AVEC R	0,123			(----------*----------)	
SANS R	0,035	(----------*----------)			
		------+----------+----------+----------+----------			
		0,000	0,050	0,100	0,150

Annexe: 08

Two-factor ANOVA tested: NA depending Variety; Liquorice

Analysis of variance for NA

Source	DL	SC	CM	F	P
VAR	1	38817,2	38817,2	2981,16	0,000
RIG	1	23629,7	23629,7	1814,76	0,000
Erreur	9	117,2	13,0		
Total	11	62564,1			

Confidence interval 95%

VAR	Moyenne	----------+----------+----------+----------+-----			
DEGLA	3040,0	(*)			
MECHD	3153,8				(*)

		----------+----------+----------+----------+-----			
		3060,0	3090,0	3120,0	3150,0

Confidence interval 95%

RIG	Moyenne	--+----------+----------+----------+----------+				
AVEC R	3141,3					(-*)
SANS R	3052,5	(*)				
		--+----------+----------+----------+----------+				
		3050,0	3075,0	3100,0	3125,0	3150,0

Annexe: 09

Two-factor ANOVA tested: FE depending Variety; Liquorice

Analysis of variance for FE

Source	DL	SC	CM	F	P
VAR	1	22969	22969	15,12	0,004
RIG	1	16875	16875	11,11	0,009
Erreur	9	13669	1519		
Total	11	53513			

Confidence interval 95%

VAR	Moyenne	---------+----------+----------+----------+---------			
DEGLA	616	(----------*----------)			
MECHD	704			(----------*----------)	
		---------+----------+----------+----------+---------			
		600	640	680	720

Confidence interval 95%

RIG	Moyenne	-----+----------+----------+----------+----------			
AVEC R	623	(----------*----------)			
SANS R	698			(----------*----------)	
		-----+----------+----------+----------+----------			
		595	630	665	700