

## **EFFECTS OF FUNGICIDE TREATMENT AND *RHIZOBIUM* INOCULATION ON CHEMICAL COMPOSITION OF FABA BEAN (*Vicia faba* L.) Seeds**

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### **ABSTRACT**

The effects of fungicidal seed dressing and *Rhizobium* inoculation on the chemical properties of faba bean seeds were studied. Two fungicides, Captan and Fernasan-D at concentrations between zero and 10 g/kg seeds were used. Inoculation with *Rhizobium leguminosorum* bv. *viceae* strain TAL 1397 immediately before or after seed dressing or inoculation at the seedling stage was adopted. Compared to uninoculated plants, *Rhizobium* inoculation by both methods significantly ( $P \leq 0.01$ ) increased seed moisture content, fat content, fibre and protein content. Carbohydrate content was significantly ( $P \leq 0.01$ ) decreased while no effect was detected on ash content. No clear differences were observed between inoculation immediately before or after seed dressing (First season). Fungicide seed dressing significantly ( $P \leq 0.01$ ) increased ash, moisture and carbohydrate contents when applied at the field recommended dose. Fat, fibre and protein contents were significantly ( $P \leq 0.01$ ) decreased with different degrees depending on fungicide toxicity and concentration. Increasing the concentration of both fungicides resulted in lower contents of fat, fibre and protein contents. No differences between the two fungicides were observed in the contents of moisture, ash and crude fibre. Captan seed dressing resulted in lower fat and crude protein content and higher carbohydrates content compared to Fernasan-D.

### **INTRODUCTION**

Legumes are unique in the high protein content of their seeds and their ability to fix atmospheric nitrogen. Faba bean (*Vicia faba* L.) is one of the major leguminous crops in Africa as well as Sudan. It is mainly grown for human consumption. The popularity of faba bean may be due to its high protein content and availability at relatively reasonable price. It is considered as one of the main sources of cheap protein the protein content of faba bean ranges from 27 to 34% (Haciseferougullari, *et al.*, 2003). Many efforts were directed to improve yield, protein content, and cookability and to decrease tannins and hard seed percentage of legumes seeds through breeding, fertilization and/or genetic engineering. Biofertilization receives a great attention because of its minimal effect on the environment and its longer lasting effect. Many factors act upon legume – *Rhizobium* symbiosis and may positively or negatively affect the yield and seed quality. These factors include cultivar, agricultural practices and locality or environment (Elsheikh and Elzidany, 1997). *Rhizobium* inoculation of faba bean has been found to increase yield and improve seed quality (Mohamed Ahmed and Abdalla, 2004). Chemical and biological fertilizers were reported to increase protein content of faba bean (Babiker *et al.*, 1995). Fungicidal seed dressing

is one of the factors that interfere with legume- *Rhizobium* association and affect chemical and physical properties of the seeds.

Objectives of this study was to assess the effects of fungicide treatment and the method of *Rhizobium* inoculation on protein content and proximate composition of faba bean seeds, variety "Agabat".

## MATERIALS AND METHODS

Two field experiments were conducted during two cropping seasons in the Demonstration Farm of the Faculty of Agriculture at Shambat (Latitude 15 ° 40/N, Longitude 32° 32/E), to study the effects of fungicidal seed dressing and *Rhizobium* inoculation on chemical composition of faba bean seeds. Table (1) shows some chemical and physical properties of the soil. The land was prepared by deep ploughing, harrowing and leveling. The area was then ridged and divided into 4 X 4 m plots, 80 cm between ridges and 5 north – south ridges per plot.

Seeds of faba bean cultivar Agabat were purchased from commercial sources from Shendi. *Rhizobium leguminosarum* by *viceae* strain TAL 1397 was supplied by the Environment and National Resources Institute (ENNRI), National Research Council, Sudan. The Crop Protection Department, Ministry of Agriculture, Khartoum North, supplied the fungicides Captan and Fernasan -D.

### Treatments Used:

Captan or Fernasan – D treatment at concentration of:

Zero g/kg seeds as control

2 g/kg seeds, 4 g/kg seeds, 6 g/kg seeds, in the first season and increased to 8 g/kg seeds and 10 g/kg seeds in the second season.

**Table (1): Some chemical and physical properties of Shambat soil**

Particle size distribution %			pH	Ec (ds/m)	Soluble Cations				SAR(meq/l)	Total N %
sand	silt	Clay			K	Na	Ca	Mg		
18	17	65	8.2	1.2	0.26	10.83	4.25	1.21	4.43	0.064

In the first season, each of these treatments was either inoculated immediately before or after fungicidal seed dressing or at the seedling stage in the furrow or otherwise uninoculated. No differences were observed between inoculation immediately before or after seed dressing. Only inoculation in conjunction with fungicidal seed dressing was adopted in the second season. Five disinfected seeds were sown per hole thinned to three at the seedling stage. The crop was irrigated every 10 – 15 days. The experiments were arranged in a complete randomized block design with three replicates. At harvest, the seeds were carefully cleaned, then ground to pass a 0.4mm screen for proximate analysis.

AOAC (1984) methods were followed in the determination of moisture, crude fibre, crude protein and fat content. Carbohydrates content was determined by differences.

**Statistical Analysis:**

Each sample was analyzed in triplicates and figures were then averaged. Data were assessed by analysis of variance (ANOVA) (Snedecor and Cochran, 1987) with the probability of  $p \leq 0.01$ .

**RESULTS AND DISCUSSION**

**Moisture content:**

As shown in Table (2), results of the first season indicated that moisture content is not affected by any of the treatments. In the second season (Table 3) *Rhizobium* inoculation significantly ( $p \leq 0.01$ ) increased seed moisture content over the uninoculated control plants. The increment in moisture content of faba bean seeds due to *Rhizobium* inoculation was reported by Elsheikh and Elzidany, (1997). Fungicidal seed dressing by Captan or Fernasan – D significantly ( $p \leq 0.01$ ) increased moisture content over the control plants up to the recommended dose but decreased again with increasing dose up to 10 g/kg seeds. The moisture content of faba bean seeds was found to be in the range of 3.7 to 5.7%. Values reported before were 6.6 – 7.8%, (Elsheikh and Elzidany 1997) and 4-6% (Ahmed, 1998).

Generally, the moisture content of legume seed was found to be affected by the relative humidity during storage (Elsayed, 1994).

**Table (2): Effects of fungicides treatment and *Rhizobium* inoculation on moisture and ash content of faba bean seeds.(first season).**

Concentration g/kg seed	<i>Rhizobium</i> inoculation	Moisture content (%)		Ash content(%)	
		Fernasan-D	Captan	Fernasan-D	Captan
0	R0	4.15(+0.07)	4.31(+0.15)	2.9(+0.4)	2.5(+0.4)
	R1	3.93(+0.11)	4.18(+0.04)	3.1(+0.3)	2.3(+0.6)
	R2	4.13(+0.11)	4.16(+0.06)	3.0(+0.1)	2.8(+0.6)
	R3	3.68(+0.60)	4.10(+0.07)	3.2(+0.3)	2.5(+0.5)
2	R0	3.99(+0.01)	3.64(+0.79)	3.5(+0.1)	3.0(+0.1)
	R1	3.85(+0.01)	4.11(+0.13)	3.4(+0.4)	3.1(+0.3)
	R2	4.10(+0.14)	4.25(+0.01)	3.5(+0.4)	2.9(+0.3)
	R3	4.15(+0.07)	4.13(+0.14)	3.1(+0.1)	2.5(+0.5)
4	R0	3.95(+0.07)	3.90(+0.14)	2.9(+0.6)	2.5(+0.5)
	R1	4.08(+0.11)	4.11(+0.06)	3.5(+0.5)	2.9(+0.5)
	R2	4.03(+0.11)	4.08(+0.04)	3.4(+0.5)	3.0(+0.4)
	R3	4.04(+0.09)	4.16(+0.06)	3.5(+0.6)	3.1(+0.1)
6	R0	4.00(+0.02)	4.17(+0.06)	3.1(+0.4)	2.8(+0.2)
	R1	4.10(+0.07)	4.11(+0.13)	3.0(+0.1)	3.5(+0.1)
	R2	4.06(+0.07)	4.19(+0.05)	2.8(+0.6)	3.0(+0.1)
	R3	4.15(+0.07)	3.99(+0.16)	3.0(+0.1)	3.4(+0.4)

	Moisture content (%)	Ash content (%)
LSD for Fungicide (F)	NS	± 0.155
LSD for Dose (D)	NS	± 0.219
LSD for Inoculation (I)	NS	NS
LSD for F × D	NS	± 0.310
LSD for F × I	NS	NS
LSD for D × I	NS	NS
LSD for F × D × I	NS	NS

Ro = Control.

R1 = Seed inoculation immediately before seed dressing.

R2 = Seedling inoculation immediately after seed dressing.

R3 = Seedling inoculation.

**Ash conten:**

*Rhizobium* inoculation by either method did not affect ash content of faba bean seeds (Tables 2 and 3). Fungicide seed dressing significantly ( $p \leq 0.01$ ) increased ash content of the seeds compared to untreated control plants. Fernasan-D treatments resulted in higher ash content compared to Captan. Increasing the concentration of either fungicide from zero to the field recommended dose increased ash content by 2%, where increasing the concentration to 10 gm fungicide/Kg seeds decreased the percentage of ash content by 2.4% but lower than the control plants. Similar findings were reported with fenugreek (Abdelgani, 1997).

The ash content of foodstuff represents the residue remaining after the organic matter has burnt. The ash obtained is not necessarily of exactly the same composition as the mineral matter present in the original food as there may be losses due to volatilization or as a result of some interactions between constituents.

**Table (3): Effects of fungicides treatment and *Rhizobium* inoculation on moisture and ash content of faba bean seeds.(second season).**

Concentration g/kg seed	<i>Rhizobium</i> inoculation	Moisture content (%)		Ash content (%)	
		Fernasan-D	Captan	Fernasan-D	Captan
0	R0	4.37(+ 0.09)	4.80(+ 0.10)	3.19(+ 0.02)	3.40(+ 0.01)
	R1	4.77(+ 0.12)	4.86(+ 0.01)	3.30(+ 0.05)	3.38(+ 0.10)
	R2	4.15(+ 0.09)	4.35(+ 0.05)	3.36(+ 0.04)	3.20(+ 0.06)
2	R0	4.47(+ 0.15)	4.44(+ 0.10)	3.41(+ 0.04)	3.41(+ 0.03)
	R1	4.92(+ 0.06)	4.78(+ 0.08)	3.41(+ 0.05)	3.35(+ 0.04)
	R2	4.17(+ 0.03)	4.63(+ 0.15)	3.26(+ 0.05)	3.38(+ 0.02)
4	R0	4.49(+ 0.31)	4.59(+ 0.04)	3.42(+ 0.04)	3.29(+ 0.07)
	R1	4.80(+ 0.10)	5.57(+ 0.04)	3.45(+ 0.12)	3.23(+ 0.04)
	R2	5.63(+ 0.09)	4.67(+ 0.12)	3.40(+ 0.09)	3.37(+ 0.21)
6	R0	4.44(+ 0.05)	4.45(+ 1.00)	3.44(+ 0.04)	3.22(+ 0.02)
	R1	5.03(+ 0.08)	4.55(+ 0.13)	3.45(+ 0.02)	3.32(+ 0.10)
	R2	4.68(+ 0.10)	5.11(+ 0.04)	3.57(+ 0.21)	3.36(+ 0.11)
8	R0	4.82(+ 0.05)	4.48(+ 0.04)	3.25(+ 0.02)	3.30(+ 0.07)
	R1	5.66(+ 0.06)	4.75(+ 0.44)	3.45(+ 0.02)	3.24(+ 0.01)
	R2	4.22(+ 0.04)	4.52(+ 0.08)	3.38(+ 0.02)	3.38(+ 0.14)
10	R0	4.55(+ 0.14)	4.75(+ 0.39)	3.37(+ 0.08)	3.25(+ 0.10)
	R1	4.30(+ 0.26)	4.90(+ 0.37)	3.33(+ 0.04)	3.25(+ 0.05)
	R2	4.68(+ 0.08)	4.69(+ 0.27)	3.33(+ 0.04)	3.25(+ 0.09)

	Moisture content (%)	Ash content (%)
LSD for Fungicide (F)	± 0.06	± 0.03
LSD for Dose (D)	± 0.11	± 0.05
LSD for Inoculation (I)	± 0.08	NS
LSD for F × D	± 0.18	± 0.07
LSD for F × I	± 0.11	± 0.05
LSD for D × I	± 0.19	± 0.09
LSD for F × D × I	± 0.26	± 0.13

Ro = Control  
 R1 = Seed inoculation  
 R2= Seedling inoculation

**Fat content:**

As shown in Tables (4 and 5), *Rhizobium* inoculation significantly ( $p \leq 0.01$ ) increased fat content of faba bean seeds. Seedling inoculation resulted in higher fat content compared to seed inoculation. Fungicide seed dressing significantly ( $p \leq 0.01$ ) decreased it with different degrees depending on the fungicide toxicity. Captan, which is more toxic, resulted in lower fat

content than Fernasan-D. Increasing the fungicide concentration above the recommended dose significantly ( $p \leq 0.01$ ) decreased faba bean seeds fat content.

**Table (4): Effects of fungicides treatment and *Rhizobium* inoculation on fat and crude fibre content of faba bean seeds.( first season).**

Concentration g/kg seed	<i>Rhizobium</i> inoculation	Fat content (%)		Crude fibre content (%)	
		Fernasan-D	Captan	Fernasan-D	Captan
0	R0	1.47(+0.31)	1.13(+0.15)	5.8(+0.7)	6.7(+0.2)
	R1	1.20(+0.20)	1.23(+0.12)	6.8(+0.3)	6.9(+0.4)
	R2	1.83(+0.33)	1.27(+0.31)	6.5(+0.4)	6.9(+0.3)
	R3	1.77(+0.15)	1.23(+0.25)	6.7(+0.3)	6.8(+0.2)
2	R0	1.07(+0.12)	1.20(+0.01)	7.1(+0.4)	6.5(+0.2)
	R1	1.16(+0.12)	1.30(+0.20)	7.2(+0.4)	7.1(+0.2)
	R2	1.47(+0.25)	0.90(+0.50)	7.0(+0.1)	7.0(+0.1)
	R3	1.87(+0.15)	1.20(+0.17)	5.9(+0.5)	7.0(+0.1)
4	R0	1.10(+0.17)	1.07(+0.15)	6.5(+0.4)	6.6(+0.1)
	R1	1.10(+1.70)	1.10(+0.40)	6.9(+0.4)	6.0(+0.1)
	R2	1.37(+0.15)	1.00(+0.01)	6.8(+0.3)	5.8(+0.4)
	R3	1.43(+0.12)	1.33(+0.15)	6.8(+0.4)	5.6(+0.3)
6	R0	1.00(+0.01)	0.93(+0.12)	6.2(+0.2)	6.7(+0.3)
	R1	1.27(+0.25)	1.27(+0.05)	6.8(+0.2)	6.9(+0.3)
	R2	1.33(+0.25)	1.07(+0.21)	6.6(+0.2)	6.8(+0.1)
	R3	1.37(+0.05)	1.30(+0.01)	6.5(+0.2)	6.9(+0.3)

	Fat content (%)	Crude Fibre (%)
LSD for Fungicide (F)	± 0.09	NS
LSD for Dose (D)	± 0.12	± 0.18
LSD for Inoculation (I)	± 0.12	± 0.18
LSD for F × D	NS	± 0.25
LSD for F × I	± 0.17	NS
LSD for D × I	NS	± 0.36
LSD for F × D × I	NS	± 0.51

Ro = Control.

R1 = Seed inoculation immediately before seed dressing.

R2 = Seedling inoculation immediately after seed dressing.

R3 = Seedling inoculation.

The increase in fat content of faba bean seeds due to biological fertilization was reported by Elsheikh and Elzidany, (1997), groundnut and fenugreek, (Abdelgani,1997). Fat content of faba bean was found to be in the range of 0.9-1.8% which was comparable to previous values were 1.6-2% (Musallam, *et al.*, 2004).

**Crude Fibre Content:**

*Rhizobium* inoculation by either method significantly ( $p \leq 0.01$ ) increased crude fibre content of faba seeds over the control uninoculated plants. Fungicidal seed dressing at doses above the field recommended rates significantly ( $p \leq 0.01$ ) decreased fibre content whereas no significant differences were observed between the two fungicides (Tables 4 and 5).

Regardless the treatment applied the crud fiber content of faba bean seeds found to be in the range of 5.6-7.2% .Reported values were 5.7-6.78% ( Elsheikh and Elzidany, 1997).

In general, the crude fibre content is influenced by the environmental condition and varietal characteristics. In faba bean, the cultivar, location and time of harvest are the factors that led to fibre content variation (EL Tinay *et al.*,1989).

Table (5): Effects of fungicides treatment and *Rhizobium* inoculation on fat and crude fibre content of faba bean seeds.( second season).

Concentration g/kg seed	<i>Rhizobium</i> Inoculation	Fat content (%)		Crude fibre content (%)	
		Fernasan-D	Captan	Fernasan-D	Captan
0	R0	1.28(+ 0.02)	1.23(+ 0.24)	7.63(+ 0.44)	7.17(+ 0.32)
	R1	1.24(+ 0.06)	0.97(+ 0.05)	5.75(+ 0.01)	6.77(+ 0.82)
	R2	1.06(+ 0.07)	1.02(+ 0.10)	6.47(+ 0.01)	6.95(+ 0.86)
2	R0	1.43(+ 0.40)	1.02(+ 0.04)	7.13(+ 0.02)	7.37(+ 0.44)
	R1	1.09(+ 0.05)	1.07(+ 0.04)	6.64(+ 1.54)	6.70(+ 0.58)
	R2	0.89(+ 0.10)	0.96(+ 0.16)	7.06(+ 0.01)	6.49(+ 0.34)
4	R0	1.20(+ 0.07)	1.09(+ 0.10)	8.01(+ 0.36)	7.15(+ 0.63)
	R1	0.89(+ 0.04)	1.02(+ 0.03)	6.70(+ 0.59)	7.28(+ 0.37)
	R2	0.91(+ 0.19)	1.11(+ 0.01)	5.15(+ 1.78)	6.00(+ 1.26)
6	R0	1.04(+ 0.05)	0.76(+ 0.09)	6.87(+ 0.39)	6.47(+ 1.03)
	R1	1.03(+ 0.10)	0.89(+ 0.05)	6.91(+ 0.49)	6.46(+ 1.12)
	R2	1.03(+ 0.01)	0.02(+ 0.17)1	6.63(+ 0.01)	6.85(+ 0.42)
8	R0	1.05(+ 0.04)	0.97(+ 0.22)	6.48(+ 0.48)	6.36(+ 0.39)
	R1	0.97(+ 0.14)	0.98(+ 0.09)	6.87(+ 0.33)	5.70(+ 1.11)
	R2	0.97(+ 0.15)	0.94(+ 0.01)	6.51(+ 0.34)	6.23(+ 0.3)
10	R0	1.00(+ 0.01)	0.84(+ 0.12)	6.97(+ 0.35)	6.17(+ 0.20)
	R1	0.82(+ 0.04)	0.79(+ 0.05)	6.88(+ 0.33)	6.25(+ 0.39)
	R2	1.20(+ 0.65)	0.82(+ 0.11)	6.21(+ 0.97)	6.11(+ 0.01)

	Fat content (%)	Crude fibre content (%)
LSD for Fungicide (F)	± 0.0	NS
LSD for Dose (D)	± 0.11	± 0.46
LSD for Inoculation (I)	± 0.08	± 0.33
LSD for F × D	NS	NS
LSD for F × I	NS	NS
LSD for D × I	NS	NS
LSD for F × D × I	NS	NS

Ro = Control  
R1 = Seed inoculation  
R2= Seedling inoculation

#### Crude Protein Content:

Legume seeds are rich in protein. The crude protein content in the seeds varied from 31.8% to 39.7% (Alghamdi,2009) with a well-balanced amino acid pattern. Faba bean contains a high protein content compared to other legumes seeds which amount to 33.4% ( Elsheikh *et al.*,2000).

*Rhizobium* inoculation significantly ( $p \leq 0.01$ ) increased crude protein content of faba bean seeds over the uninoculated control plants by 7%. Seedling inoculation resulted in higher values than seed inoculation (Tables 6 and 7). El Tilib *et al.* (1994) reported that protein content increases with improved plant nutrition and that *Rhizobium* inoculation and nitrogen fertilization were found to increase protein content of faba bean (Babiker *et al.*, 1995), and indeed other legumes such as soybean (Mukhtar and Abu Naib, 1988).

Fungicidal seed dressing significantly ( $p \leq 0.01$ ) decreased crude protein content of the seeds. The amount of reduction was proportional to the fungicide toxicity and concentration as toxicity and high concentrations reduced the efficiency of nitrogen fixation (Abdelgani,1997). Captan was found to reduce crude protein of faba bean seeds by 20% compared to 19% reduction by Fernasan-D.

**Carbohydrates content:**

*Rhizobium* inoculation significantly ( $p \leq 0.01$ ) decreased carbohydrates content compared to uninoculated control plants (Tables 6 and 7). The amount of carbohydrates ranged between 47.85 and 57.3%. Reported values ranged between 52.2 and 60.5% (Musallam *et al.*, 2004). The results reflect the effect of inoculation on moisture, fat, fibre and protein contents where the increase in these constituents due to inoculation was countered by decrease in carbohydrates content. The reduction in carbohydrates content of faba bean seeds due to *Rhizobium* inoculation was reported by Elsheikh and Elzidany, (1997). Fungicidal seed dressing by both fungicide significantly ( $p \leq 0.01$ ) increased the carbohydrates content. Increasing the fungicide concentration over the recommended field rate also resulted in a significant ( $p \leq 0.01$ ) increase in this parameter (Abdelgani, 1997).

Generally, the carbohydrate content is inversely related to the protein content of faba bean seeds (Elsheikh and Elzidany, 1997).

**Table (6): Effects of fungicides treatment and *Rhizobium* inoculation on crude protein and carbohydrates content of faba bean seeds. (first season)**

Concentration g/kg seed	<i>Rhizobium</i> inoculation	crude protein content (%)		carbohydrates content (%)	
		Fernasan-D	Captan	Fernasan-D	Captan
0	R0	33.97(+0.21)	31.90(+1.70)	51.68(+0.8)	53.49(+0.4)
	R1	34.23(+0.65)	32.90(+1.20)	50.74(+0.7)	52.79(+0.8)
	R2	34.57(+0.59)	33.00(+0.01)	49.97(+0.3)	51.87(+1.0)
	R3	36.33(+1.52)	35.40(+0.50)	48.32(+1.7)	49.97(+0.8)
2	R0	32.70(+0.20)	31.00(+0.90)	51.64(+0.0)	54.69(+0.8)
	R1	32.47(+0.32)	32.40(+0.80)	51.91(+0.4)	51.99(+1.1)
	R2	32.70(+0.60)	32.80(+0.70)	51.23(+0.4)	47.85(+0.7)
	R3	34.87(+0.31)	34.20(+0.80)	50.11(+0.1)	50.97(+0.7)
4	R0	31.47(+0.42)	30.80(+0.80)	53.18(+0.8)	55.13(+1.5)
	R1	31.70(+0.30)	32.20(+0.80)	52.72(+0.9)	53.69(+0.8)
	R2	31.20(+0.30)	31.70(+0.60)	53.20(+0.3)	54.42(+0.7)
	R3	33.60(+0.30)	34.00(+0.01)	50.60(+0.1)	51.98(+0.8)
6	R0	29.90(+0.40)	28.27(+0.80)	55.80(+0.8)	57.30(+0.6)
	R1	31.10(+0.01)	30.13(+0.57)	53.76(+0.9)	54.10(+0.4)
	R2	30.80(+0.40)	29.80(+0.78)	54.41(+0.7)	55.16(+0.2)
	R3	33.83(+0.35)	33.07(+0.21)	51.18(+1.1)	51.24(+0.8)

	Crude protein content (%)	Carbohydrates (%)
LSD for Fungicide (F)	± 0.28	± 0.33
LSD for Dose (D)	± 0.40	± 0.47
LSD for Inoculation (I)	± 0.40	± 0.47
LSD for F × D	± 0.57	± 0.66
LSD for F × I	± 0.57	± 0.66
LSD for D × I	NS	± 0.94
LSD for F × D × I	NS	± 1.33

Ro = Control.

R1 = Seed inoculation immediately before seed dressing.

R2 = Seedling inoculation immediately after seed dressing.

R3 = Seedling inoculation.

Table 7: Effects of fungicides treatment and *Rhizobium* inoculation on crude protein and carbohydrates content of faba bean seeds. (second season).

Concentration g/kg seed	<i>Rhizobium</i> Inoculation	crude protein content		carbohydrates content	
		Fernasan-D	Captan	Fernasan-D	Captan
0	R0	33.93( 00.42)	31.50(+ 1.72)	49.60(+0.71)	52.41(+ 1.04)
	R1	34.80(+ 0.20)	32.21(+ 1.85)	50.14(+ 1.27)	51.81(+ 0.37)
	R2	35.60(+ 0.53)	33.55(+ 1.37)	49.36(+ 1.27)	50.92(+ 0.37)
2	R0	32.80(+ 0.36)	32.60(+ 0.40)	50.70(+ 0.21)	51.16(+ 0.45)
	R1	33.33(+ 0.32)	34.60(+ 1.40)	50.91(+ 0.09)	49.50(+ 0.88)
	R2	34.93(+ 0.21)	35.10(+ 2.30)	49.66(+1.18)	49.44(+ 0.88)
4	R0	31.70(+ 1.30)	33.40(+ 1.70)	51.18(+ 0.37)	50.48(+ 0.36)
	R1	32.90(+ 1.00)	34.60(+ 1.80)	51.08(+ 0.27)	48.30(+ 0.73)
	R2	33.40(+ 0.40)	35.00(+ 0.01)	51.51(+ 0.36)	49.85(+ 1.00)
6	R0	30.40(+ 1.20)	31.20(+ 0.50)	53.81(+ 0.36)	52.91(+ 0.28)
	R1	29.97(+ 1.15)	31.60(+ 0.90)	53.61(+ 0.45)	53.16(+ 0.37)
	R2	32.17(+ 0.50)	32.90(+ 0.50)	51.92(+ 1.00)	50.76(+ 0.20)
8	R0	31.30(+ 1.36)	29.00(+ 0.01)	53.10(+ 1.10)	55.89(+ 1.08)
	R1	31.57(+ 0.86)	31.00(+ 0.01)	52.48(+ 0.64)	54.33(+ 0.82)
	R2	32.67(+ 0.26)	32.40(+ 1.10)	52.37(+ 0.64)	52.53(+ 0.82)
10	R0	29.40(+ 1.24)	27.90(+ 0.90)	54.70(+ 0.79)	57.09(+ 0.18)
	R1	30.70(+ 1.21)	29.53(+ 0.61)	53.93(+ 0.90)	55.38(+ 0.62)
	R2	32.53(+ 0.50)	31.17(+ 0.37)	53.05(+ 0.86)	54.94(+ 0.73)

	Crude protein content (%)	Carbohydrates (%)
LSD for Fungicide (F)	± 0.36	± 0.30
LSD for Dose (D)	± 0.62	± 0.51
LSD for Inoculation (I)	± 0.44	± 0.36
LSD for F × D	± 0.88	± 0.72
LSD for F × I	NS	± 0.51
LSD for D × I	NS	± 0.51
LSD for F × D × I	NS	NS
Ro = Control		
R1 = Seed inoculation		
R2= Seedling inoculation		

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تأثير المبيدات الفطرية والتلقيح بيكتريا العقد الجذرية على الخصائص الكيميائية  
لبذور الفول المصري (البلدي)  
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تمت دراسة تأثير المبيدات الفطرية والتلقيح بيكتريا العقد الجذرية على الخصائص الكيميائية لبذور الفول المصري (البلدي) صنف عقبات. تم استخدام مبيدين فطريين هما الكابتان والفيرناسان بتركيزات مختلفة بين صفر و 10 جم /بذرة، كما استخدمت بيكتريا العقد *Rhizobium leguminosarum* bv. *viceae* TAL1397 مباشرة قبل وبعد إضافة المبيد الفطري للبذرة أو عند ظهور البادرات.

أدى التلقيح بيكتريا العقد الجذرية بأي من الطرق المستخدمة إلى زيادة معنوية ( $P \leq 0.01$ ) في محتوى رطوبة البذرة، محتوى الدهون والألياف والبروتين، بينما انخفض معنوياً ( $P \leq 0.01$ ) محتوى البذرة من المواد الكربوهيدراتية. ولم يؤدي التلقيح إلى أي أثر في محتوى الرماد. تقدم التلقيح عند ظهور البادرات على التلقيح مباشرة قبل أو بعد إضافة المبيد الفطري في كل المعاملات تحت الدراسة.

أدت إضافة المبيدات الفطرية لبذرة الفول المصري إلى زيادة معنوية في كل نسبة الرماد والرطوبة والمواد الكربوهيدراتية بينما انخفضت معنوياً ( $P \leq 0.01$ ) نسبة البروتين والألياف والدهون بنسب تعتمد على سمية المبيد وتركيزه. لم تظهر الدراسة أي فروقات بين المبيدين في نسبة الرماد والرطوبة والألياف، بينما أدى إضافة الكابتان إلى نسب أقل في محتوى البذرة من البروتين والدهون ونسبة أعلى من المواد الكربوهيدراتية مقارنة بمبيد الفيرناسان الفطري.

قام بتحكيم البحث

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