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RESPONSE OF SELECTED SESAME GENOTYPES TO BIO- AND MINERAL- PHOSPHORUS FERTILIZATION UNDER THE CONDITIONS OF A NEWLY RECLAIMED CALCAREOUS SOIL.

BY

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ABSTRACT

A field experiment was executed on a newly reclaimed calcareous soil at the Experimental Farm of the Fac. of Agric at Fayoum, to assess the response of 21 sesame genotypes to 4 combinations of mineral phosphorus and phosphate solubilizing bacteria (PSB), during two successive seasons of 2005 & 2006. Fertilization treatments partial P-mineral substitution from P-recommended dose by using phosphate solubilizing bacteria, i.e. 25% P_2O_5 + PSB, 50% P_2O_5 + PSB, 75% P_2O_2 +PSB, 100% P_2O_2 + PSB which as compared to the recommended P-minerals as a control were allocated in the main plots, and the genotypes were distributed in the sub-plots of the split plot arrangement with three replications.

The obtained results indicated that, except few cases, all physiological parameters (estimated at flowering stage) and agronomic traits (determined at maturity) were significantly affected by fertilization treatments (T), genotypes (G) and G x T interaction effects, indicating that the tested genotypes were genetically varied and thereby differed in their nutrient requirements as well as their fertilization responses. The treatment of 75% P_2O_5 + PSB was superior for almost all studied traits, whether saving one fourth of the recommended dose of phosphate fertilization. However, the total estimates of carbohydrates, sugars, chlorophyll, carotenoids, indols, free amino acids, N, P and K contents showed significantly increased and decrease in free phenols. The data led to conclude that the chemical compositions traits, as a result of biosynthesis processes in plants, were mainly under genetic control. Where in most cases, any genotype exhibited either low or high values irrespective to the treatment. For instance, under all treatments, line 5 showed the least total chlorophyll, line 6 had the least carotenoids, phenols and N percentage, while lines 5, 8 and 14 showed the highest N percentage. Also, it was observed that shortage in available P led to increase the free phenols, as a growth inhibitor, but this effect is mostly associated with genotype. P availability, caused by PSB, for almost all genotypes resulted in an increase in N availability. The increment percentages in seed yield of plants fertilized by 75% P_2O_5 +PSB were 40.8, 11.5, 5.4, and 113.8% as compared with those of 25% P_2O_5 +PSB, 50% P_2O_5 +PSB, 100% P_2O_5 +PSB and unbiofertilized soil control. The corresponding ratios for seed yield/faddan were 13.4, 7.4, 1.3 and 60.5% respectively.

The most promising genotypes, suitable for growing on such calcareous soil under III treatment were lines number 2, 3, 4, 7, 8, 10, 11, 12, 13 and 14 due to their superiority in chemical composition and better partitioning of photosynthates to

reproductive organs, and then resulted in an improve for yield. Results of path analysis were determined the most important yield contributor, either physiological or agronomic traits.

In general, the obtained results revealed that application of combination of bio- and mineral-phosphorus fertilization led to ameliorate fertility status of the experimental calcareous soil and improve its productivity, because of the positive effect of PSB on solubility of precipitated phosphate into available form, and increased the plant ability to absorb its requirements of P and in turn resulting in improved growth and yield.

Key words; Sesame genotypes, Bio- and mineral phosphorus fertilization, Physiological parameters, Yield and yield components and Path analysis.

INTRODUCTION

Sesame (*Sesamum indicum* L.) is one of the important edible oil crops cultivated in Egypt since ancient times. Nowadays, it occupies a limited area (about 70 thousand faddan), and consequently its production cannot be covers the local demands especially for industry purposes. The production shortage thereby overcomes by importation. Moreover, it is not expected to increase sesame area and production on the old land within the Nile Valley due to heavy competition of the relatively high monetary main summer crops which occupied most crop rotation area. So, to solve this problem we have to develop new genotypes with improved yield and quality and are able to grow well on the newly reclaimed soils, as imperative expansion area, outside the Nile Valley.

However, these newly reclaimed soils are oftenly sandy and/or calcareous in nature and inherently suffering low fertility due to nutrients deficient which may be owing low cation exchange capacity, high $CaCO_3$ content and high pH. Unfortunately, intensive application of chemical fertilizers has no benefit because of minerals rapid fixation in calcareous or leaching downin sandy one, as well as their low mobility in bulk soil toward root zone (Olsen and Watanable, 1970). In addition, this non–rational application of chemical fertilization could be increased the production cost and environmental pollution. Therefore, the use of combinations of mineral and bio-fertilizers as a cheap, safe, effective and alternative source for chemical fertilizers was confirmed and preferable (Kennedy and Tchan, 1992).

Phosphate fertilizers are particularly important for the production of oil crops, and phosphorus deficiency has been identified as one of the major limiting factors for their production, especially in sandy and/or calcareous soils. Many investigators recorded a positive effect of phosphate fertilizers on the productivity of sesame (Dwivedi and Namdeo, 1992 and Othman, 1995). However, the efficiency of plant utilization of added phosphorus is very low due to its rapid fixation in such soils (El-Dosouky and Attia, 1999). A solve of this problem is the use of combinations of mineral phosphorus fertilizer together with biological phosphate solubilizing bacteria (PSB). Where PSB is known by its ability to dissolve the precipitated form of phosphate [$Ca_3(PO_4)_2$] to available form, i.e. monovalent anion (H_2PO_4), which easily utilized by plant, and in turn enhancing to its ability to produce some growth promoting substances such as indole acetic acid, gibberellins and cytokynines (El-Dosouky and Attia, 1999, Mahmoud *et al.*, 2000 and El-Rewainy, and Galal, 2004).

Therefore, the present work was designed to evaluate the F_5 of 15 sesame genotypes (resulted from 6 x 6 diallel crosses) together with their parents under combinations of mineral phosphorus and inoculant of phosphate solubilizing bacteria, grown on a newly reclaimed calcareous soil, with a hope to improve yield and quality genotypes depending on their chemical composition and agronomic traits as well as identifying the important yield contributors as essential information for further improvement in subsequent selection program.

MATERIALS AND METHODS

The genetic stocks used in the present study consisted of 6 parental sesame genotypes and their 15 F_5 populations, derived from an early diallel crosses carried out by Sharaan and Ghallab (1998). These genotypes were planted on a newly reclaimed calcareous soil at the Experimental Farm of the Faculty of Agriculture, at Demo, Fayoum Governorate during 2005 and 2006 summer seasons, under some combinations of phosphorus fertilizer and phosphate solubilizing bacteria, PSB (*Basellus megatherium*). The treatments were arranged into split plot with a complete randomized complete block design with three replications. The mineral- and bio- fertilizer treatments (100% P_2O_5 – as a control; which received the recommended dose phosphorus without inoculation, 25% P_2O_5 + PSB, 50% P_2O_5+ PSB, 75% P_2O_5 + PSB, and 100% P_2O_5 + PSB) were allocated in the main plots, where the sub–plots were devoted for genotypes. During the field preparation, in between building and returning the ridges, mono calcium superphosphate (15.5% P_2O_5) at the rates under study (25, 50, 75 and 100% of the recommended dose) were added, while inoculation of seeds by PSB were practiced immediately before planting. The plot size was 10.5m^2. Data of some physical and chemical soil proprieties are shown in Table(1).

Table (1): Some physical and chemical properties of the experimental soil.

Soil properites		1st season	2nd season
ECe dS/m		4.56	4.4
pH 1:2.5		8.07	8.12
Particle size distribution	Sand	77.2	78.3
	Silt	12.5	11.8
	Clay	10.3	9.9
Texture classes		Loamy sand	Loamy sand
$CaCO_3$%		15.04	14.88
Organic matter%		.89	0.84
Total elements%	N	.00521	0.0603
	P	0.0873	0.0784
	K	1.0600	6241.0
Available nutrients (mg/Kg)	N	30	32
	P	4.12	4.14
	K	324	312

Seeding was done in hills, within ridges of 60 cm apart, on June 5 and 8 in the first and second seasons, respectively. Ammonium nitrate (33.5% N) at the rate of 15 units/faddan, as an active dose, was added at the planting time. Irrigation tooks place immediately after sowing. Potassium sulphate (48% K2O) at the rate of 24 units/faddan was practiced befor the first irrigation. Seedling were thinned, at 28 days age, to secure two plants/hill, spaced by 15cm between hills. The other recommended agricultural practices for growing sesame plant were followed.

At flowering time, two vegetative samples of five plants were randomly taken from each plot to estimate the chemical composition using either fresh (F.W) or dry (D.W) weight. Total carbohydrates (mg/g, D.W) was determined colormetrically according to Michel *et al.* (1956). Total indols (mg/g, D.W) after Larson *et al.* (1962) and total free amino acids (mg/g, D.W) after Jayarman (1981) were also determined. In addition, total chlorophyll (mg/g, F.W) as well as total carotenoids concentration (mg/g, F.W) in fresh leaves were estimated using the method described by Welburn and lichtenthaler (1984). Total sugars (mg/g, D.W.) and free phenols (mg/g, F.W) as well as nitrogen (N%), phosphorus (P%) and potassium (K%) concentration were determined following the methods of A.O.A.C. (1995).

At harvest time, a sample of ten guarded plants were randomly taken from each plot to determine the agronomic traits, i.e., fruiting zone length, number of branches/plant, number of capsules/main stem, number of capsules/branches and seed yield/plant. Seed yield/faddan was calculated on plot yield basis. Data of all chemical and agronomic traits were subjected to analysis of variance. Combined analysis was followed, where the error variances of the two seasons were homogenous, and the means were compared by LSD (Gomez and Gomez, 1984). To specify the most important direct and indirect trait effects on seed yield, path coefficient technique was imploded following the method outlined by Dewey and Lu (1959).

RESULTS AND DISCUSSION

Analysis of variance presented in Table (2) show that years were of significant effect on all physiological parameters of growth stage, except for total free amino acids and nitrogen percentage, as well as on agronomic traits of maturity stage except for fruiting zone length. These results may be taken as an indicator for the consistency of these three exception traits which less affected by seasonal fluctuations as compared with other studied traits, may be due to their genetic controlling factors. Seasonal influences on some chemical composition and yield component traits were previously reported by several authors (Gomaa *et al.*, 1995, Nasr *et al.*, 1998 and El-Dosouky and Attia, 1999).

Both genotypes (G) and fertilization treatments(T) had considerable effects on all traits under studied at the growth and maturity stages. These results indicated that the tested genotypes were of diverse genetic background and responded differently to bio– and mineral-phosphorus fertilization treatments. These genotypic differences have been attributed to variation in the root size and distribution as well as its ability to nutrients certain elements from the soil which logically affecting biosynthesis processes and plant organ growth and development.

Also, all chemical composition parameters, except for N and potassium (K) contents, and all agronomic traits were markedly influenced by GxT interaction effect. The significant interaction effect on most of the studied traits confirmed the differences among the tested genotypes due to variation in their genetic constitution, and consequently their different responses to fertilization treatments. These results are in harmony with those reported by El-Kramany *et al.* (2000) and Sharaan *et al.* (2002). In connection with these results, Attia (2004) suggested that differences among peanut genotypes of diverse origin reflected in differences in their nutrient requirements and their ability to accumulate translocate and utilize nutrients due to the differences in their root physiology and development.

Table (2): Mean squares for yield, some yield components and chemical composition traits of sesame genotypes grown under newly reclaimed calcareous soil conditions (over two seasons).

Traits	Mean squares						
	Rep's	Years	Treat. (T)	Error (a)	Genotypes (G)	G x T	Error (b)
Total Carbohydrates (mg/g D.W)	2.544	237.73**	3517.3**	29.512	3540.00**	53.150**	19.992
Total sugar (mg/g D.W)	0.565	6.001**	125.978**	0.004	3.235**	0.96**	0.193
Total Chlorophyll (mg/g F.W)	0.001	0.545**	0.357**	0.002	1.609**	0.014**	0.004
Total carotnouds (mg/g F.W.)	0.00001	0.009**	0.003**	0.00013	0.002**	0.00004**	0.00002
Total indoles (mg/g D.W)	0.002	0.617**	1.013**	0.002	0.869**	0.014**	0.003
Total free amino acid (mg/g)	0.026	0.421	72.997**	0.195	221.43**	1.749**	0.330
Free phenols (mg/g D.W)	0.033	24.132**	27.118**	0.104	39.491**	0.877**	0.161
N%	0.007	0.001	2.679**	0.034	1.578**	0.061	0.049
P%	0.001	0.021**	0.048**	0.001	0.001**	0.001**	0.0003
K%	0.0050	0.790**	0.600**	0.001	1.550**	0.010	0.010
Fruiting zone length (cm)	8.738	1497.19*	53969.19**	9343.85	1834.627**	912.855**	98.411
No. branches /plant	80.247	0.001	94.649**	3.206	5.503**	0.962**	0.241
No. capsules/ main stem	13349.753	74.951	15302.07**	473.418	1085.129**	255.91**	56.672
No. capsules/ branches	43887.998	28.604	32583.55**	2446.22	3427.019**	646.578**	154.72
Seed/ plant (g)	99.16	2.07	1298.695**	11.987	36.457**	8.718**	2.469
Seed yield/ fed. (ardb)	3.084	0.209	101.714**	0.319	2.062**	0.911**	0.166

*,**: Significantly at 5%and 1% level, respectively

1. Fertilization effect:

a. Physiological parameters:

As shown in Table (3), all used fertilization treatments increased the total values of carbohydrates, sugars, chlorophyll, carotenoids, indols, amino acids, as well as N, P and K percentages as compared with the unbiofertilized control. These results reflect the importance of phosphorus fertilization for growing sesame (Olsen and Watanable, 1970) through improving its chemical composition (particularly if phosphorus was in an available form). Availability of phosphorus, as an essential element for growth and yield of sesame, especially in the calcareous soil under study, was achieved by using the inoculant of phosphate solubilizing bacteria (PSB) which is known by its ability to dissolve the precipitated form of phosphate to an available one depending on its efficiency in producing inorganic, organic acids and/or CO_2 (El-Sayed, 1994 and Zayed, 1998). These bacteria may encourage plant to produce some growth promoting substances such as auxins, gibberellins and cytokinens (Sabik *et al.*, 2001) which may improve plant growth and stimulate microbial development in the rhizosphere (Abdel-Rasoul *et al.*, 2002).

Table (3): Effect of phosphorus and bacterial inoculation treatments on mean performance for some chemical constituent traits of sesame grown under newly reclaimed soil conditions (over two seasons).

Treatment	Total Carbohydrates (mg/g D.W)	Total sugar mg/g D.W	Total Chlorophyll (mg/g F.W)	Total carotnouds (mg/g F.W.)	Total indoles (mg/g D.W)	Total free amino acid (mg/g D.W)	Free phenols (mg/g D.W)	Macronutrients%		
								N %	P %	K %
100% P_2O_5 (Cont.)	141.5	25.45	1.54	0.103	1.43	8.06	3.37	3.35	0.22	1.69
25% P_2O_5+PSB	140.4	24.74	1.49	0.097	1.45	7.82	3.5	3.33	0.2	1.64
50% P_2O_5 +PSB	146.0	28.19	1.56	0.103	1.52	8.66	3.58	3.49	0.23	1.73
75% P_2O_5+PSB	152.1	30.68	1.62	0.108	1.61	9.44	3.27	3.63	0.25	1.79
100% P_2O_5 +PSB	150.8	30.72	1.61	0.108	1.62	9.47	3.93	3.63	0.25	1.8
LSD	1.578	1.012	0.01	0.003	0.013	0.128	0.094	0.054	0.007	0.010

The present results showed that the treatment of 75% P_2O_5 +PSB was superior for all the abovementioned traits with an insignificant difference for 100% P_2O_5 + PSB, as well as both treatments surpassed that of 50% P_2O_5 + PSB. Whereas, 25% + PSB was of the useful less effect where it showed the lowest estimation. The treatment of 75% P_2O_5 +PSB was ranked as the second treatment, after 100% P_2O_5 +PSB, producing lowest total phenols content while 25%P_2O_5 +PSB had the highest content followed by that of 50% P_2O_5 +PSB, and all fertilization treatments showed lower phenols estimations than that of unbiofertilized control. This may explain the excess of available phosphorus, as an essential nutrient for growth, resulted in a pronounced decreases of phenols as growth inhibitor. The abovementioned results indicated that application of ¾ of the recommended dose of phosphate fertilizer together with inoculation with PSB was enough to improve the chemical composition of sesame plants grown on a calcareous soil.

b. Agronomic traits:

All fertilization treatments, except fruiting zone length of the plants fertilized with 100% P_2O_5 + PSB, had significantly better values of all agronomic traits than those of unbiofertilized control (Table 4). The treatment of 75% P_2O_5 +PSB showed the tallest fruiting zone length, but without significant differences with the other applied treatments. Also, plants fertilized with 75% P_2O_5 +PSB produced the greatest numbers of branches and capsules/main stem, followed by those fertilized with 100% P_2O_5 +PSB, and then those fertilized with 50% P_2O_5 +PSB. These results are in agreement with those obtained by El-Dosouke and Attia (1999). Attia (2004) and Girgis (2006). However, the treatment of 100% P_2O_5 + PSB produced plants with highest number of capsules/branches, although they had short fruiting zone. This may explain that the excess of available P caused by SPB resulted in changing in growth habits of the tested genotypes and the distribution of photosynthesis to the reproductive organs allocated on main stem or branches, where these genotypes were early breed for the greatest number of capsules per main stem (Ghallab and Sharaan *et al.*, 1998). It is interesting to note that the 75% P_2O_5 + PSB treatment produced plants having tallest fruiting zone and greatest total number of capsules/plant (112 capsules). For all of these abovementioned traits, plants fertilized by 25% P_2O_5 +PSB produced the lowest values, due to shortage in phosphorus.

Table (4): Effect of phosphorus and bacterial inoculation treatments on mean performance for yield and some yield component traits of sesame grown under newly reclaimed soil conditions (over two seasons).

Treatment	Fruiting zone length (cm)	No. branches /plant	No. capsules/ main stem	No. capsules/ branches	Seed/ plant (g)	Seed yield/ fed. (ardb)
100% P_2O_2 (Cont.)	105.21	0.99	38.40	11.01	6.89	3.32
25% P_2O_2+PSB	117.44	1.61	47.88	24.20	10.46	4.11
50% P_2O_2 +PSB	125.10	2.38	59.19	45.58	13.21	5.03
75% P_2O_2 +PSB	141.62	3.07	66.07	45.44	14.73	5.40
100% P_2O_2 +PSB	86.53	2.84	59.69	46.08	13.97	5.33
LSD	28.08	0.52	6.32	14.37	1.01	0.164

Superiority of 75% P_2O_5 +PSB treatment in producing plants with improved yield components may be attributed to its superiority in creating significant increases of chemical compositions, promoting nutrients supplementation, improving the vegetative growth and better partitioning of photosynthate greatest to reproductive organs. Therefore, this treatment produced the seed yield/plant and seed yield/faddan, higher than those of 50% P_2O_5 +PSB or 100% P_2O_5 +PSB and all these three treatments were markedly increased those of 25% P_2O_5 +PSB. These results one in line with those reported by several authors (Sabik *et al*, 2001; El-Nagar, 2002, Attia, 2004; El-Rewainy, and Galal, 2004 and Girgis, 2006). The increment percentages in seed yield of plants fertilized by 75% P_2O_5 +PSB were 40.8, 11.5, 5.4, and 113.8% as compared with those of 25% P_2O_5 +PSB, 50% P_2O_5 +PSB, 100% P_2O_5 +PSB and unbiofertilized control. The corresponding ratios for seed yield/faddan were 13.4, 7.4, 1.3 and 60.5%, respectively.

2. Effect of genotypes:

a. Physiological parameters:

Data presented in Table (5) show that line number 11 possessed the greatest total carbohydrates, (170.8 mg/g D.W), surpassing all lines and parental populations, followed by line No.9 (162.6 mg/g D.W) and the parents No. 16, 19 and 21. Moreover, lines No. 1, 2, 3, 4 and 12 had values more than 149.0 mg/g D.W. Whereas, lines No. 7, 10 and 12 showed the lowest estimation of total carbohydrates.

Table (5): Effect of genotypes on mean performance for some chemical composition traits of sesame grown under newly reclaimed soil conditions (over two seasons).

Genotypes	Total Carbohydrates (mg/g D.W)	Total sugar mg/g D.W	Total Chlorophyll (mg/g F.W)	Total carotnouds (mg/g F.W.)	Total indoles (mg/g D.W)	Total free amino acid (mg/g D.W)	Free phenols (mg/g D.W)	Macronutrients%		
								N	P	K
1	150.3	39.24	1.87	0.098	1.78	6.40	4.32	3.38	0.237	1.73
2	150.4	35.26	1.70	0.109	1.79	6.30	3.87	3.40	0.237	1.91
3	151.1	22.18	1.68	0.104	1.75	7.57	3.75	3.46	0.236	2.02
4	149.0	23.14	1.27	0.106	1.55	5.98	4.84	3.21	0.231	1.73
5	139.2	14.75	1.01	0.103	1.48	8.01	2.44	3.84	0.224	1.97
6	133.6	23.54	1.57	0.072	1.35	7.33	1.79	3.55	0.229	2.07
7	138.4	23.15	1.48	0.106	1.35	8.57	3.14	3.18	0.229	1.84
8	134.7	23.49	1.65	0.104	1.45	8.66	4.21	3.90	0.228	1.90
9	162.6	18.63	1.22	0.110	1.49	8.45	4.68	3.32	0.220	1.73
10	145.7	21.94	1.37	0.105	1.70	8.26	4.26	3.33	0.247	1.96
11	170.8	36.59	1.56	0.104	1.42	7.38	5.05	3.63	0.226	1.60
12	149.2	23.68	1.76	0.110	1.56	9.37	2.94	3.66	0.226	1.75
13	139.4	22.84	1.49	0.102	1.36	3.64	5.05	3.60	0.229	1.72
14	138.8	43.32	1.51	0.112	1.83	5.71	4.02	3.82	0.234	1.89
15	134.7	31.00	1.73	0.111	1.35	8.51	3.58	3.62	0.220	1.64
16	158.1	42.04	1.69	0.110	1.64	14.06	6.13	3.22	0.226	1.40
17	136.7	25.25	1.74	0.098	1.39	12.31	2.16	3.36	0.228	1.61
18	135.4	33.63	1.22	0.102	1.37	8.79	5.26	3.39	0.216	1.16
19	156.4	24.39	1.74	0.104	1.37	10.51	3.06	3.16	0.228	1.69
20	134.3	33.10	1.81	0.102	1.68	13.86	2.29	3.81	0.228	1.35
21	159.7	25.94	1.80	0.110	1.38	12.80	4.53	3.40	0.230	1.68
LSD	2.263	1.649	0.03	0.002	0.028	0.291	0.203	0.112	0.008	0.051

Line No. 14 (43.32 mg/g D.W) and the parent 16 (42.0 4 mg/g D.W) exhibited the greatest values of total sugars surpassing all other tested genotypes. This line ranked also as the first genotype having the greatest estimation of total indols (1.8 mg/g) and total carotenoids (0.112 mg/g F.W) followed by lines 1 and 2 for indols and by 15, 12, 9 and two parent 16 and 21 for carotenoids. In addition, it was among the superior lines contained a relatively high percentage of N (3.82%) and had relatively high values of P (0.234%) and K (1.89%).

Line No. 1(1.87 mg/g F.W) followed (but with significant difference) by the two parents number 20 and 21 (1.8 mg/g F.W) exerted an improved estimation of total chlorophyll, which significantly exceeded those of all other tested genotypes. Line 1 was also among lines had high estimation for the total indols (1.78 mg/g D.W) and P content (0.237%). Parent number 16 had the highest content of total free amino acids (14.06 mg/g D.W) followed by the two parents 20 and 21 and parent 17. But this parent (number 16) exhibited the highest estimate of total free phenols (6.13 mg/g D.W) followed by parent 18 (5.26) and line number 13 (5.05 mg/g D.W). Whereas, the least estimation of phenols, as growth inhibitor, was recorded by line number 6 (1.79 mg/g D.W) surpassing all tested genotypes followed by lines 12 (2.94 mg/g D.W) and 5 (2.44 mg/g D.W) and parent 17 (2.16 mg/g D.W).

Concerning nutrients uptake, line No. 8 (3.90%) followed by lines 5 (3.84%) and 14 (3.82%) for N; lines 10 (0.247) followed by lines, 1, 2 and 3 (0.234 – 0.237%) for P and line 6 (2.07%) and 3 (2.02%) for K were superior. It is interesting to note that all lines except of the superior one (line 10), were insignificantly different from all tested genotypes, except parent 18 (0.216%), in regard to P content, indicating the availability of P induced by PSB.

b. Agronomic traits :

The data listed in Table (6) reveale that line No. 12 possessed the tallest fruiting zone (126.58 cm) and differences followed by lines 6, 7, 8, 9 and 10 (>122cm), and all surpassed the other tested genotypes. Superiority of most of these lines may be ascribed to their high contents of carbohydrates, indols, carotenoids, N, P and/or K as well as their intermediate content of phenols. The parent number 20 had the greatest number of branches (3.19 Brs) followed with significant differences by lines 7 (2.79), 13 and 14 (2.77) and all surpassed the other tested genotypes. This may be attributed to the lines were selected early for low branching and greatest number of capsules/main stem. Lines number 10 with produced the greatest number of capsules / main stem (65.81 capsules) and insignificant differences followed by lines 7, 9 and 13 (> 61 capsules) which increased all the other lines and parents in this trait.

Line No. 7 ranked as the first genotype and had the greatest number of capsules/branches (60.76 capsules) with significant differences, followed by the parent 20 (53.56) and the two lines number 4 and 14. It is note worthy that line number 7 had the greatest total number of capsules/plant (122 capsules) follcwed by the parent 20 (102 caps), and line 13 (96 caps) as well as lines 4 and 14 (93 caps.). In this respect, Ragab (1982), Rao *et al.* (1991) Ghallab and Sharaan (1998) and Sharaan *et al.* (2002) confirmed genotypic differences concerning their number of capsules/plant and considered it as the most important yield contributor traits which should be taken as criterion for selecting the improved genotypes.

Table (6): Effect of genotypes on mean performance for yield and some yield component traits of sesame genotypes grown under newly reclaimed calcareous soil conditions (over two seasons).

Genotypes	Fruiting zone length (cm)	No. branches /plant	No. capsules/ main stem	No. capsules/ branches	Seed/ plant (g)	Seed yield/ fed. (ardb)
1	113.97	2.17	50.95	33.95	11.10	4.62
2	107.96	2.20	56.84	28.43	11.68	4.95
3	107.49	2.17	52.81	28.01	10.92	4.72
4	119.90	2.37	56.06	47.29	12.82	4.95
5	116.48	2.30	51.05	35.64	12.59	4.58
6	125.94	1.54	48.93	18.86	11.18	4.41
7	125.17	2.79	61.69	60.76	13.48	4.83
8	125.61	2.01	48.45	33.30	11.97	4.98
9	123.85	1.77	61.39	34.13	11.62	4.40
10	122.36	1.57	65.81	26.11	13.72	4.86
11	119.19	1.90	56.19	30.28	11.23	4.50
12	126.58	2.07	59.27	31.20	12.78	4.76
13	104.46	2.77	61.97	35.70	12.22	5.07
14	111.17	2.77	47.09	46.38	13.86	4.94
15	106.29	1.80	50.28	16.24	11.34	4.38
16	103.49	1.97	57.68	35.73	12.86	4.72
17	106.85	2.27	44.36	32.44	11.29	4.54
18	110.33	1.87	49.24	25.51	10.54	4.25
19	118.74	1.84	55.13	28.78	10.51	4.36
20	115.34	3.19	58.58	53.56	9.90	4.19
21	107.63	2.39	45.39	41.37	11.27	4.45
LSD	**5.02**	**0.248**	**3.81**	**6.29**	**0.795**	**0.206**

The greatest values of seed yield/plant were produced by line No. 14 (113.879), line 10 (13.72g) and line 7 (13.489) with significant differences followed by same other genotypes with relatively high seed yield/plant such as 4, 5, 12, 13 and 11 (>12.6g). Such superiority was due to their compensatory yield components which resulted in better vegetative growth and dry matter accumulation as well as good partitioning to reproductive organs. These results are in accordance with those reported by several investigators (Gomaa *et al.*, 1995; El-Dosouky and Attia, 1999; Attia, 2001, El-Nagar *et al.*, 2002; Attia, 2004 and Girgis, 2006). Line No. 13 produced the highest seed yield/faddan (5.07 or ardab) without significant differences, followed by lines No. 2, 4, 7, 8, 10, and 14 (>4.8 ardab), which surpassed the other tested genotypes. Most of these seven lines exhibited high P content, meaning that P was in available form caused by PSB and resulted in balanced nutrients uptake which reflected on improving plant growth and crop yield.

3. Interaction:

a. Chemical Composition

line 11 either under 75% P_2O_5 +PSB (174.67 mg/g D.W) or 100% P_2O_5 +PSB (171.17 mg/g D.W) exerted the highest estimation for total carbohydrates, with significant differences, followed by that of the some line fertilized by 50% P_2O_5 +PSB, lines 1 and 9 under 75% P_2O_5 +PSB and line 9 under 100% P_2O_5 +PSB (Table, 7). These results may be indicated that carbohydrate content in lines 11 and 9 were greatly influenced by their genetic constituent. Whereas, the lowest estimation of total carbohydrates were recoded by lines 6 and 15 under 25 P_2O_5 +PSB as well as by lines 8 and 15 under the control treatment.

Concerning total sugars content, line 1 under 75% P_2O_5 +PSB (50.50 mg/g D.W) showed the greatest value, followed by line 2 under 50% P_2O_5 +PSB (46.92 mg/g D.W) as well as line 14 under either 75% P_2O_5 +PSB or 100% P_2O_5 +PSB and line 14 under 75% P_2O_5 +PSB. Also, line1 under both 75% P_2O_5 +PSB and 100% P_2O_5 +PSB (1.93 mg/g F.W) and line 2 under 75% P_2O_5 +PSB (1.9 mg/g F.W) had the greatest values of total chlorophyll. Whereas, line 5 under all tested treatments including control exhibited the lowest estimation for both total of sugars and chlorophyll, reflecting that both traits were mainly genetically controlled. In regard to total carotenoids, lines 14, 15 and parent 21 under 75% P_2O_5 +PSB and 100% P_2O_5 +PSB produced the greatest values (0.12 mg/g F.W), whereas, line 6 under all treatments including control showed the lowest values (0.07–0.08 mg/g F.W). Moreover for total indols, lines 1, 2, 3 and 14 under 75% P_2O_5 +PSB and 100% P_2O_5 +PSB produced the greatest values (1.83–1.89 mg/g D.W), while lines 7 (1.15 mg/g D.W) and 11 (1.25 mg/g D.W) under control treatment as well as 7, 6 and 15 under 25% P_2O_5 +PSB showed the lowest ones (1.2–1.28 mg/g D.W). These results, particularly for lines 1, 2, 3, 5, 6 and 14, confirmed again that these physiological parameters were mostly of genetical behavior.

Line 20 under 75% P_2O_5 +PSB (15.58 mg/g D.W) as well as it (15.87 mg/g D.W) and line 16 (15.5 mg/g D.W) under 100% P_2O_5 +PSB exhibited the greatest values of total free amino acids, with significant differences, followed by the same two lines under 25% P_2O_5 +PSB, as well as line 16 and line 17 under 75% P_2O_5 +PSB and 100% P_2O_5 +PSB. Whereas, line 13 under the control or 25% P_2O_5 +PSB had the lowest estimations.

Regarding total free phenols, line 6 which recorded the lowest estimations of total carotenoids, exhibited the least estimations of total free phenols under all phosphorus and control treatments (1.52–1.99 mg/g D.W) due to its genetic constitution. On the other hand, line 16, which showed relatively high total free amino acids, gave the greatest values either under control (7.78 mg/g D.W) or 25% P_2O_5 +PSB, followed by line 11, 13 and 18 under control and lines 13, 16 and 18 under 25% P_2O_5 +PSB. These results may be indicated that the unavailable phosphorus increased total free phenols, but this effect was associated with the genotype.

Table (7): Effect of interactions between genotypes, phosphorus and inoculation treatments on some chemical composition traits of sesame grown under a newly reclaimed soil as a combined data.

Treatment	Genotypes	Total Carbohydrate (mg/g D.W)	Total sugar mg/g D.W	Total Chlorophyll (mg/g F.W)	Total carotenoids (mg/g F.W.)	Total indoles (mg/g D.W)	Total free amino acid (mg/g D.W)	Free phenols (mg/g D.W)	Macronutrients%		
									N	P	K
100% P_2O_5 (Cont.)	1	142.17	31.47	1.87	0.10	1.68	6.08	5.35	3.39	0.23	1.71
	2	141.00	20.85	1.47	0.11	1.73	5.38	4.64	3.15	0.24	1.88
	3	147.17	15.67	1.60	0.10	1.62	6.43	4.04	3.38	0.22	1.97
	4	147.83	20.30	1.25	0.11	1.48	5.64	5.72	3.11	0.22	1.67
	5	133.17	13.62	0.97	0.10	1.38	7.79	2.80	3.77	0.22	1.91
	6	127.67	22.80	1.53	0.07	1.27	6.22	1.99	3.30	0.22	2.02
	7	134.17	21.17	1.47	0.10	1.15	7.76	3.51	3.05	0.22	1.80
	8	127.00	19.90	1.65	0.10	1.34	7.90	4.34	3.83	0.22	1.86
	9	161.83	18.30	1.18	0.11	1.42	7.86	4.99	3.21	0.22	1.69
	10	142.33	20.42	1.36	0.10	1.63	8.01	4.80	3.06	0.21	1.93
	11	169.00	35.57	1.61	0.10	1.25	6.09	5.66	3.54	0.21	1.52
	12	141.17	21.98	1.74	0.11	1.29	9.12	3.24	3.54	0.21	1.70
	13	135.83	21.75	1.47	0.10	1.27	2.40	5.61	3.58	0.22	1.67
	14	133.50	43.10	1.49	0.11	1.80	5.49	4.28	3.70	0.22	1.86
	15	128.00	29.13	1.73	0.11	1.28	8.29	4.15	3.55	0.21	1.57
	16	157.17	40.70	1.67	0.11	1.57	13.73	7.78	3.19	0.22	1.40
	17	132.50	23.63	1.79	0.10	1.27	11.55	2.26	3.26	0.22	1.60
	18	130.83	31.78	1.19	0.10	1.30	8.02	6.40	3.27	0.21	1.14
	19	154.67	23.60	1.75	0.10	1.27	10.00	3.18	3.07	0.22	1.65
	20	126.83	33.53	1.81	0.10	1.63	12.92	2.43	3.72	0.22	1.34
	21	156.67	25.18	1.80	0.11	1.33	12.58	5.02	2.75	0.22	1.66
25% P_2O_5+PSB	1	146.00	33.97	1.76	0.09	1.74	5.77	5.01	3.22	0.21	1.62
	2	140.33	25.70	1.63	0.10	1.71	5.05	4.44	3.02	0.21	1.77
	3	144.67	19.08	1.50	0.10	1.68	6.62	3.94	3.33	0.23	1.92
	4	144.00	19.70	1.20	0.09	1.51	5.55	5.41	3.21	0.21	1.64
	5	133.17	13.48	0.98	0.10	1.37	7.61	2.76	3.72	0.20	1.87
	6	126.67	20.30	1.49	0.07	1.28	6.37	1.95	3.40	0.20	1.97
	7	132.17	21.22	1.43	0.10	1.20	7.74	3.48	2.94	0.21	1.79
	8	128.00	19.93	1.53	0.10	1.35	7.93	4.25	3.87	0.20	1.86
	9	155.33	16.62	1.18	0.11	1.42	7.02	4.89	3.06	0.16	1.64
	10	140.67	18.38	1.32	0.09	1.65	7.97	4.72	3.17	0.20	1.84
	11	165.33	33.32	1.51	0.10	1.31	6.61	5.31	3.50	0.20	1.50
	12	141.00	21.35	1.71	0.10	1.39	8.87	3.23	3.48	0.20	1.68
	13	132.00	20.20	1.45	0.10	1.33	2.43	5.59	3.45	0.20	1.63
	14	134.17	37.82	1.46	0.10	1.77	5.40	4.22	3.71	0.21	1.79
	15	129.67	28.75	1.61	0.10	1.28	8.24	4.26	3.33	0.20	1.59
	16	150.33	38.32	1.59	0.10	1.54	12.88	7.40	3.06	0.20	1.35
	17	132.17	23.07	1.63	0.09	1.32	10.98	2.21	3.19	0.21	1.56
	18	133.17	31.20	1.18	0.09	1.32	8.12	5.71	3.13	0.19	0.90
	19	152.17	22.70	1.66	0.10	1.35	9.75	3.14	3.03	0.20	1.59
	20	131.83	30.02	1.75	0.10	1.61	11.42	2.37	3.68	0.20	1.31
	21	155.17	24.43	1.72	0.10	1.32	11.95	4.96	3.32	0.20	1.59

Table (7): Continued

Treatment	Genotypes	Total Carbohydrate (mg/g D.W)	Total sugar mg/g D.W	Total Chlorophyll (mg/g F.W)	Total carotnouds (mg/g F.W.)	Total indoles (mg/g D.W)	Total free amino acid (mg/g D.W)	Free phenols (mg/g D.W)	Macronutrients%		
									N	P	K
50% P_2O_5 +PSB	1	145.83	34.23	1.87	0.10	1.80	6.71	4.30	3.39	0.22	1.73
	2	155.50	46.92	1.71	0.11	1.80	8.24	3.71	3.46	0.22	1.91
	3	155.17	23.00	1.66	0.10	1.75	7.09	3.74	3.43	0.24	1.97
	4	148.17	23.20	1.25	0.11	1.54	5.87	4.77	3.16	0.23	1.71
	5	139.67	14.75	1.02	0.10	1.45	7.86	2.30	3.89	0.22	1.97
	6	134.83	22.87	1.55	0.07	1.29	6.99	1.95	3.56	0.23	2.06
	7	138.17	22.57	1.47	0.11	1.38	8.64	3.05	3.16	0.23	1.83
	8	136.00	24.28	1.59	0.10	1.46	8.62	4.18	3.90	0.23	1.91
	9	162.17	18.32	1.21	0.11	1.46	8.55	4.61	3.26	0.23	1.72
	10	146.00	21.93	1.37	0.10	1.69	8.28	4.16	3.31	0.22	1.99
	11	170.83	35.87	1.61	0.10	1.41	6.91	5.20	3.61	0.22	1.57
	12	144.33	24.20	1.75	0.11	1.57	9.33	3.08	3.72	0.22	1.74
	13	137.67	22.17	1.49	0.10	1.37	3.47	5.03	3.64	0.23	1.72
	14	138.17	43.25	1.53	0.11	1.82	5.79	4.19	3.79	0.24	1.87
	15	135.00	30.65	1.71	0.11	1.37	8.49	3.47	3.71	0.22	1.68
	16	156.33	42.27	1.68	0.11	1.63	13.82	6.03	3.21	0.23	1.39
	17	136.50	25.27	1.70	0.10	1.36	11.82	2.21	3.34	0.23	1.60
	18	136.17	33.42	1.22	0.10	1.37	8.98	5.21	3.38	0.22	1.21
	19	155.67	24.17	1.73	0.10	1.40	9.96	3.09	3.10	0.23	1.69
	20	133.67	33.22	1.80	0.10	1.67	13.53	2.26	3.79	0.23	1.35
	21	159.50	25.47	1.81	0.11	1.36	12.88	4.70	3.52	0.22	1.68
75% P_2O_5 +PSB	1	169.83	50.50	1.93	0.10	1.85	6.92	4.21	3.45	0.25	1.79
	2	158.83	39.05	1.90	0.11	1.89	6.60	3.36	3.68	0.25	1.93
	3	157.83	25.90	1.81	0.11	1.86	8.91	3.50	3.58	0.25	2.09
	4	153.50	26.62	1.31	0.11	1.62	6.44	4.36	3.27	0.24	1.83
	5	144.67	15.85	1.04	0.11	1.58	8.41	2.21	3.91	0.23	2.04
	6	138.17	25.70	1.63	0.08	1.45	8.52	1.52	3.68	0.24	2.17
	7	142.50	25.20	1.53	0.11	1.49	9.32	2.87	3.32	0.26	1.87
	8	141.00	26.90	1.71	0.11	1.54	9.39	4.12	3.95	0.24	1.93
	9	167.67	19.97	1.26	0.11	1.56	9.46	4.45	3.54	0.25	1.78
	10	149.67	24.52	1.41	0.11	1.76	8.51	3.87	3.56	0.25	2.03
	11	174.67	39.05	1.66	0.11	1.57	8.69	4.71	3.76	0.25	1.70
	12	159.67	25.62	1.80	0.11	1.76	10.03	2.94	3.78	0.25	1.82
	13	145.33	24.77	1.53	0.11	1.41	4.80	4.84	3.67	0.25	1.79
	14	143.67	46.57	1.54	0.12	1.87	5.72	4.00	3.93	0.25	1.94
	15	141.33	33.38	1.77	0.12	1.41	8.79	3.04	3.79	0.24	1.70
	16	163.50	44.42	1.76	0.11	1.73	14.37	5.62	3.37	0.24	1.44
	17	141.33	27.10	1.78	0.10	1.51	13.57	2.12	3.50	0.24	1.63
	18	139.00	35.70	1.25	0.11	1.44	9.42	4.72	3.58	0.23	1.28
	19	159.00	25.72	1.79	0.11	1.42	11.28	2.81	3.27	0.25	1.74
	20	139.17	34.67	1.83	0.11	1.75	15.58	2.20	3.93	0.25	1.38
	21	163.33	27.17	1.84	0.12	1.44	13.53	4.45	3.76	0.26	1.73

Table (7): Continued

Treatment	Genotypes	Total Carbohydrate (mg/g D.W)	Total sugar mg/g D.W	Total Chlorophyll (mg/g F.W)	Total carotenoids (mg/g F.W.)	Total indoles (mg/g D.W)	Total free amino acid (mg/g D.W)	Free phenols (mg/g D.W)	Macronutrients%		
									N	P	K
100% P_2O_2 +PSB	1	147.83	46.02	1.93	0.10	1.83	6.53	2.75	3.44	0.26	1.79
	2	156.17	43.77	1.81	0.11	1.85	6.25	3.19	3.66	0.26	2.07
	3	150.83	27.23	1.82	0.11	1.84	8.78	3.55	3.57	0.24	2.12
	4	151.33	25.87	1.32	0.11	1.62	6.39	3.95	3.27	0.25	1.80
	5	145.33	16.03	1.05	0.11	1.63	8.35	2.10	3.91	0.24	2.06
	6	140.67	26.03	1.64	0.08	1.47	8.53	1.54	3.81	0.24	2.15
	7	145.00	25.60	1.53	0.11	1.52	9.39	2.80	3.44	0.23	1.91
	8	141.33	26.42	1.76	0.11	1.55	9.49	4.16	3.94	0.25	1.95
	9	166.17	19.93	1.25	0.11	1.57	9.37	4.48	3.52	0.24	1.80
	10	150.00	24.43	1.40	0.11	1.77	8.55	3.76	3.54	0.24	2.03
	11	174.17	39.17	1.41	0.11	1.57	8.59	4.38	3.72	0.25	1.71
	12	159.83	25.27	1.80	0.11	1.80	9.52	2.19	3.78	0.25	1.82
	13	146.17	25.32	1.53	0.10	1.42	5.12	4.20	3.65	0.25	1.78
	14	144.67	45.88	1.53	0.12	1.89	6.17	3.40	3.94	0.25	1.97
	15	139.67	33.08	1.81	0.12	1.41	8.73	2.96	3.74	0.23	1.69
	16	163.33	44.50	1.76	0.11	1.72	15.50	3.82	3.28	0.24	1.44
	17	140.83	27.18	1.78	0.10	1.50	13.65	2.00	3.51	0.25	1.64
	18	138.00	36.05	1.25	0.11	1.42	9.43	4.26	3.59	0.23	1.28
	19	160.33	25.77	1.78	0.11	1.41	11.57	3.07	3.30	0.24	1.75
	20	140.17	34.08	1.84	0.11	1.76	15.87	2.20	3.94	0.24	1.37
	21	163.83	27.45	1.84	0.12	1.43	13.05	3.53	3.65	0.25	1.72
LSD		5.060	3.688	0.07	0.005	0.062	0.650	0.454	0.250	0.019	0.113

Concerning nitrogen percentage, lines 8 under 75% P_2O_5 +PSB showed the greatest value (3.95%) followed by the same line under the rest of applied treatments as well as lines 5, 12 & 14 and parent 20 under all applied treatments including the control one. It is note worthy that N percentage was gradually increased by increasing phosphorus fertilization in a ranges of (3.7–3.8%) for control to (3.91–3.94%) for 100% P_2O_5 +PSB, indicating that phosphorus availability, induced by PSB, increased N availability. This result supported with the previously detected by Attia (2004) and El-Rewainy, and Galal (2004).

Lines 7 and parent 21 under 75% P_2O_5 +PSB as well as lines 1 and 2 under 100% P_2O_5 +PSB had the greatest phosphorus percentage (0.26%) without significant differences, followed by almost all genotypes tested under 75% P_2O_5 +PSB and 100% P_2O_5 +PSB (0.25%). Whereas line 9 (0.16%) and parent 18 (0.19%) under 25% P_2O_5 +PSB showed the lowest percentages. These results reflected the positive effect of PSB for dissolving unavailable form of phosphate to available one in the rhizosphere. The relatively high percentage of potassium was recorded by line 6 under 75% P_2O_5 +PSB, followed by line 6 also under 100% P_2O_5 +PSB (2.15%), line 3 under 75% P_2O_5 +PSB (2.09%), line 2.3 and under 100% P_2O_5 +PSB (2.06–2.12%) and line 6 under 50% P_2O_5 +PSB (2.06%). Whereas parent 16, 18 and parents 20 under 25% P_2O_5 +PSB under all treatments including control had the lowest values (0.9- 1.44%).

b. Agronomic traits:

Data listed in Table (8) reveal that line 9 (163.69 cm) as well as lines 5, 8 and 12 and the parent 19 (152.5–161.3 cm) under 75% P_2O_5 +PSB treatment had the tallest fruiting zone length. Whereas, lines 3 and 13 and the parent 21 (64.25–72.42 cm) fertilized with 100% P_2O_5 +PSB as well as lines 2, 14 and 15 and the parent 17 (69.7– 89.7cm) under the control treatment which showed the shortest fruiting zone length.

The parent number 20 (4.17 branch) received 75% P_2O_5 +PSB and line 7 fertilized with 50% P_2O_5 +PSB, 75% P_2O_5 +PSB and 100% P_2O_5 +PSB (3.5–5.76 branch) produced the greatest number of branches/plant. While, the unbiofertilized plants of the two parents 17 (0.0 branch) and 16 (0.33 branch) and the two lines 7 and 11 (0.50 branch), as well as line 6 under 25% P_2O_5 +PSB showed the lowest number of branches/plant. It is obvious that this vegetative – reproductive organs ratio were clearly affected by fertilization treatments, particularly by 75% P_2O_5 together with the inoculant bacteria which dissolved the precipitated phosphate into available form and promoted plants to produce some growth regulators, but this effect was greatly influenced by genotypes. These findings are in line with those reported by El-Dosouky and Attia (1999), Attia (2004) and Girgis (2006).

The greatest number of capsules/main stem was obtained by the parent 19 (81.67 caps) when fertilized with 75% P_2O_5 +PSB followed by the parent 16 (>73.9 caps) under 50% P_2O_5 +PSB, 75% P_2O_5 +PSB and 100% P_2O_5 +PSB, due to its strong genetic factor effect. Also, lines 7, 9 and 10 under 75% P_2O_5 +PSB treatment showed a similar high number of capsules (>73.4 caps). Concerning number of capsules/branches, line 7 (84.08 caps) and line 4 (80.35 caps) fertilized with 100% P_2O_5 +PSB as well as the same two lines and parent 20 under 50% P_2O_5 +PSB produced the greatest number (73.0–79.8 caps). Whereas, the non-branching parent of 17 had 0.0 capsules/branches and lowest number of capsules/main stem, followed by lines 3, 4, 5, 6, 8, 9, 10 & 15 and two parents 16, 18 (1.01–7.5 caps) under the control treatment.

Line number 14, due to its superiority in number of capsules per branches and per main stem, as well as carotenoids, indols, N and P, produced the highest seed yield/plant (17.23g) under 75% P_2O_5 +PSB, which insignificantly different from lines 4, 7, 9, 10 & 13 and the parent 17 under the same treatment (15.7–16.6g) and 7 fertilized by either 50% P_2O_5 +PSB or 100% P_2O_5 +PSB (15.7–16.1 g), followed by lines 3, 4 & 8 and parents 16 and 21 under 75% P_2O_5 +PSB. This may be due to the availability of phosphorus which activated plants to absorb minerals, encouraged biosynthesis processes, and promoted dry matter accumulation with better partitioning into reproductive organs.

Line 14 which showed the highest seed yield/plant, in addition to its superiority of caretenoids, indols, N & P, as well as line 6 showed the least content of total free phenols, as growth inhibitor, and high K percentage, produced the high seed yield/faddan (6.04 ardab) under 75% P_2O_5 +PSB and insignificantly different from lines 2, 3, 4, 8, 12 and 13 (5.81–5.93 and) under the same treatment, as well as lines 1, 2, 3, 8, 13 and 17 (5.2–5.85 ardab) under 100% P_2O_5 +PSB. While the two parents 17 on 21 (2.51 ardab) as well as lines 1, 3 and 9 and parent 19 (>3 ardab) under the control treatment, which showed the lowest yield.

Table (8): Effect of interactions between genotypes and phosphorus and inoculation treatments on yield and some yield components of sesame grown under a newly reclaimed soil as a combined data.

Treat-ments	Genot ypes	Fruiting zone length (cm)	No. branches /plant	No. capsules/ main stem	No. capsules/ branches	Seed/ plant (g)	Seed yield/fed (ardb)
100% P_2O_2 (Cont.)	1	98.52	1.67	38.87	24.13	5.54	2.74
	2	89.67	1.50	37.37	12.70	5.99	3.12
	3	93.67	0.33	41.05	4.87	4.63	2.53
	4	116.50	1.17	39.55	6.04	6.34	3.24
	5	106.51	1.00	33.45	5.03	10.35	3.78
	6	132.33	0.83	37.53	3.36	7.47	3.28
	7	109.51	0.50	33.00	20.77	6.59	3.46
	8	136.99	0.33	42.92	6.19	8.55	3.74
	9	103.49	0.83	34.85	5.03	5.39	2.93
	10	112.83	1.00	46.08	4.36	11.40	4.17
	11	116.83	0.50	53.13	14.38	7.62	3.73
	12	103.66	1.00	51.63	16.91	8.65	3.82
	13	113.03	1.84	56.35	23.95	9.00	3.94
	14	89.83	1.84	39.73	24.80	9.46	3.68
	15	70.65	1.17	25.28	7.53	7.12	3.70
	16	92.35	0.33	22.77	1.01	8.71	3.52
	17	69.77	0.00	16.40	0.00	2.87	2.51
	18	118.50	0.67	33.50	4.53	7.14	3.36
	19	103.85	1.17	37.38	16.74	5.18	2.78
	20	106.50	1.84	46.77	14.57	3.72	3.26
	21	124.50	1.17	38.72	14.23	2.87	2.51
25% P_2O_2+PSB	1	130.63	1.84	48.12	31.82	9.05	3.73
	2	96.67	1.84	44.08	24.95	9.91	4.32
	3	127.35	2.17	46.28	10.70	8.96	3.92
	4	140.35	2.00	50.62	30.18	12.10	4.82
	5	115.31	1.83	47.10	20.93	10.69	4.15
	6	130.00	0.33	41.88	13.90	9.33	3.93
	7	132.19	2.67	58.85	57.33	13.25	4.46
	8	104.98	2.00	46.42	22.12	9.00	3.94
	9	107.82	1.17	58.00	32.70	9.56	4.18
	10	132.00	0.83	64.88	16.42	12.35	3.98
	11	144.16	1.00	52.82	19.90	10.02	3.53
	12	120.35	1.17	56.67	26.28	11.70	3.77
	13	118.67	1.84	52.65	38.72	10.39	4.56
	14	107.65	2.17	45.90	30.32	12.97	4.17
	15	121.20	1.67	39.05	20.08	10.07	4.12
	16	115.50	1.33	38.87	21.27	12.10	4.55
	17	94.18	1.17	33.33	19.77	10.65	4.19
	18	93.33	1.17	46.43	7.38	8.34	3.74
	19	112.00	1.34	40.38	18.25	10.05	4.08
	20	122.33	3.00	52.65	37.53	8.04	3.65
	21	99.50	1.33	40.38	7.70	11.16	4.56

Table (8): Continued

Treat-ments	Genotypes	Fruiting zone length (cm)	No. branches /plant	No. capsules/ main stem	No. capsules/ branches	Seed/ plant (g)	Seed yield/fed (ardb)
50% P_2O_2 +PSB	1	124.35	2.17	54.98	36.70	13.50	5.58
	2	123.67	2.17	67.23	31.80	14.20	5.85
	3	114.15	2.33	57.35	42.07	12.85	5.37
	4	116.84	2.33	60.02	79.85	14.97	5.51
	5	123.33	2.50	56.48	49.80	13.52	4.75
	6	134.18	1.67	51.28	22.27	12.17	4.44
	7	142.50	3.50	68.57	83.58	15.68	5.42
	8	138.85	2.33	48.28	45.90	13.60	5.66
	9	143.66	1.67	70.08	42.73	13.22	4.69
	10	130.77	1.71	70.15	34.95	14.12	4.95
	11	124.50	2.17	55.65	33.83	12.32	4.73
	12	145.02	2.34	60.00	37.72	13.92	4.84
	13	99.32	3.17	64.38	38.05	12.30	5.39
	14	128.35	2.83	48.27	59.13	14.57	5.15
	15	118.67	1.84	58.00	19.75	12.47	4.49
	16	106.68	2.34	76.18	60.75	14.10	5.14
	17	132.37	3.17	56.35	46.40	13.30	5.54
	18	113.35	1.75	54.65	25.97	11.60	4.43
	19	131.00	1.84	57.85	34.02	11.35	4.53
	20	130.17	3.34	60.52	73.00	10.45	4.05
	21	105.46	2.84	46.77	58.83	13.22	5.21
75% P_2O_2 +PSB	1	136.17	2.50	57.32	39.88	13.40	5.40
	2	145.00	2.84	67.77	40.38	13.57	5.81
	3	129.88	3.17	61.52	39.87	14.82	5.93
	4	150.02	3.50	69.58	40.05	15.48	5.56
	5	156.04	3.17	61.20	52.15	14.37	5.30
	6	138.17	2.67	62.18	32.00	13.00	5.36
	7	140.35	3.50	78.98	58.02	15.70	5.36
	8	152.54	2.75	55.85	45.92	14.60	5.77
	9	163.69	3.00	73.45	46.93	16.20	5.51
	10	141.01	2.08	77.30	39.37	16.12	6.03
	11	127.49	3.17	63.20	48.95	12.90	5.13
	12	161.33	3.00	67.55	36.87	15.22	5.93
	13	127.00	3.34	71.57	39.23	16.60	5.81
	14	140.18	3.67	52.80	58.18	17.23	6.04
	15	136.00	2.00	70.58	13.58	13.10	4.66
	16	131.18	3.00	73.90	34.35	14.82	4.92
	17	138.02	3.34	58.85	49.12	15.83	4.60
	18	142.31	3.50	56.48	63.20	13.30	5.15
	19	152.19	2.50	81.67	40.38	14.12	5.26
	20	128.50	4.17	71.95	69.03	13.60	4.97
	21	136.82	3.50	53.80	66.73	15.40	4.94

Table (8): Continued

Treat-ments	Genotypes	Fruiting zone length (cm)	No. branches /plant	No. capsules/ main stem	No. capsules/ branches	Seed/ plant (g)	Seed yield/fed (ardb)
100% P_2O_5 +PSB	1	80.17	2.67	55.48	37.20	14.00	5.67
	2	84.80	2.67	67.73	32.30	14.72	5.63
	3	72.42	2.83	57.85	42.57	13.35	5.86
	4	75.82	2.83	60.53	80.35	15.22	5.62
	5	81.18	3.00	57.00	50.30	14.02	4.93
	6	95.00	2.17	51.78	22.78	13.93	5.03
	7	101.32	3.76	69.07	84.08	16.18	5.47
	8	94.70	2.61	48.78	46.40	14.10	5.78
	9	100.63	2.17	70.57	43.23	13.72	4.70
	10	95.17	2.21	70.65	35.46	14.62	5.19
	11	83.01	2.67	56.15	34.33	13.30	5.38
	12	102.53	2.84	60.50	38.22	14.42	5.44
	13	64.27	3.67	64.88	38.55	12.80	5.62
	14	89.80	3.33	48.77	59.47	15.08	5.68
	15	84.92	2.34	58.50	20.25	13.93	4.95
	16	71.71	2.84	76.68	61.25	14.60	5.46
	17	99.90	3.67	56.85	46.90	13.80	5.85
	18	84.13	2.25	55.15	26.47	12.30	4.56
	19	94.67	2.34	58.35	34.52	11.85	5.16
	20	89.20	3.61	61.02	73.67	13.70	5.01
	21	71.88	3.11	47.27	59.35	13.72	5.01
LSD		**11.23**	**0.556**	**8.52**	**14.08**	**1.78**	**0.461**

In sum, the aforementioned discussion indicated that applying of phosphorus fertilizer in the rate of ¾ recommended dose together with PSB is adequate for improving sesame plants growth and yield under the conditions of a calcareous newly reclaimed soil. From plant breeding of view, depending upon physiological parameters and agronomic evaluation, lines 2, 3, 4, 7, 8, 10, 11, 12, 13 and 14 could be selected for direct use in such soils, under 3/4 recommended P_2O_5+PSB, saving P mineral fertilizer cost and decreasing ecological pollution. In addition, for more further improvement in these lines, selection should be practiced among and within them depending on the most important yield contributors as detected by the data listed in Table (9) such as number of capsules/main stem and number of branches followed by number of capsules/branches, as agronomic traits, together with K content percentage, total sugars and total indols as chemical composition traits.

Table (9): Direct, indirect effect, coefficient determination and relative importance some yield components and chemical composition traits attributes on seed yield/plant (over two seasons).

Traits	Source of variation			
	Direct effect	Indirect effect	Coefficient determination (CD)	Relative important
Total Carbohydrates (mg/g D.W)	0.002	-0.013	-0.011	0.94
Total sugar (mg/g D.W)	0.072	-0.014	0.059	4.91
Total Chlorophyll (mg/g F.W.)	0.035	-0.036	-0.001	0.08
Total carotnouds (mg/g F.W.)	0.000	0.000	0.000	0.03
Total indoles (mg/g D.W)	0.0105	-0.052	-0.041	3.44
Total free amino acid (mg/g D.W)	0.030	-0.013	0.016	1.37
Free phenols (mg/g D.W)	0.021	-0.048	-0.027	2.24
N%	0.003	0.017	0.019	1.63
P%	0.001	-0.017	-0.016	1.35
K%	0.1472	-0.034	0.113	9.49
Fruiting zone length(cm)	0.017	0.063	0.080	6.71
No. branches /plant	0.092	0.135	0.226	18.99
No. capsules/ main stem	0.113	0.136	0.249	20.84
No. capsules/branches	0.026	0.087	0.112	9.41
Residual effect			0.221	18.57

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استجابة التراكيب الوراثية المنتخبة من السمسم للتسميد الفوسفاتي الحيوي والمعدني تحت ظروف أراض جيرية مستصلحه حديثاً

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تم تقيم ٢١ تركيب وراثى من السمسم من خلال تجربة حقلية بمزرعة كلية الزراعة بالفيوم أوض جيرية مستصلحة حديثا تحت أربعة توليفات من التسميد الفوسفاتي مع بكتيريا مذيبه للفسفور (PSB) بالإضافة لمعاملة الكنترول خلال موسمي ٢٠٠٥ ، ٢٠٠٦ وكانت معدلات التسميد هي ٢٥ % فو٢ أ٥ + البكتيريا ألمذيبه ، ٥٠% فو٢أ٥ + البكتيريا المذيبة ، ٧٥ % فو٢أ٥ + البكتيريا ألمذيبه ، ١٠٠% فو٢أ٥ مع البكتيريا ألمذيبه بالإضافة إلى الكنترول (التسميد الفوسفاتي بالجرعة الموصى بها للمحصول) وتمت التجربة في تصميم القطع المنشقه مره واحده واحتلت الجرعات السماديه القطع الرئيسية أما التراكيب الوراثيه فكانت في القطع المنشقه وذلك في ثلاث مكررات .

وقد أظهرت النتائج المتحصل عليها ما يلى – فيما عدا بعض حالات قليلة – تأثرت الصفات الفسيولوجية (ألمقاسه عند مرحلة التزهير)، ومكونات المحصول (ألمقاسه عند الحصاد) معنويا بالتسميد والتراكيب الوراثيه والتفاعل بينهما . مما يشير إلى اختلاف التراكيب ألمختبره فيما بينها وراثيا ومن ثم اختلافاتها في الاحتياجات الغذائية وأيضا الاستجابة للتسميد.

المعاملة ٧٥ % فو٢أ٥ من الجرعة السماديه الموصى بها مع البكتيريا ألمذيبه للفوسفور كانت أفضل المعاملات في معظم الصفات التي درست حيث أعطت زيادة في الكربوهيدرات والسكريات والكلوروفيل والكاروتينات والأندولات والأحماض الأمينيه الحرة وتركيز كل من النيتروجين والفوسفور والبوتاسيوم كما أعطت انخفاض في الفينولات الحرة ، فضلا عن توفير ربع الجرعة السمادية من الفوسفور.

أكدت النتائج أن الصفات الكيميائية (الناتجة من عمليات التخليق الحيوي في النباتات) محكومه أساسا بالتركيب الوراثى حيث أنه في معظم الحالات أظهرت التراكيب الوراثيه انخفاض أو ارتفاع لهذه الصفات بصرف النظر عن المعاملة، وعلى سبيل المثال تحت كل المعاملات كانت السلالة ٥ أقل في الكلوروفيلات الكلية أما السلالة ٦ فكانت الأقل في والكاروتينات والفينولات وتركيز النيتروجين بينما السلالات ٥، ٨،١٤ فقد أعطت أعلى تركيز للنيتروجين . أيضا لوحظ أن النقص في الفوسفور المتاح أعطى زيادة في الفينولات الحرة كمثبط للنمو ولكن هذا التأثير كان مرتبطا بالتركيب الوراثى .

في معظم التراكيب الوراثيه أعطي الفوسفور المتاح مع البكتيريا ألمذيبه زيادة في النيتروجين المتاح، وكانت نسبة الزيادة في محصول النبات المسمد بالجرعة ٧٥ % + البكتيريا ألمذيبه هي ٤٠,٨ ، ١١,٥ ، ٥,٤ ، ١١٣,٨ % مقارنة بالجرعات ٢٥% ، ٥٠ % ، ١٠٠ % مع البكتيريا ألمذيبه والكنترول وكانت نسبة الزيادة في محصول الفدان لنفس المعاملة هي ١٣,٤ ، ٧,٤ ، ١,٣ ، ٦٠,٥ % مقارنة بالمعاملات الأربعة على التوالي. وكانت التراكيب الوراثيه المبشرة والأكثر ملائمة للنمو في ارض جيرية تحت هذه المعاملة الثالثة هي السلالات ٢ ، ٣ ، ٤ ، ٧ ، ٨ ، ١٠ ، ١١ ، ١٢، ١٣ ، ١٤ نتيجة تفوقها في الصفات الكيميائية لنموها الخضري نتج عنه تحسن في البناء الضوئي رفع المادة الجافة للأجزاء الثمرية مما انعكس في ارتفاع إنتاجيتها.

ومن خلال نتائج معامل المرور تحددت أهم الصفات إسهاما في المحصول سواء كانت صفات فسيولوجية أو مكونات محصول .

وعموما دلت النتائج إلى أن استخدام التوافيق بين التسميد المعدني والحيوي في الأراضي الجيرية المستصلحة حديثا أدى إلى تحسين إنتاجيتها بسبب التأثير الإيجابي للبكتيريا ألمذيبه للفوسفور لقدرتها علي تحويل الفوسفات إلي الصورة المتاحة للامتصاص فضلا عن انها تساعد أيضا في إتاحة عناصر غذائية أخري وتزيد قدرة النبات علي امتصاص احتياجاته منها مما ينتج عنة تحسين نموة ومحصوله