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Response of Two Wheat Varieties to Partial Replacement of Recommended Nitrogen Fertilizer by Bacterial Inoculations

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TWO FIELD trials were carried out at the Agricultural Production and Research Station, National Research Centre, El Nubaria Province, El Behira Governorate, Egypt, during the two successive winter seasons 2006-2007 and 2007-2008, to study growth characteristics, yield and yield attributes of two wheat varieties, *i.e.* Sakha-93 and Sakha-94, to partial replacement of recommended nitrogen fertilizer by bacterial inoculation (Azospirillum or Nitrobein). The plant height, number and dry weight of spikes/m^2 and straw yield/feddan showed substantial varietial differences. While, the dual application of biofertilizers and recommended nitrogen fertilizer increased almost all growth characteristics, yield and yield components, this increase was significance with the studied characters except, plant height at 90 days after sowing and blades area (cm^2) at 90 and 120 days after sowing and number of spikelets /spike, number of grains /spikelet, seed index, harvest index and grain protein content. Seed inoculation with either Azospirillum or Nitrobein and 50 % of recommended nitrogen fertilizer showed the lowest values of the aforementioned traits compared with the other treatments. The effect of the interaction between varietial differences and nitrogen fertilization treatments on growth characteristics, yield and yield components are not significant in most studied characters except number of spikes/m^2 in the two growth samples and dry weight of spikes/m^2, grain, straw and biological yield /feddan.

Keywords : Wheat varieties, Nitrogen fertilization, Bacterial inoculation, Growth characteristics, Yield and yield attributes.

Egypt, like other developing countries, suffers from food shortage problem as a result of large increase in population and loss of agricultural soils. This situation makes the problem of food production and human nutrition more acute. Egypt is considered the biggest importer of wheat in the world. To meet our present and future food production goals, high yielding and disease resistant varieties, application of balance fertilizers, improved agricultural practices and application of suitable plant protection measures must be adopted. However, maintenance of soil fertility / productivity is increasingly challenging due to intensive production of food crops, excessive tillage, and depletion of soil organic matter and increase in soil salinity.

Choice of suitable wheat cultivar with high production potential is the most important factor for increasing wheat production to overcome shortage of food. Wheat cultivars show considerable diversity in yield and yield components (Fayed, 1992; Metwally *et al.*, 1998; Sultan *et al.*, 2000; El-Habbasha, 2001; Zaki *et al.*, 2004 and Abdel–Ati & Zaki, 2006).

Nitrogen fertilizer is one of the most important factors for crop growth, high yield and good quality. Apart of nitrogen fertilizer can be subject to loss through volatilization, dinitrification, runoff and leaching thus contribute to environmental pollution and loss of production cost. This in turn, leads to reduce the net return, thus there is a strong justification for exploiting the use of biological N fixation to replace part of the N requirements. Sharief *et al.* (1998) pointed out that raising nitrogen fertilizer level from 107 to 143 or 178 kg N/ha significantly increased plant height and grain yield. Sarhan *et al.* (1999) stated that N fertilization even up to 250 kg N/ha increased grain yield. According to Fares (1997), microbial inoculation by certain free living N_2 fixing bacteria increased grain and straw yield and N content of plant and minimized the amount of chemical fertilizer applied and reduced soil pollution. Mohiuddin *et al.* (2000) reported that combination of Azofert, Phosphert or Bioplin with low NPK levels significantly increased plant height, total dry mater production, yield attributes, grain and straw yield.

Increased need to grow wheat in marginal sandy soils thus, indicate the necessity to integrate the biological N fixation and mineral N fertilization. This investigation is aimed to study the response of two wheat varieties to partial replacement of recommended nitrogen fertilizer by bacterial inoculation and their combinations on growth characteristics, yield and yield attributes.

Material and Methods

Two field experiments were carried out at the Agricultural Production and Research Station, National Research Centre, El- Nubaria Province, El Behira Governorate, during the two successive winter seasons 2006-2007 and 2007-2008. Soil sample was taken at depth of 30 cm for mechanical and chemical analyses as described by Chapaman & Pratt (1978) (Table 1). Split plot design with three replications was used, two cultivars, *i.e.*, Sakha-93 and Sakha-94, as the main plot and sub-plots as three combinations of biofertilizers and inorganic fertilizers as 100, 75 and 50 % of recommended nitrogen fertilizer. Each plot consisted of 15 rows (20 cm spacing) of 3.5 meter length, *i.e.*, 10.5 m^2 (1/400 feddan), with seed rate of 60 kg/feddan (equivalent to 150 kg/ha). Planting date was 17^{th} and 20^{th} November in 2006 and 2007 seasons, respectively. Seed were coated with biofertilizers, just before sowing using Arabic gum as an adhesive agent and were drilled within the row. Peat based inoculum contained Azospirillum at 10^6 c.f.u./g, while Nitrobein inoculum contained Azotobacter and Azospirillum microorganisms at 10^7 c.f.u./g. For the standard inorganic N fertilizer treatment (100 % of recommended dose) *i.e.* control 80 kg N/feddan

was applied as ammonium sulfate (20.6 % N) in two equal doses on 15 and 45 days after sowing. Phosphorus and potassium were added during seed bed preparation at 100 kg/feddan each of calcium superphosphate (15.5 % P_2O_5) and potassium sulfate (48 % K_2O). Sprinkler irrigation was applied as needed. Standard cultural practices of growing wheat followed by the farmers of this district were adapted.

TABLE 1. Mechanical and chemical analyses of the experimental soil (2006-2007 and 2007-2008 seasons).

Properties \ Year	2006-2007	2007-2008
	30 cm	30 cm
Mechanical analysis		
Sand (%)	91.20	92.33
Silt (%)	3.70	2.95
Clay (%)	5.10	4.72
Soil texture	Sandy	Sandy
Chemical analysis		
PH	7.40	7.50
E.C.(m mohs/cm^2)	0.30	0.50
$CaCO_3$ (%)	1.40	1.65
Organic matter (%)	0.30	0.24
Soluble N (ppm)	8.10	7.45
Available P (ppm)	3.20	4.12
Exchangable K (ppm)	20.00	26.00

Data recorded

Response evaluations

Two random samples of 25 cm length X 40 cm width from each plot were taken at the heading stage and 30 days later (90 and 120 days after sowing). Plant height (cm), number of spikes/m^2, spikes weight/m^2 (g), spike length (cm), number of grains /spike, number of spikelets/ spike, number of grains/spikelet and seed index were measured. Leaf area (cm^2) was estimated according to the method described by Bremner & Taha (1966). Leaf blades were dried in a forced air oven at 70°C till constant weight for recording dry weights. Grain, straw and biological yields (ton/feddan) were determined for the plot area and then converted to yield per feddan. Thus, harvest index (grain yield / total biological yield) was determined. Concentration of N in the grain was determined by the improved Kjeldahl method (A.O.A.C., 1955), and grain protein content was calculated (total N X 5.75). Data were subjected to statistical analysis of variance as described by Snedecor & Cochran (1990) and the combined analysis of the two seasons results were conducted according to the method adopted by Steel & Torrie (1980). Mean values of the recorded data were compared by using the least significant differences (L.S.D 0.05).

Results and Discussion

Varietial differences

Growth characters

All growth parameters evaluated (Table 2) were non-significant between the two cultivars on 90 days after sowing (DAS), while dry weight and area of leaf blades were non-significant on 120 DAS. These results agree with those obtained by El-Habbasha (2001).

Yield and yield attributes

Data presented in Table 3 show no significant differences between Sakha-93 and Sakha-94 in the yield and yield attributes except, plant height, dry weight of spikes/m^2, and straw yield / feddan. Whereas, Sakha-93 surpassed Sakha-94 in straw yield / feddan, while Sakha-94 surpassed in plant height (cm) and dry weight of spike /m^2 (g). In general, these results are in harmony with those obtained by Abdel–Ati & Zaki (2006) who reported that grain, straw, biological yields and yield components were significantly differed owing to variety.

Effect of partial replacement of recommended nitrogen fertilizer by bio-fertilizers

Growth characters

Partial replacement of recommended nitrogen fertilizer by bio-fertilizers (Azospirillum or Nitrobean) significantly influenced number of spikes/m^2, dry weight of spikes/m^2 and dry weight of blades/m^2 on 90 and 120 DAS (Table 4). The treatment Azospirillum + 100 % recommended nitrogen fertilizer produced the greatest number of spikes/m^2, dry weight of spikes/m^2 and dry weight of blades/m^2 on 90 DAS. On 120 DAS, Nitrobean + 100 % recommended nitrogen fertilizer was superior to all other treatments. Addition of either 75 % or 100 % recommended nitrogen fertilizer + Nitrobean did not differ significantly in dry weight of spikes/m^2 at 90 DAS and plant height at 120 DAS. Seed inoculation with either Azospirillum or Nitrobein and 50 % of recommended nitrogen fertilizer showed the lowest values of the aforementioned traits compared with the other treatments.

Yield and yield attributes

Among the yield attributes evaluated (Table 5), the treatment affects were non-significant on number of spikelets/ spike, number of grains/spikelets, seed index, harvest index and grain protein content. Addition of 100 % recommended nitrogen fertilizer to the plots inoculated with either Azospirillum or Nitrobean did not differ significantly in the most of yield and yield attributes. Azospirillum + 100 % recommended nitrogen fertilizer resulted in highest dry weight of

spikes/m^2. Addition of either 75 or 100% recommended nitrogen fertilizer to the grains inoculated with either Azospirillum or Nitrobean did not differ significantly in yield and most of yield attributes. Seed inoculation with either Azospirillum or Nitrobein and 50% of recommended nitrogen fertilizer showed the lowest values of the above traits compared with the other treatments. Insignificant difference between some treatments clearly illustrate the beneficial role of nitrogen fixers for enhancing plant growth through their capacity in nitrogen fixation as well as their effects on metabolites secretions. Biofertilizers contain free living nitrogen fixing microorganisms which contribute part of the nitrogen requirement of the growing plants. This may be due to mineral fertilization enhanced plant growth which increased plant metabolites which encouraged the growth of microorganisms through the save of organic matter and the increment in nitrogen fertilizer was lost through volatilization, dinitrification, runoff and leaching. The presences of free living nitrogen fixing bacteria to supplement nutrients to the growing plants that necessitates to the development of sustainable agricultural practices. These results agree with the reports of Fares (1997) and Mohiuddin *et al.* (2000)

Effect of interaction between wheat varieties and partial replacement of recommended nitrogen fertilizer by bio-fertilizers

Growth characters

Data presented in Table 6 show that the effect of interaction between varieties and biofertilizers with nitrogen fertilizer at 90 and 120 DAS on most of growth characters were not significant, except, number of spikes/m^2 at 90 and 120 DAS. Sakha-93 records the highest number of spikes/m^2 (543 and 524) on 90 DAS with 100 % recommended nitrogen fertilizer with either Azospirillum or Nitrobean. On 120 DAS, the highest number of spikes/m^2 was by Sakha-94 cultivar which received 100% recommended nitrogen fertilizer with Azospirillum (609) followed by Sakha-93 with same N level with Nitrobean (598).

Yield and yield attributes

Data presented in Table 7 illustrate that the effect of interaction between variety and partial replacement of recommended nitrogen fertilizer by bio-fertilization on yield and yield attributes, no significant differences were observed between treatments except, dry weight of spikes/m^2, grain, straw and biological yield / feddan. Sakha-94 records the highest value of dry weight of spikes/m^2 and grain yield/feddan with Nitrobean + 100 % recommended nitrogen fertilizer, while Sakha-93 records the highest straw and biological yield / feddan with addition of 100 % recommended nitrogen fertilizer to either Nitrobean or Azospirillum, respectively. These results are in harmony with those obtained by Sharief *et al.* (1998) and Hosam El-Din (2006).

TABLE 2. Effect of varietial differences on growth characteristics of wheat varieties on 90 and 120 days after sowing (combined data of 2006-2007 and 2007-2008 seasons) .

Growth characteristics / Varieties	90 days after sowing (90 DAS)					120 days after sowing (120 DAS)				
	Plant height (cm)	Number of spikes/m^2	Dry weight of spikes/m^2 (g)	Dry weight of blades/m^2 (g)	Blades area cm^2/m^2	Plant height (cm)	Number of spikes/m^2	Dry weight of spikes/m^2 (g)	Dry weight of blades/m^2 (g)	Blades area cm^2/m^2
Sakha-93	118.83	496.00	310.41	407.09	76896.98	127.83	566.17	827.46	413.88	72676.68
Sakha-94	120.33	476.17	314.35	405.09	76060.51	129.33	575.00	845.71	425.12	73296.86
LSD at 0.05	N.S	N.S	N.S	N.S	N.S	1.31	4.34	5.78	N.S	N.S

TABLE 3. Effect of varietial differences on yield and yield attributes of wheat varieties (combined data of 2006-2007 and 2007-2008 seasons).

Yield and yield attributes / Varieties	Plant height (cm)	Dry weight of spikes/ m^2 (g)	Spike length (cm)	Number of grains/ spike	Number of spikelets/ spike	Number of grains/ spikelets	Seed index (g)	Grain yield (ton/ feddan)	Straw yield (ton/ feddan)	Biological yield (ton/ feddan)	Harvest index (%)	Grain protein content (%)
Sakha-93	129.17	858.00	14.90	63.95	20.73	3.08	54.35	2.23	6.32	8.55	0.26	11.09
Sakha-94	131.00	875.20	15.12	64.50	21.24	3.03	54.62	2.28	6.07	8.35	0.27	11.04
LSD at 0.05	1.25	7.56	N.S	N.S	N.S	N.S	N.S	N.S	0.19	N.S	N.S	N.S

TABLE 4. Effect of biofertilizers and nitrogen fertilization on growth characteristics of wheat varieties on 90 and 120 days after sowing (combined data of 2006-2007 and 2007-2008 seasons).

Growth character / Fertilizer treatments	90 days after sowing (90 DAS)					120 days after sowing (120 DAS)				
	Plant height (cm)	Number of spikes/m^2	Dry weight of spikes/m^2 (g)	Dry weight of blades/m^2 (g)	Blades area cm^2/m^2	Plant height (cm)	Number of spikes/m^2	Dry weight of spikes/m^2 (g)	Dry weight of blades/m^2 (g)	Blades area cm^2/m^2
Azo+ 50% nitrogen fertilizer	116.50	423.50	292.41	357.36	69859.52	125.50	548.50	780.51	404.81	68359.02
Azo+ 75% nitrogen fertilizer	119.00	508.50	315.02	416.39	78406.54	128.50	566.00	828.84	417.15	74906.43
Azo+100% nitrogen fertilizer	121.50	532.00	322.77	448.47	79605.45	131.50	595.50	872.34	436.43	75700.27
Nitro+ 50% nitrogen fertilizer	118.00	433.00	307.09	373.77	73896.25	126.00	541.00	811.23	396.45	73500.68
Nitro+ 75% nitrogen fertilizer	120.00	497.00	314.56	414.91	77810.75	129.00	576.00	850.81	423.67	73010.68
Ntro+100% nitrogen fertilizer	122.50	522.50	322.44	425.65	79293.95	131.00	596.50	875.77	438.51	72443.55
LSD at 0.05	N.S	10.4	9.06	9.56	N.S	2.11	6.21	15.54	11.31	N.S

TABLE 5. Effect of biofertilizers and nitrogen fertilization on yield and yield attributes of wheat varieties (combined data of 2006 - 2007 and 2007-2008 seasons).

Yield and yield attributes / Fertilizer treatments	Plant height (cm)	Dry weight of spikes/m^2 (g)	Spike length (cm)	Number of grains/ spike	Number of spikelets/ spike	Number of grains/ spikelets	Seed index (g)	Grain yield (ton/ feddan)	Straw yield (ton/ feddan)	Biological yield (ton/ feddan)	Harvest index (%)	Grain protein content (%)
Azo+ 50% nitrogen fertilizer	127.50	854.79	14.01	51.78	19.84	2.61	53.96	2.21	5.83	8.04	0.27	10.56
Azo+ 75% nitrogen fertilizer	130.00	863.13	14.78	63.21	20.82	3.04	54.43	2.24	6.06	8.30	0.27	11.10
Azo+100% nitrogen fertilizer	132.50	875.69	15.53	68.65	21.78	3.16	54.98	2.39	6.66	9.05	0.26	11.37
Nitro+ 50% nitrogen fertilizer	128.00	846.01	14.51	62.70	20.76	3.02	53.84	2.03	5.74	7.76	0.26	10.74
Nitro+ 75% nitrogen fertilizer	130.00	868.30	15.51	69.31	21.67	3.20	54.55	2.24	6.39	8.63	0.26	11.27
Ntro+100% nitrogen fertilizer	132.50	891.67	15.74	69.71	21.03	3.33	55.17	2.45	6.49	8.94	0.27	11.34
LSD at 0.05	2.43	13.4	0.51	2.01	N.S	N.S	N.S	0.23	0.48	0.40	N.S	N.S

TABLE 6. Interaction between varietial differences, biofertilizers and nitrogen fertilization on growth characteristics of wheat varieties on 90 and 120 days after sowing (combined data of 2006-2007 and 2007-2008 seasons).

Varieties	Growth character / Fertilizer treatments	90 days after sowing (90 DAS)					120 days after sowing (120 DAS)				
		Plant height (cm)	Number of spikes/m^2	Dry weight of spikes/ m^2 (g)	Dry weight of blades/ m^2 (g)	Blades area cm^2/m^2	Plant height (cm)	Number of spikes/m^2	Dry weight of spikes/ m^2 (g)	Dry weight of blades/ m^2 (g)	Blades area cm^2/m^2
Sakha-93	Azo+ 50% nitrogen fertilizer	116.00	434.00	295.23	353.50	69573.54	125.00	545.00	769.65	401.25	68573.01
	Azo+ 75% nitrogen fertilizer	119.00	522.00	312.50	412.62	78958.54	127.00	563.00	812.32	408.99	72958.21
	Azo+100% nitrogen fertilizer	120.00	543.00	325.65	451.32	79858.65	131.00	582.00	868.32	430.50	75758.25
	Nitro+ 50% nitrogen fertilizer	116.00	445.00	301.62	379.54	75356.25	126.00	536.00	801.23	386.54	74536.29
	Nitro+ 75% nitrogen fertilizer	120.00	508.00	307.56	419.56	77589.25	128.00	573.00	836.25	420.35	72989.24
	Ntro+100% nitrogen fertilizer	122.00	524.00	319.89	425.98	80045.65	130.00	598.00	876.98	435.65	71245.05
Sakha-94	Azo+ 50% nitrogen fertilizer	117.00	413.00	289.58	361.21	70145.50	126.00	552.00	791.36	408.36	68145.02
	Azo+ 75% nitrogen fertilizer	119.00	495.00	317.54	420.15	77854.54	130.00	569.00	845.36	425.30	76854.64
	Azo+100% nitrogen fertilizer	123.00	521.00	319.88	445.62	79352.25	132.00	609.00	876.36	442.36	75642.29
	Nitro+ 50% nitrogen fertilizer	120.00	421.00	312.56	368.00	72436.25	126.00	546.00	821.23	406.36	72465.06
	Nitro+ 75% nitrogen fertilizer	120.00	486.00	321.56	410.25	78032.25	130.00	579.00	865.36	426.98	73032.12
	Ntro+100% nitrogen fertilizer	123.00	521.00	324.98	425.32	78542.25	132.00	595.00	874.56	441.36	73642.05
LSD at 0.05		N.S	11.4	N.S	N.S	N.S	N.S	12.8	N.S	N.S	N.S

TABLE 7. Interaction between varietial differences, biofertilizers and nitrogen fertilization on yield and yield attributes of wheat varieties (combined data of 2006-2007 and 2007-2008 seasons).

Varieties	Yield and yield attributes / Fertilizer treatments	Plant height (cm)	Dry weight of spikes/m^2 (g)	Spike length (cm)	Number of grains/ spike	Number of spikelets/ spike	Number of grains/ spikelets	Seed index (g)	Grain yield (ton/ feddan)	Straw yield (ton/ feddan)	Biological yield (ton/ feddan)	Harvest index (%)	Grain protein content (%)
Sakha-93	Azo+ 50% nitrogen fertilizer	125.00	845.25	14.32	50.01	19.69	2.54	54.23	2.22	5.64	7.86	0.28	10.96
	Azo+ 75% nitrogen fertilizer	129.00	849.66	14.36	60.55	20.32	2.98	54.65	2.31	6.01	8.32	0.27	11.03
	Azo+100% nitrogen fertilizer	132.00	864.69	15.36	68.24	22.30	3.06	55.06	2.46	7.11	9.57	0.25	11.49
	Nitro+ 50% nitrogen fertilizer	127.00	835.66	14.32	61.16	20.32	3.01	53.36	1.98	5.80	7.78	0.25	10.46
	Nitro+ 75% nitrogen fertilizer	130.00	863.35	15.32	70.27	21.36	3.29	54.11	2.09	6.23	8.32	0.25	11.28
	Ntro+100% nitrogen fertilizer	132.00	889.36	15.69	73.49	20.36	3.61	54.69	2.34	7.12	9.46	0.24	11.29
Sakha-94	Azo+ 50% nitrogen fertilizer	130.00	864.33	13.69	53.54	19.98	2.68	53.69	2.19	6.02	8.21	0.26	10.16
	Azo+ 75% nitrogen fertilizer	131.00	876.59	15.20	65.87	21.32	3.09	54.21	2.16	6.11	8.27	0.26	11.17
	Azo+100% nitrogen fertilizer	133.00	886.69	15.69	69.06	21.25	3.25	54.89	2.31	6.21	8.52	0.27	11.25
	Nitro+ 50% nitrogen fertilizer	129.00	856.36	14.69	64.24	21.20	3.03	54.32	2.07	5.67	7.74	0.26	11.01
	Nitro+ 75% nitrogen fertilizer	130.00	873.25	15.69	68.35	21.98	3.11	54.98	2.39	6.54	8.93	0.26	11.26
	Ntro+100% nitrogen fertilizer	133.00	893.98	15.78	65.93	21.69	3.04	55.65	2.56	5.85	8.41	0.30	11.39
LSD at 0.05		N.S	13.51	N.S	N.S	N.S	N.S	N.S	0.18	0.35	0.4	N.S	N.S

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استجابة صنفين من القمح للإحلال الجزئى للسماد النتروجينى الموصى به بواسطة التلقيح البكتيرى

السيد فتحي الهباشة ، مدحت ميخائيل توفيق و ماجدة حسانين محمد
قسم بحوث المحاصيل الحقلية – المركز القومي للبحوث – القاهرة – مصر .

أجريت تجربتان حقليتان فى موسمى ٢٠٠٦ /٢٠٠٧ ، ٢٠٠٧ / ٢٠٠٨ بمحطة البحوث والإنتاج التابعة للمركز القومى للبحوث بمنطقة النوباريه – محافظة البحيرة وذلك بغرض دراسة استجابة صنفين من القمح (سخا-٩٣ و سخا-٩٤) للإحلال الجزئى للسماد النتروجينى المعدنى الموصى به بواسطة التلقيح البكتيرى (الأزوسبيريللم والنتروبين) ودراسة تأثير ذلك على بعض الصفات الخضرية وصفات المحصول ومكوناته.

وقد أشارت النتائج على عدم وجود اختلافات صنفيه بين الصنفين موضع الدراسة فى صفات النمو الخضرية عند عمر ٩٠ يوم من الزراعة فى حين اختلف الصفات معنويا عند ١٢٠ يوم من الزراعة فى صفات طول النبات وعدد السنابل / م٢ و الوزن الجاف للسنابل / م٢ كذلك كان هناك اختلافا معنويا فى صفات المحصول بين الصنفين خاصة صفات طول النبات والوزن الجاف للسنابل /م٢ ومحصـول القش طن / فدان. أدى الاستخدام المشترك للسماد المعدنى بمعدل ١٠٠ ٪ من الكمية الموصى بها بالإضافة إلى لقاحات الأزوسبيريللم والنتروبين إلى إنتاج أعلى كمية من المحصول ومكوناته مع عدم وجود اختلافات معنوية بينهما فى أغلب الصفات موضع الدراسة، كذلك فإن إضافة ٧٥ ٪ من السماد النتروجينى إلى كلا اللقاحين أدى إلى عدم وجود فروق معنوية مع معدل ١٠٠٪ من الموصى به مع اللقاحات المستخدمة فى أغلب صفات المحصول ومكوناته. تأثير التفاعل بين الاختلافات الصنفية ومعاملات التسميد النتروجينى والحيوى لم يكون لها تأثير معنوى على صفات النمو والمحصول ومكوناته فيما عدا صفة عدد

السنابل /م٢ عند عمري ٩٠ و ١٢٠ يوم من الزراعة والوزن الجاف للسنابل /م٢ ومحصول الحبوب والقش و المحصول البيولوجى /فدان .

وبناء على نتائج هذه التجربة يمكن القول أنه تحت ظروف هذه التجربة أن التلقيح بالأسمدة الحيوية المستخدمة بصفة عامة يمكن أن يوفر كمية من الأسمدة النتروجينية قد تصل إلى ٢٥ ٪ مما سوف يؤدى إلى تقليل تكاليف الإنتاج والتلوث البيئى دون التأثير على إنتاجية الفدان أو جودة المحصول.