EFFECT OF SEED INOCULATION WITH *AZOTOBACTER* ON RAPE YIELD IN EGYPT

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Abstract

The effect of seed inoculation with *Azotobacter chroococcum*, as well as organic and inorganic nitrogen fertilizers on growth of rape plants was studied. A field experiment was carried out at Ismailia, Egypt. Inoculation with Azotobacter as well as organic amendments raised the yield of seeds by 16.8% . These treatments also raised densities of *Azotobacter* in rhizosphere and plain soil .

INTRODUCTION

Nitrogen fixing bacteria are widely distributed in nature, high potential of nitrogen fixation seems to belong to non-symbiotic bacteria (Dobereiner and Day1975). The magnitude of asymbiotic nitrogen fixation is markedly affected by physical and chemical conditions in the habitat (Ishac *et al.*, 1987), Antoun and Armanious 1990, Abd-El-Malek and Ishac 1968, and Harper and Lynch 1979. El-Sawy *et al.* (1986), showed that inoculation with *Azotobacter* increased the growth of Egyptian henbane crop. They reported also that half of the nitrogen fertilizer can be saved through inoculation of seeds with asymbiotic nitrogen fixers. The present work aimed mainly at studying the effect of inoculation of rape seeds with *Azotobacter chroococcum* on yield .

MATERIALS AND METIODS

A field experiment was conducted in sandy soil in Ismailia. Mechanical and

chemical analyses of the soil are presented in Table 1. Rape was planted in 3 x 3.5 m. plots. A complete randomized block design in four replications was used. All plots were uniformly fertilized with 30 kg super-phosphate and 50 kg potassium sulphate/feddan. Two rates of nitrogen fertilizer were used, namely 60 and 120 kg. ammonium sulphate/feddan.

Table 1. Mechanical and chemical analyses of the soil.

Mechanical analysis :	
Coarse sand	60.84 %
Fine sand	36.36 %
Silt and clay	1.78 %
Chemical analysis :	
Cations and anions meq./L.	
Ca^{++}	0.37
Mg^{++}	0.31
Na^{+}	0.56
K^{+}	0.13
CO_3^{--}	0.00
HCO_3^{-}	0.41
CL^{-}	0.36
SO_4^{--}	0.61
C_aCO_3	1.62 %
pH in 1 : 5 soil : water suspension	7.70
Water Holding Capacity	22.62 %
Total nitrogen	0.007 %
Organic carbon	0.17 %
C/N ratio	25.89 : 1

All the previous treatments were duplicated with *Azotobacter Chroococcum* as a seed inoculant. The inoculant was a culture containing 9 x 10^6 cells/ml. It was added to peat moss containing 4% $CaCO_3$, at the rate of 1:1. Seeds of rape were coated with this inoculant just before sowing. Counts of *Azotobacter* were determined by using the MPN method (Page *et al.* 1982).

RESULTS AND DISCUSSION

Densities of *Azotobacter* sp. in free and rhizosphere soil are shown in Table 2

and Figs. 1 and 2. Highly significant differences in counts of *Azotobacter* were found among treatments in free and rhizosphere soils, Organic amendments raised counts of *Azotobacter*.

In general, *Azotobacter* population in rhizosphere and free soil, increased as a result of seed inoculation. This result is in agreement with that found by Fayez (1981) .

Inoculation with *Azotobacter* raised also the plant hieght, number of branches and shoot dry weight by 14.42, 35.0 and 16.9%, respectively. These results are in accordance with those reported by Harper and Lynch (1979). Inoculation raised also the seed yield by 16.8% over the average of all the uninoculated treatments.

Data in Table 4, Show that there is a significant increase in seed yield as a result of inoculation with *Azotobacter chroococcum*. This result is in agreement with that found by Antoun *et al.* (1991), and Harper and Lynch (1979).

It could be concluded from these data that inoculation of rape seeds with *Azotobacter chroococcum*, would raise the yield by about 60.2 Kilogram per each feddan of sandy soil.

Table 2. Counts of *Azotobacter* x 10^3. g^{-1} soil.

Treatments	Inoculation*	Average counts of Azotobacter	
		Free soil	Rhizosphere
60 kg N/feddan	+	21	1067
	-	17	116
120 kg N/feddan	+	20	805
	-	16	136
20 ton farmyard manure/feddan	+	35	4810
	-	23	216
10 ton farmyed manure/feddan	+	50	4202
	-	25	186
20 ton town-refuse/fed.	+	33	3269
	-	27	157
10 ton town-refuse/fed	+	44	1376
	-	25	157
20 ton chicken droppings/fed.	+	40	1389
	-	28	180
10 ton chicken droppings/fed.	+	53	1147
	-	29	197

* + = Inoculated - = Uninoculated

Table 3. Effect of inoculation of *Azotobacter* on growth of rape.

Treatments	Plant height (cm)	Number of branches/plant	Shoot dry weight (gm)
Inoculated	73.30	2.70	9.0
Uninoculated	64.20	2.00	7.7
L.S.D. 0.05%	8.39	0.21	0.2

Table 4. Effect of inoculation of *Azotobacter* on seed yield of rape .

Treatments	Seed yield	
	g/plant	Kg/feddan
Inoculated	11.960	418.8
Uninoculated	10.250	358.6
L.S.D. 0.05%	0.099	7.9

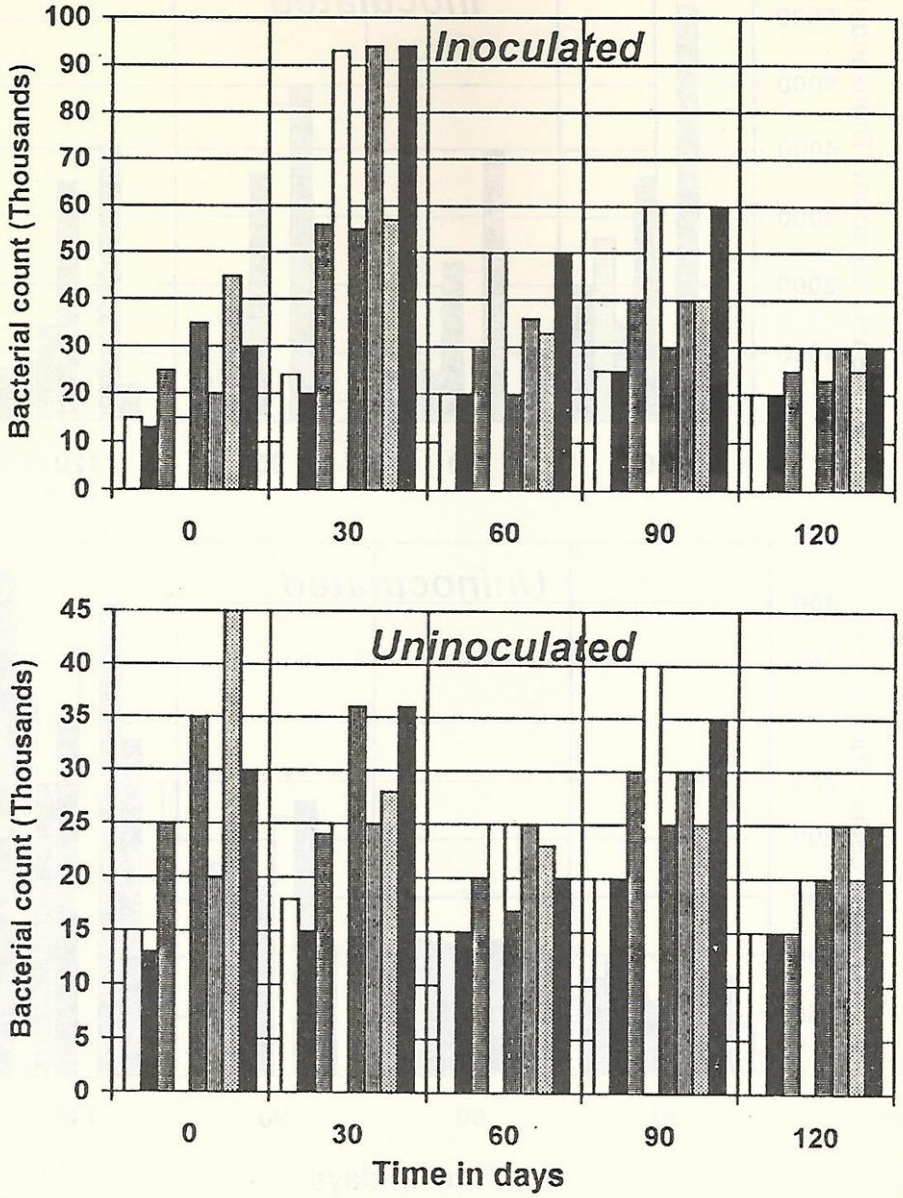

Fig. 1. Population of *Azotobacter* sp. in free soil.

60 Kg N	120 Kg N	20 FYM	10 FYM
20 TR	10 TR	20 CD	10 CD

FYM= farm yard manure, TR= twon refuse, CD= chicken droppings

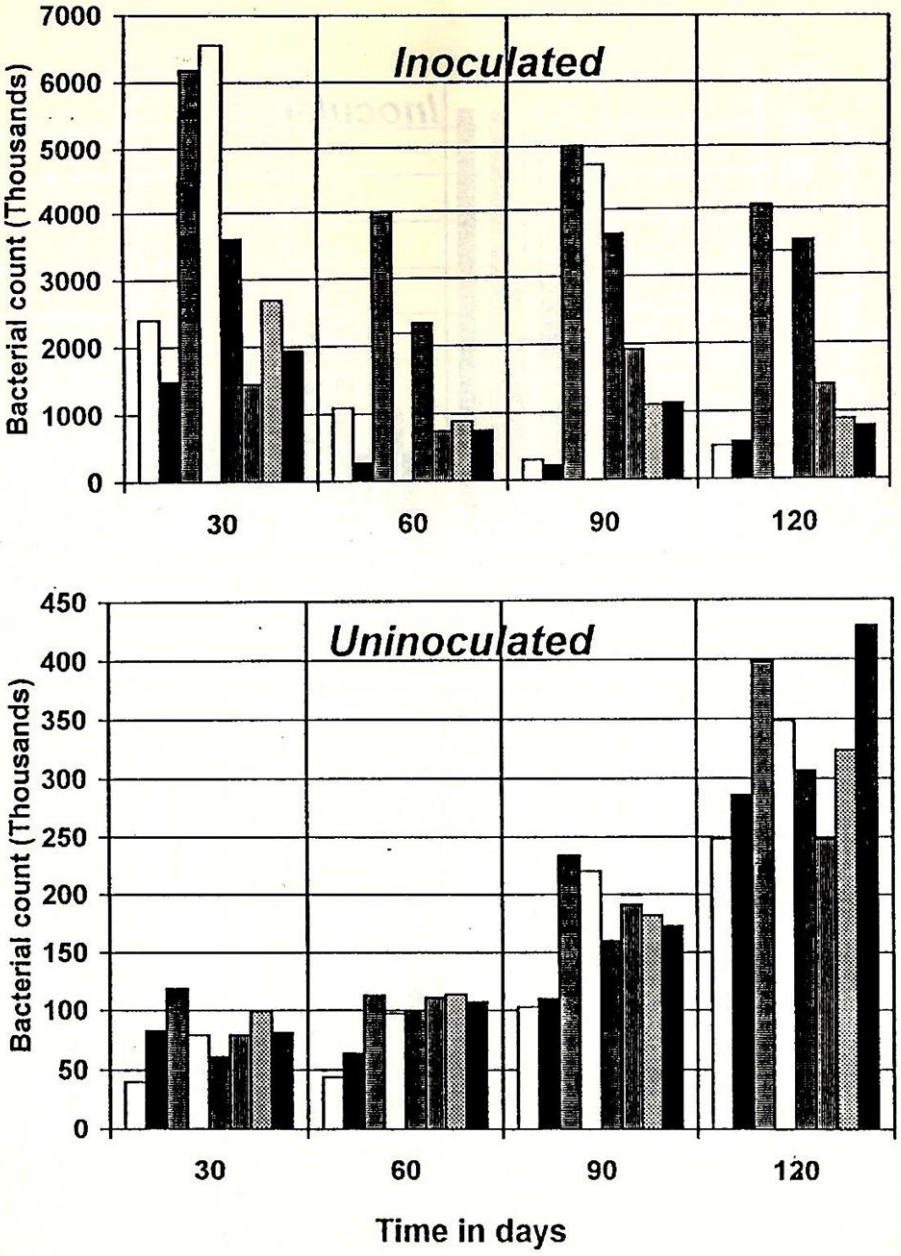

Fig. 2. Population of *Azotobacter* sp. in rhizosphere of rape plants .

60 Kg N	120 Kg N	20 FYM	10 FYM
20 TR	10 TR	20 CD	10 CD

FYM= farm yard manure, TR= twon refuse, CD= chicken droppings

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تأثير تلقيح البذور ببكتريا الأزوتوباكتر على محصول الشلجم فى مصر

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تمت دراسة تأثير تلقيح بذور نباتات الشلجم ببكتريا الأزوتوباكتر كما تم دراسة تأثير الأسمدة النيتروجينية العضوية والغير عضوية على النمو والمحصول وذلك فى تجربة حقلية فى محافظة الإسماعيلية.

وجد أن التلقيح بالأزوتوباكتر كروكوكم وكذلك التسميد العضوى قد رفع من محصول البذور بمقدار ١٦,٨٪. كما لوحظ أيضا زيادة أعداد بكتريا الأزوتوباكتر فى منطقة جذور النباتات وأيضا فى التربة الحرة.