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A Note on the Effect of Intercropping and *Rhizobium* Inoculation on the Seed Quality of Faba Bean (*Vicia faba* L.)

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Mixed cropping is practiced, traditionally, in many parts of the world. The interest in intercropping is due to some established and speculated advantages such as higher yields, more efficient land use, development of energy-efficient and sustainable agriculture and improvement of soil fertility through contribution of fixed nitrogen by the legume component (Ofori and Stern 1987). *Rhizobium* inoculation has been reported to increase the seed protein content of faba bean (Elsheikh and Elzidany 1997) and groundnut (Elsheikh and Mohammedzein 1998). This is attributed to increase in nitrogen fixation efficiency and translocation of fixed nitrogen to the seeds. The objective of this investigation was to study the effect of intercropping and *Rhizobium* inoculation on the physical and chemical characteristics of faba bean seeds.

A field experiment was conducted during 1996/97 growing season in the Demonstration Farm of the Faculty of Agriculture at Shambat (15° 40` N, 32° 32 E and 386 m asl). The soil is montmorillonitic clay with a pH ranging from 8.0 to 8.5, EC of 2.4 dSm^{-1}, and N and P contents of 0.02 and 0.03 mg kg-1 soil, respectively. Seeds of the faba bean cv. Selaim and the maize cv. Giza 2 were either grown as: (i) monocrop, (ii) in the same hole, or (iii) in alternate holes. Three seeds were placed in each hole with spacing of 70 cm and 30 cm between rows and holes, respectively, in plots of 5x4 m. Faba bean seeds were either uninoculated or inoculated with *Rhizobium leguminosarum* biovar *viciace* strain TAL 1397 or strain TAL 1399. The experiment was designed in completely randomized blocks with four replications. At harvest, the seeds of faba bean were collected, proximate analysis was carried out and tannin content was determined according to AOAC (1984). Hard seed percentage and

hydration coefficient were determined according to Elsheikh and Elzidany (1997), whereas, *in vitro* protein digestibility (IVPD) was determined according to Saunder *et al.* (1973). Samples from each subplot was analyzed in triplicate and the figures were averaged, and analysis of variance (ANOVA) was carried out. The Duncan multiple range test was used to separate means.

The results in Table 1 indicate that *Rhizobium* inoculation and/or intercropping treatments significantly increased the ash, crude fibre, fat and protein content of faba bean compared to the uninoculated monocrop control. The carbohydrate content was significantly decreased, whereas, the moisture and tannin contents were significantly increased by inoculation, with no response for the intercropping practice. However, the hard seed percentage was neither affected by the *Rhizobium* treatments nor by the intercropping methods. No significant differences between the two intercropping methods (same hole or alternate holes) were found in all parameters measured. However, inoculation with *Rhizobium* strain TAL 1399 showed consistently better results in proximates compared to the other two treatments (control or inoculation with the strain TAL 1397).

The results of the moisture content is in agreement with that reported by Elsheikh and Elzidany (1997) who found that the moisture content of groundnut was not affected by the application of biological, chemical or organic fertilizers. However, the moisture content is generally affected by the relative humidity at the time of harvest and during storage. Ash and fat contents were significantly increased by inoculation. The fibre is an important constituent of human food and animal feed. It is needed in reasonable proportions as a bulking agent to maintain diet and help in movement of food through the digestive tract. Crude fibre is, generally, influenced by the environmental conditions, varietal characteristics and fertilization treatments (Elsheikh and Mohammedzein 1998).

Table 1. The effect of intercropping and *Rhizobium* inoculation on some parameters of faba bean seed quality

Treatment	Moisture (%)	Ash (%)	Fibre (%)	Fat (%)	Protein (%)
No inoculation					
Monocrop	4.03a	2.93a	4.73a	1.60a	21.5a
Same hole	4.50a	3.36b	5.81b	1.90b	24.8b
Alternate holes	4.30a	3.36b	5.73b	1.83b	25.2b
Mean	4.28	3.22	5.43	1.78	23.8
S. E. ±	0.65	0.15	0.34	0.15	0.70
***Rhizobium* TAL 1397**					
Monocrop	6.10a	3.06a	5.56a	2.01a	26.0a
Same hole	6.68a	3.53b	6.53b	2.41b	29.3b
Alternate holes	6.56a	3.80b	6.56b	2.50b	30.0b
Mean	6.45	3.46	6.18	2.31	28.4
S. E. ±	0.65	0.15	0.34	0.15	0.70
***Rhizobium* TAL 1399**					
Monocrop	6.20a	3.40a	6.03a	2.20a	27.1a
Same hole	6.80a	3.93b	6.90b	2.79b	31.6b
Alternate holes	6.60a	3.94b	7.03b	2.90b	32.9b
Mean	6.53	3.76	6.65	2.63	30.5
S. E. (mean) ±	1.2	0.31	0.70	0.40	1.40
S. E. (treatments) ±	0.65	0.15	0.34	0.15	0.70

Table 1 (Continued)

Treatment	Carbohydrates (%)			Hard seed (%)	Hydration coefficient (%)
No inoculation					
Monocrop	65.81b	76.90a	0.030a	1.7a	172.3a
Same hole	59.63a	80.20b	0.040a	2.3a	181.0b
Alternate holes	59.78a	80.30b	0.030a	2.6a	182.8b
Mean	61.53	79.13	0.033	2.2	178.7
S. E. ±	1.6	1.4	0.01	0.33	2.0
***Rhizobium* TAL 1397**					
Monocrop	57.24b	80.84a	0.120a	2.6a	182.4a
Same hole	51.65a	84.98b	0.130a	2.2a	188.3b
Alternate holes	51.01a	84.12b	0.120a	3.2a	189.7b
Mean	53.3	83.31	0.123	2.67	186.8
S. E. ±	1.6	1.4	0.01	0.33	2.0
***Rhizobium* TAL 1399**					
Monocrop	55.11b	80.20a	0.13a	2.5a	182.4a
Same hole	48.11a	84.20b	0.12a	3.2a	188.8b
Alternate holes	46.67a	83.40b	0.12a	3.0a	189.5b
Mean	49.96	82.60	0.12	2.9	186.9
S. E.(mean) ±	3.2	3.2	0.01	0.65	2.8
S. E. (treatment) ±	1.6	1.4	0.01	0.33	2.0

IVPD = *In vitro* protein digestibility.

Means not sharing a common superscript (s) in a column (for each of the three *Rhizobium* treatments) are significantly different at $P \leq 0.05$.

Rhizobium inoculation, nitrogen, sulphur and chicken manure fertilization significantly increased protein content of faba bean (Elsheikh and Elzidany 1997). The enhancing effect of *Rhizobium* could be attributed to the high concentration of nitrogen available to the plant, through the nitrogen fixation process, which increases the protein content in treated plants. The higher protein content in seeds of the intercrop, in this study, could be attributed to the lower yields i.e smaller sink size as compared to the larger sink size of the monocrop. However, lack of significant differences between the two intercropping methods, could be attributed to the spreading nature of the roots of the two crops, so that they might bridge the gap between the alternate rows. In this study, the increase in fat, fibre and protein content due to inoculation is counteracted by the decrease in carbohydrate content.

Despite the increase in tannin content, inoculation improved IVPD of faba bean compared to the uninoculated control. This could be attributed to higher levels of seed protein when collected from plants. Similar results were also reported for faba bean by Elsheikh and Elzidany (1997). The presence of tannin is mostly associated with decrease in biological availability of macromolecules such as proteins and carbohydrate. Among the major factors that influence hard seed percentage are environmental conditions, locality, harvesting time, variety and agronomic practices. Hydration coefficient was significantly increased by inoculation with *Rhizobium* compared to the uninoculated control. High hydration coefficient indicates that these seeds are capable of imbibing water efficiently after soaked, and it is a valuable quality factor for consumers. Generally, the results of this study indicate that both inoculation with *Rhizobium* and intercropping may play an important role in the improvement of the seed quality and nutritional characteristics of faba bean.

REFERENCES

AOAC (1984). *Official Methods of Analysis.* 14th ed. Association of Official Analytical Chemists. (AOAC), Washington D. C.

Ofori, F. and Stern, W. R. (1987). Cereal legume intercropping system. *Advances in Agronomy* 41, 78-80.

Elsheikh, E. A. E. and Elzidany, A. A. (1997). Effect of *Rhizobium* inoculation, organic and chemical fertilizers on proximate composition, *in vitro* protein digestibility (IVPD), tannin and sulphur content of faba beans. *Food Chemistry* 59, 41-45.

Elsheikh, E. A. E. and Mohammedzein, E. M. M.(1998). Effect of *Rhizobium,* VA mycorrhiza and fertilizers on seed composition of groundnut. *Annals of Applied Biology* 132, 325-330.

Saunder, R. M.; Connor, M. A.; Booth, A. N.; Bickoff, E. N. and Kohler, C. O. (1973). Measurements of digestibility of alfalfa protein concentrate by *in vivo* and *in vitro* methods. *Journal of nutrition* 103, 530-535.

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أثر التحميل والرايزوبيوم على نوعية حبوب الفول المصرى

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موجز البحث: أجريت تجربة حقلية بمزرعة كلية الزراعة بجامعة الخرطوم فى موسم 97/1996 لدراسة تأثير التحميل (الزراعة البينية) والرايزوبيوم على الخصائص الكيميائية والفيزيائية لبذور الفول المصرى . أدى التلقيح بالرايزوبيوم والتحميل (الزراعة البينية) لزيادة معنوية فى محتوى الألياف والرماد والدهون والبروتين وهضم البروتينات خارجيا ، ولنقص معنوى فى محتوى الكاربوهيدرات . كما أدى التلقيح بالرايزوبيوم فقط لزيادة فى محتوى التانين والرطوبة . ولم تتأثر نسبة البذور الصلدة بلقاح الرايزوبيوم ولا بالزراعة البينية .