Effect of Chemical Fertilizers, Chicken Manure and Bacteria Inoculation Treatments on Productivity of *Brassica Alba,* L. Plants under North Sinai Conditions

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Abstract: A field experiment was carried out during winter seasons of 2008/2009 and 2009/2010 at the experimental farm of ornamental and medicinal plants, Faculty of Environmental Agriculture Sciences at El-Arish, Suez Canal University, North Sinai, to study the effect of different types of fertilizers; i.e., chemical fertilizer (NPK), chicken manure (ChM) and three types of inoculation bacteria phosphate solving bacteria (PSB), nitrogen fixing bacteria (NFB) and potassium release bacteria (KRB) on growth, seed and fixed oil yields of White Mustard (*Brassica alba*, L.) plants. Results showed that application of ChM 20 m^3/fed. (full dose) alone, ChM 10 m^3/fed. (half dose) + NFB or ChM (half dose) + PSB enhanced most *Brassica alba*, L. plants growth characteristics in both seasons as compared to chemical fertilizer in both seasons. As well as; application of ChM (half dose) with PSB increased all plant growth parameters, viz; fresh and dry weights of roots, leaves, shoots and total fresh weights as well as branches number per plant. The highest leaf pigments content, NPK and carbohydrates percentages were recorded with ChM (half dose) + PSB. Also, application of ChM + PSB gave highest seed yield. The favorable treatments for producing the highest of fixed oil yield/fed was ChM (half dose) + PSB or plus NFB. Application of ChM (half dose) with inoculation of PSB was the favorable treatment for increasing total seed yield and its components and fixed oil yields expressed as number and weight of seeds per plant and per fed. in both season followed by the treatment received ChM (half dose) + NFB only.

Keywords: *Brassica alba*, chemical fertilizer, inoculation bacteria, chicken manure.

INTRODUCTION

White Mustard (*Brassica alba*, L.) plant belongs to Family Brassicaceae, native to Mediterranean region and the Crimea, but introduced into other a country. It has become naturalized in many areas and is a weed of cultivated lands. Is among the Medicinal plants that can be cultivated in the new land. White Mustard seeds contains an enzyme myrosin and a glucoside sinalbin which yields upon hydrolysis, acrinyl isothiocyanate, a pungent tasting but almost odorless oil. Sinalbin mustard oil is only slightly volatile with steam, and causes blisters on the skin.

The medicinal uses of *Brassica alba*, L. is a good effect on rheumatic and used as flavoring material in food also use in salad and in industry food of sauces mustard. For all these uses of this plant is considered one of the most valuable medicinal plants, which needs research dealing with organic and biological agriculture for product pure drug, free from the chemical materials percentages, which are harmful on the public health.

Also we need of increasing the medicinal plant production in Egypt, it must be an ultimate goal to meet the great increase of population to avoid chemical therapy side effect on human health through utilization of the medical herbs, also to increase the economic revenue and foreign currency through their production over that the world began to recently come back to nature in particular for utilizing medical plants and use microorganisms in biofertilization to reduce or replace the chemical fertilizer.

To confront this problem, it was necessary to develop alternative methods of supplying nutrients to growing plant the utilization of biofertilizer is considered today by many scientists as a promising alternative particularly for developing countries.

The significant role of chemical fertilizers in increasing the medicinal plants production is fully recognized. However, in the recent years, many constraints have been raised due to their adverse impacts on the public health, environment and national income. Biofertilizers are, generally, based on altering the rhizospher flora, by seed or soil inoculation with certain organisms, capable of inducing beneficial effect on a compatible host. Biofertilizers mainly comprise nitrogen fixer, phosphate dissolvers or potassium release bacteria. These organisms may affect their host plant by one or more mechanisms such as nitrogen fixation, production of growth promoting substance or organic acids, enhancing nutrients uptake or protection against pathogens.

Therefore, this investigation aimed to study the effect of chemical fertilizer, chicken manure and biofertilization with nitrogen fixing bacteria, phosphorus solving bacteria, potassium release bacteria on the growth, yield and the main components of mustard plant to reveal the suitable treatments producing the highest herbs containing more fixed oil. El-sawy *et al*., (1998) on *Ammi visnaga*, Saleh *et al*.,(1998) on datura, Harridy and Amara (1998) on roselle plant and Kandeel *et al*, (2002) on sweet basil, Nour EL-Dein(2004) on *Brassica alba*, L. and in other plants and Abdel-Ghani (2008), Abd-Allah *et al*., (2001) and Hashem *et al.,* (2013) on rosemary found that inoculation with full dose of in-organic N- fertilizer remarkably increase growth and yield .

MATERIALS AND METHODS

The main objective of this research was to study the effect of different types of fertilizers; i.e., chemical fertilizer (NPK), organic manure source as chicken manure (ChM), and three types of inoculation bacteria or three bio-fertilizers phosphate solving bacteria (PSB), potassium release bacteria (KRB) and nitrogen fixing bacteria (NFB) on growth and yield of *Brassica alba,* L. plants. Plants were grown in the winter season in sandy soil by using drip-irrigation system. The mechanical and chemical analyses of the soil used and organic manure were tabulated in (Tables 1 & 2) and irrigation water used analyses in (Table 3). The source of chicken manure (ChM) was from poultry farm at North Sinai. Meteorological data (temperature degrees (c°), relative humidity (%) and total rain (mm. /month) for El-Arish region during (2008/2009& 2009/2010) seasons is shown in (Table 4).

The seeds of White Mustard (*Brassica alba,* L.) were obtained from Medicinal and Aromatic Plants Section, El-Dokki, Agricultural Research Center Cairo Egypt. The seeds were sown on 15th November in 2008 and 2009 seasons, respectively directly in experimental land. The distance between rows was 75 cm and between hills in the same line was 25cm. plot area was 10.80 m^2. (6 m. long and 1.80 cm wide). After germination the plants were thinned at two plants per hill then after one week thinned at one plant per hill (21333 plants/fed.).

The plants of *Brassica alba,* L. were harvested at end March in both seasons when the pods turns golden green and the seeds were firm enough.

Thre strains of microorganism were used in this study; the first was nitrogen fixing bacteria (NFB) (*Azospirrlum brasilense*,), phosphorus solving bacteria (PSB) (*Paenibacillus polmyx*) and potassium release bacteria (KRB) (*Pseudomonas fluerescens*,). The source of NFB, PSB and KRB was obtained from the Bio Agriculture Research Center, The inoculated (500 ml/l) was diluted three times (after 20 days from appearance of the real leaves then every 15 days between another doses) 100 ml/plant every season and dipped on root zone of the White Mustard (*Brassica alba,* L. plants). The bacteria were preserved on specific media under (1-8° C) to use it in different addition stages.

This study included 11 treatments as follows:

1- Full dose of chemical fertilizer as [150 kg of ammonium sulphate (20.5% N); 150 kg of calcium super phosphate (16% P_2O_5) and 75 kg of potassium sulphate (48% K_2O)]/fed, (NPK).
2- Half dose of (NPK) as [75 kg of ammonium sulphate + 75 kg super phosphate + 35.5 kg of potassium sulphate]/fed + bacteria inoculation of nitrogen fixing bacteria (NFB).
3- Half dose of (NPK) + phosphate solving bacteria (PSB).
4- Half dose of (NPK) + potassium release bacteria (KRB).
5- Half dose of (NPK) + NFB +PSB+ KRB.
6- Full dose of chicken manure (20m^3/fed) (ChM).
7- Half dose of (ChM) 10 m^3/fed + NFB.
8- Half dose of (ChM) + PSB.
9- Half dose of (ChM) + KRB.
10- Half dose of (ChM) + NFB +PSB+ KRB.
11- Half dose of (ChM) + half dose of (NPK).

The plots which included fertilization with calcium super phosphate and chicken manure treatments was added before planting in each season in only one dose. As for nitrogen and potassium fertilizers they were divided into in five equal doses alternately with bacteria inoculation treatments.

Table (1): Some initial chemical and physical characteristics of soil.

Parameters	2008/2009	2009/2010
Dissolving ions meq.L-1 (soil past extract)		
Ca^{++}	3.03	2.10
Mg^{++}	2.11	2.20
Na^{+}	1.18	4.49
K^{+}	0.48	0.31
Cl^{-}	1.02	2.30
CO_3^{--}	**0.00**	**0.00**
HCO_3^{-}	2.00	2.40
SO_4^{--}	3.78	4.40
ECe (dsm-1)	0.68	0.91
pH (1: 2.5)	8.10	8.20
Organic carbon (g./kg^{-1})	0.93	1.22
Organic matter (g./kg^{-1})	1.60	2.10
Ca CO_3 (g./kg^{-1})	3.95	3.95
Particular size distribution %		
Clay	0.16	0.16
Silt	0.33	0.33
Fine sand	76.1	76.1
Coarse sand	18.71	18.71
Soil texture	Sandy soil	Sandy soil

Table (2): Chemical analyses of chicken manure in the two seasons.

Parameters	Chicken manure(ChM)
T. nitrogen g.kg^{-1}	33.5
T. phosphor g.kg^{-1}	0.40
T. potassium g.kg^{-1}	21.0
Organic carbon g.kg^{-1}	431
Organic matter g.kg^{-1}	743
C/N Ratio	12.9

Table (3): Chemical analyses of irrigation water**.**

pH	EC (dSm^{-1})	Soluble ions (meq/L)								S.A.R	S.S.P. %
		Cations				Anions					
		Ca^{++}	Mg^{++}	Na^{+}	K^{+}	Cl^{-}	HCO_3^{-}	CO_3^{--}	SO_4^{--}		
7.5	7.54	15.4	14.6	45.2	0.2	47.5	2	-	25.9	11.6	60

Table (4): Meteorological data: temperature degrees (°C), relative humidity (%) and total rain (mm./month) for El-Arish region during (2008/2009 & 2009/2010) seasons.

Months	2008/2009					2009/2010				
	Temperature (°C)			R.H	Rain	Temperature (°C)			R.H	Rain
	Max.	Min.	Avr.	(%)	(mm/month)	Max.	Min.	Avr.	(%)	(mm/month)
November	25.3	14.4	19.7	71	16.2	25.0	12.0	12.5	70	17.0
December	21.4	10.2	15.5	66	22.2	20.0	9.0	14.5	69	28.0
January	19.0	8.0	13.5	73	28.0	20.2	9.3	15.0	70	15.0
February	19.0	8.0	13.5	70	19.0	20.4	8.3	14.5	67	11.0
March	21.0	9.0	15.0	70	15.0	20.6	9.3	14.9	72	23.9
April	25.0	12.0	18.5	67	11.0	26.9	10.2	18.5	71	-

*Meteorological Laboratory at EL-Arish - North Sinai.

Samples of three plants were randomly taken from each plot to determine the following parameters and statistically analyzed:

Vegetative growth parameters:

- Plant height (cm), main stem diameter (mm), number of leaves, branches/plant, root length (cm) and number of root branches.
- Fresh and dry weights/plant (g) of leaves, stem, roots and total herb, length of roots (cm).

Vegetative growth parameters were recorded at full flowering stage period.

All plant parts were dried at 70 ^{0}C till constant weight, then dry weight of root, leaves and stem were recorded and total dry weight of plant were calculated.

Yield and its components parameters:

Number, fresh and dry weights of pods/plant (g), dry weight of 100 pods and dry weight of 100seeds (g).

Chemical analysis*:*

1- Photosynthetic pigments were extracted and determined in fresh leaves samples (as mg/gm) by pure acetone according to the procedure of Fadeel (1962).

2-Nitrogen, phosphorus, potassium and total carbohydrates percentages were determined in dried harvested leaves of White Mustard plants at 70^{0}C for 72 hours according to A.O.A.C. (1980) .

Determination of fixed oil percentage and yield per plant:

Soxhlet method was used for estimation of fixed oil percentage in dry seeds per plant (ml) as stated by the A.O.A.C. (1980). Oil yield per plant (ml) and per fed. (L) were calculated as follows:

$$\text{Oil yield per plant (ml)} = \frac{\text{Fixed oil percentage x Seeds dry weight/plant(g)}}{100}$$

Statistical analysis:

The experimental design was complete randomized block design with three replication and statistical analysis of the obtained data was carried out according to Snedecor and Cochran (1980). Duncan's multiple range tests was used for comparison among means (Duncan, 1958).

RESULTS AND DISCUSTION

Effect of chemical fertilizer, chicken manure and bacteria inoculation treatments on the morphological characters of White Mustard *Brassica alba*, L plant.

Data presented in Table (5) show that chicken manure treatments generally increased White Mustard (*Brassica alba*, L.) plant height, number of leaves, branches/plant, induced significant effect for stem diameter, root length and number of root branches parameters show significant effects compared with those of chemical fertilization ones alone or chicken manure 20 m^3/fed. alone or with other bacteria inoculation**.** The treatments by 10 m^3/fed. chicken manure with bacteria inoculation (PSB) gave highly significant increase and were more effective in increasing all morphological characters in this respect. These results hold true in the two seasons. These results are in accordance with those found by Chezhiyan *et al.* (2003) on *Phyllanthus amarus*, Sakr (2005) on senna plants. Abdel-Kader and Ghaly (2003) showed that

treating coriander plant with biofertilizer (Nitrobien) increased the plant height and number of shoots per plant. Sharaf (1995) on *Datura stramonium*,L. showed that, growth parameters as rate of branching number and plant height was positively influenced by free living fixating bacteria i.e. *Azospirillum brasilense* and *Azotobacter*. Also, Abdou (2003) on *Chrysanthemum morifolium*, L. plants stated that, all studied vegetative growth characters were significantly increased due to the application of (PSB) biofertilization. Abou-Aly and Gomaa (2002) showed that inoculation with *Azotobacter chroococcum* or *Azospirillum brasilense* combined with *Glomus mosseae* gave a significant increase in vegetative growth of coriander plants. Also these results are similar to those found by Abd-Allah *et al.,* (2001) and Hashem *et al.,* (2013) on rosemary found that all growth characters herb significantly increased with all bio-fertilization treatements.

The increase in leaves number/plant due to organic fertilization treatments might be due to their role in bud differentiation as well as branching, leading to more leaves. Moreover, the enhancing effect in this respect might be due to the positive effect of it on branching as mentioned before.

This result may be attributed to the increments of extractable phosphorus of sandy and calcareous soil which enhance root growth and consequently the vegetative growth.

The increase in plant height resulting from using chicken manure might be due to that it might enhance cell division and/or cell enlargement. These nutrients might participate directly or indirectly on plant anabolism resulting in more plant materials.

However, the increase in plant height might be due to the application of chicken manure fertilization for its importance to consist the amino acids to form the proteins, which participate in cell enlargement and cell division. While phosphorus has an important role in producing energy for the physiological processes as synthesis proteins by formation the coenzyme adenine triphosphate (ATP).

Effect of chemical fertilizer, chicken manure and bacteria inoculation treatments on the fresh and dry weights of vegetative growth on *Brassica alba*, L plant.

The data presented in Table 6 show that herb fresh and dry weights per plant gradually increased by using the treatments of 10 m^3/fed. chicken manure plus bacteria inoculation phosphate solving bacteria. Moreover, addition these treatment gave the highest values of fresh and dry weights of total plant (881.6 g. - 971.4g.) and (132.5g. - 115.2g.) in the first and second seasons, repectively and showed significant increase compared to the other treatements under study. These results were similar to those found by Abd- Allah *et al*. (2001) mentioned that application of biofertilizers (Biogene and Nitrobien) improved vegetative growth of egg plants and increases the fresh and dry weights per plant, Abd EL-Latif *et al.* (2002) obtained the maximum values of plant height, number of branches/plant, fresh and dry weights of *Matricaria chamomill,* L. plants when received biofertilizer treatment of 4 kg Biogene / faddan. Also, Shalan (2004) on borage plants using biofertilizers application plus organic manure, Sakr (2005) on senna plants using organic-inorganic and biofertilizers they found that al organic and biofertilizers treatements increased plant growth under study .

Effect of chemical fertilizer, chicken manure and bacteria inoculation treatments on the seed yield components on *Brassica alba*, L plant:

In table (7) data show that average between the treatments it is clear in both seasons. It can be concluded that ChM at the half dose supplemented with PSB increased the seed yield components during both seasons. Data also reveal that there were significant differences among treatments in the two seasons. Also, the superior treatment which increased yield and its component; viz, number of pods per plant (703.6 g – 723.6 g), dry weight of 100 seeds was (0.5997g - 0.6967 g), weight of 100 pods was (16.30g – 16.60 g), fresh and dry weights of pods per plant. (1146.8g – 1179.4g and 820.5g–967.5 g/plant in the first and second seasons respectively) that application of ChM 10 m^3/fed. with PSB was the superior interaction treatment, which significantly increased all yield parameters . In the other hand, seeds dry weight per plant (g) and per fed.(kg) recorded highly significant increase by using the same treatment compared to the other treatments

These results are in accordance with those reported by Yadav and Khurana (2000) on fennel reported who that seed treatment with azotobacter improved number of umbels / plant, seeds / umbel and total seed yield.

The increments of total yield and its components due to application of ChM + PSB may be owe to a balanced C/N ratio in plants which had moderately growth, and consequently good fruit set leading to an increase in number and weight of fruits per plant. On the other hand, the reduction in total yield via application of PSB may be owe directly to the inhibition effect on plant growth as shown in Table (7) and reduction in number and weight of seed per plant. These results are in agreements with those reported by Baboo and Rana (1995) on coriander, Singh (1998) on coriander and Garg *et al.*, (2004) on fennel they reported that using bacteria inoculated by Azotobacter improved number of umbels/plant, seeds/umbel and total seed yield..

The increments of total yield due to ChM+PSB application may be owe to the increments in, plant growth expressed as fresh weight of roots, leaves, stem and total fresh weight per plant; and dry weight per plant . In this respect, Attia and Saad (2001) on *Catharanthus roseus*,L. plants, Badr El-Din *et al.*, (2001) on *Trigonella foenum-greacum, L. and* Harridy *et al*., (2001) on lemongrass plants mentioned that the highest total yield of fresh and dry herb were obtained by the plants inoculated with *Azotobacter* without NPK fertilizers. Zayed *et al.*, (2004) on borage plants (*Borago officinalis*, L.) showed that treating plants with Nitrobein increased the yield especially at the rate of 600 gm/kg seeds compared with the other treatments.

Effect of chemical fertilizer, chicken manure and bacteria inoculation treatments on the chemical constituents of *Brassica alba*, L plant.

The data of nitrogen, protein, phosphorus, potassium and total carbohydrates percentages in dried leaves of plants were shown in Table (8). The results clearly demonstrated that, ChM at the half dose plus phosphate solving bacteria caused a slight increase in the percentage of chemical constituents in the leaves during both season. However, the differences between inoculation treatments and control were a high significant in the first and the second season. These findings are in agreement with those obtained by Ali (2002) on *Corianrum sativum*, L. plants, and Helmy (2003) on roselle. Apparently, it is well known that phosphate solubilizing bacteria might enhance the phosphorylation via increased available-P in soil hence improved phosphorus percentage in leaves. Also these results might be due to that, phosphorine raised the available phosphorus in the soil and the plant tissues. As it is known that phosphorus is a constituent of nucleic acids, phospholipids the coenzymes NAD and NADP and most important as a consistent of ATP, thereby, phosphorus could significantly altered plant carbohydrate contents .

Effect of chemical fertilizer, chicken manure and bacteria inoculation treatments on the fixed oil yield of *Brassica alba*, L plant.

The fixed oil percentage in dry seeds as affected by chicken manure and biofertilization (PSB) are shown in Table (9) showed that organic manure as ChM at the half dose plus phosphate solving bacteria had a significant effect on fixed oil percentage in both seasons. In the second season gave the fixed oil percentage in dry seed (28.15%) compared to (27.45) in the first season it gave highest It did not differ significantly for all treatments in both seasons. These results are in accordance with those reported by, Harridy *et al*. (2001) on lemongrass, Shalan *et al.,*(2001) on chamomile Khater *et al.,* (1996) on *Hibiscus sabdariffa*, L plant, Eid and EL-Ghawwas (2002) on marjoram, Abdel-Kader and Ghaly (2003) on coriander plant. Concerning oil yield/ plant and per fed., which showed the highest values of oil yield per fed. by ChM at the half dose supplemented with PSB in the first and second seasons.

Effect of chemical fertilizer, chicken manure and bacteria inoculation treatments on the plant pigments on *Brassica alba*, L plant.

Data illustrated the effect of (PSB) biofertilizer on chlorophyll a, chlorophyll b and carotenoids in leaves were presented in Tables (10). It revealed that in both seasons, application of (PSB) caused a significant increase in chlorophyll a, b and carotenoids of plant leaves if compared with other treatments in the two seasons. These findings may prove that the beneficial effect of inoculation with phosphate solving bacteria it was mainly increasing the release of phosphorus in the soil which is reflected in increasing phosphorus activity and the growth promoting substances produced by them. Also, the role of phosphorus in stimulated chlorophyll synthesis through encourages pyridoxal enzymes formation which plays an important role in α-amino levulinic acid synthetase as a primary compound in chlorophyll synthesis. The obtained results are in harmony with those obtained by Ali (2002) on *Corianrum sativum*, L. plant.

This increase led to an increment in the number of chloroplasts in the leaf, inducing chlorophyll synthesis and an increase cytokinin content. Cytokinin is known to delay senescence of plant tissue through its effect on reducing the loss of chlorophyll . Similar results on leaf pigments were also reported by Abd EL-Fattah and Sorial (2000) on squash, Abdel-Mouty (2000) on cowpea and Abdou (2003) on *Chrysanthemum morifolium*, L.

The above mentioned results agreed with those obtained by Abou-Aly and Gomaa (2002) on *Corianderum sativum*, L.

Table (5): Effect of chemical fertilizer, chicken manure and bacteria inoculation treatments on the morphological characters of *Brassica alba,* L. plant during successive seasons (2008/2009 and 2009/2010).

Treatments		Characters					
		Plant height (cm)	No. of leaves/plant	No. of branches/plant	Stem diameter (mm)	Root length (cm)	No. of root branches'
	BI	First season 2008/2009					
100 % NPK	O	125.3 bc	84.67 c	23.67 bc	10.37 c-e	20.67 ab	25.33 c-e
50 % NPK	NFB	106.3 c	50.00 d	24.33 bc	10.07 e	12.43 b	21.00 e-g
	PSB	115.3 c	47.33 d	22.33 bc	9.967 e	10.20 b	17.67 fg
	KRB	101.7 c	48.33 d	19.00 c	10.03 e	16.43 ab	17.33 g
	NFB+PSB+KRB	143.0 b	50.00 d	27.33 ab	10.20 de	14.63 ab	22.67 e-g
50 % NPK+50%ChM	O	224.3 a	112.3 b	27.33 ab	11.33 ab	19.53 ab	29.33 b-d
100 % ChM	O	227.0 a	168.0 a	28.00 ab	11.60 a	20.50 ab	40.67 a
50 % ChM	NFB	227.3 a	172.7 a	28.00 ab	10.97 a-c	21.33 ab	30.67 bc
	PSB	228.0 a	177.7 a	32.00 a	11.40 ab	25.50 a	33.33 b
	KRB	209.3 a	73.00 c	23.67 bc	10.77 b-d	18.03 ab	23.00 e-g
	NFB+PSB+KRB	216.0 a	82.00 c	27.33 ab	11.17 ab	19.07 ab	24.00d e-g
		Second season 2009/2010					
100 % NPK	O	118.5 g	84.67 c	20.00 d-f	11.03 bc	17.00 ab	25.00 cd
50 % NPK	NFB	141.7 f	47.00 d	22.33 cd	11.07 bc	18.00 ab	22.33 d
	PSB	147.1 f	47.33 d	18.33 f	10.73 c	15.00 b	20.00 d
	KRB	146.7 f	46.00 d	19.33 ef	10.90 c	16.00 b	19.33 d
	NFB+PSB+KRB	202.7 e	50.00 d	19.33 ef	12.20 a	17.33 ab	24.67 cd
50 % NPK+50%ChM	O	229.3 b-d	110.7 b	23.67 c	11.50 a-c	18.33 ab	30.00 bc
100 % ChM	O	236.0 a-c	112.3 b	26.67 b	11.33 bc	18.67 ab	32.00 ab
50 % ChM	NFB	238.0 ab	162.0 a	29.67 a	11.47 a-c	20.67 ab	33.00 ab
	PSB	249.7 a	165.0 a	30.33 a	11.77 ab	23.67 a	36.67 a
	KRB	218.3 d	88.00 c	19.67 d-f	11.20 bc	17.00 ab	22.33 d
	NFB+PSB+KRB	222.7 cd	89.33 c	21.67 c-d	11.27 bc	17.67 ab	24.00 d

100% NPK = Chemical fertilizer as 150 kg. of ammonium sulphate; 150 kg. of Super phosphate and 75 kg. of potassium sulphate/fed. BI = bacteria inoculation, NFB = Nitrogen Fixing Bacteria, PSB = "Phosphate Solving Bacteria, KRB = Potassium release Bacteria and 100% ChM = Organic fertilizer as chicken manure 20 m^3/fad.

Table (6): Effect of chemical fertilizer, chicken manure and bacteria inoculation treatments on the fresh and dry weights of *Brassica alba,* L. plant during successive seasons (2008/2009 and 2009/2010).

Treatments		Characters							
		Fresh weights of				Dry weights of			
		Leaves (g)	Shoots (g)	Roots (g)	Total Plant (g)	Leaves (g)	Shoots (g)	Roots (g)	Total plant (g)
	BI	First season 2008/2009							
100 % NPK	O	241.9 d	152.0 ef	33.46 de	427.3 ef	21.01de	10.69 e	16.32 ab	37.48 f
50 % NPK	NFB	237.7 d	106.5 ef	16.53 f	360.7 f	15.95ef	6.82 e	4.93 de	27.70 fg
	PSB	161.7 e	92.97 ef	23.73 ef	278.4 g	16.17ef	6.06 e	4.63 e	26.86 fg
	KRB	287.8 c	89.67 f	15.47 f	392.9 f	13.04f	3.88 e	4.79 de	21.72 g
	NFB+PSB+KRB	335.5 b	112.4 ef	23.33 ef	471.2 de	14.29f	7.33 e	6.32 de	27.94 fg
50 % NPK+50%ChM	O	351.5 ab	309.6 cd	85.50 b	766.8 c	28.46bc	27.31 cd	15.10 ab	70.87 cd
100 % ChM	O	367.0 ab	501.6 a	78.73 bc	947.3 a	30.83b	32.64 c	16.42 ab	79.89 c
50 % ChM	NFB	379.2 a	366.8 bc	79.33 bc	825.4 bc	51.20a	48.65 b	16.65 ab	116.5 b
	PSB	380.2 a	415.9 b	105.6 a	881.6 ab	53.16a	61.62 a	17.68 a	132.5 a
	KRB	272.5 cd	159.7e	64.13 c	496.4 de	20.40de	23.24 d	9.16 cd	52.81 e
	NFB+PSB+KRB	159.5 e	295.4 d	47.13 d	502.1 d	25.11cd	21.92 d	12.36 bc	59.39 de
		Second season 2009/2010							
100 % NPK	O	268.6 ef	165.9 cd	37.25 de	471.7 de	26.5 bc	17.48 ef	6.327 f	50.32 ef
50 % NPK	NFB	232.7 fg	145.3 cd	40.69 cd	418.6 e	17.83 de	14.09 f	7.360 f	41.32 fg
	PSB	186.2 g	111.3 d	28.21e	518.7de	15.93 e	13.09 f	6.467 f	35.48 g
	KRB	326.0 cd	187.5 cd	48.31 c	561.8 c-e	27.47 bc	20.82 de	10.17 ef	58.46 de
	NFB+PSB+KRB	359.0 b-d	248.4 bc	61.17 b	669.3 b-d	23.07 cd	26.03 cd	13.93 de	63.03 d
50 % NPK+50%ChM	O	333.1 b-d	318.3 b	80.23 a	731.5 bc	29.44 ab	32.49 c	19.16 bc	81.09 bc
100 % ChM	O	373.5 a-c	362.3 ab	82.46 a	818.3 ab	31.35 ab	41.40 b	19.35 bc	92.09 b
50 % ChM	NFB	384.6 ab	363.7 ab	85.87 a	834.1 ab	32.19 ab	51.47 a	20.74 ab	104.4 a
	PSB	424.0 a	459.5 a	87.99 a	971.4 a	34.3 9a	56.61a	24.17 a	115.2 a
	KRB	304.6 de	259.2 bc	67.68 b	631.5 b-d	27.86 bc	26.69 cd	15.75 cd	70.30 cd
	NFB+PSB+KRB	179.0 g	179.9 cd	33.97 de	392.8 e	21.64 c-e	27.55 c	16.53 b-d	65.72 d

100% NPK = Chemical fertilizer as 150 kg. of ammonium sulphate; 150 kg. of Super phosphate and 75 kg. of potassium sulphate/fed. BI = bacteria inoculation, NFB = Nitrogen Fixing Bacteria, PSB = "Phosphate Solving Bacteria, KRB = Potassium release Bacteria and 100% ChM = Organic fertilizer as chicken manure 20 m^3/fad.

Table (7): Effect of chemical fertilizer, chicken manure and bacteria inoculation treatments on seed yield components of *Brassica alba*, L plant during successive seasons (2008/2009 and 2009/2010).

Treatments		Characters						
		No. of pods/plant	Dry weight of 100 seeds (g)	Dry weight of 100 pods (g)	Seeds dry weight /plant (g)	Pods fresh Weight/ Plant (g)	Pods dry weight /plant (g)	Seeds yield /fed (kg)
	BI	First season 2008/2009						
100 % NPK	O	236.3 d	0.5432 a	15.20 ab	49.07 c	359.1 ef	115.9 f	1046.8 bc
50 % NPK	NFB	185.9 e	0.4667 b	16.10 a	43.45 c-e	299.2 f	112.4 f	926.91 bc
	PSB	243.5 d	0.2667 d	15.94 ab	33.04 de	388.1 d	126.8 ef	704.84 bc
	KRB	145.7 e	0.5867 a	15.30 ab	41.52 c-e	222.9 ef	79.17 g	885.74 bc
	NFB+PSB+KRB	258.7 d	0.4697 b	13.13 d	50.42 c	339.6 d	147.8 e	1075.6 b
50 % NPK+50%ChM	O	341.8 c	0.3833 c	15.53 a	59.88 b	530.8 c	278.8 c	1276.9 b
100 % ChM	O	643.2 b	0.5363 a	13.47cd	64.90 a	866.3 b	521.1 b	1384.5 ab
50 % ChM	NFB	181.6 f	o.5000 a	13.40 cd	40.69 c	109.3 e	83.7 ef	654.7 C
	PSB	703.6 a	0.5997 a	16.30 a	67.81 a	1146.8 a	820.5 a	1446.3 a
	KRB	185.9 e	0.5333 a	12.53 d	42.76 c-e	232.9 d	136.2 ef	912.19 bc
	NFB+PSB+KRB	306.5 c	0.5333 a	13.70 cd	48.54 cd	419.9 c	244.2 d	1035.8 ab
		Second season 2009/2010						
100 % NPK	O	253.6 d	0.5076 a	15.20 ab	30.05 ab	385.4 ef	113.9f	641.0 b
50 % NPK	NFB	273.3 b	0.4333 b	10.1 of	25.45 ab	187.7 ef	138.6 cd	542.9 b
	PSB	123.4 d	0.2697 d	12.2 i	24.12 b	297.0 a	245.8 bc	d 514.5
	KRB	197.5 e	0.5667 a	15.30 ab	24.56 b	222.1 ef	79.17 g	cd 523.9
	NFB+PSB+KRB	148.9 bc	0.4667 a	14.0 e	32.08 ab	362.1 a	275.6 b	684.3 b
50 % NPK+50%ChM	O	159.2 a-c	0.3963 c	13.6 c	33.99 ab	464.8 a	374.2 a	725.1 b
100 % ChM	O	682.3 b	0.5387 a	13.47 cd	40.49 a	866.3 a b	311.1 b	864.7 ab
50 % ChM	NFB	81.6 f	0.5084 a	13.40 cd	20.85 cd	243.3 e	130.7 ef	444.7 d-e
	PSB	723.6 a	0.6967 a	16.60 a	45.80 a	1179.4 a	967.5 a	977.0 a
	KRB	185.9 e	0.5333 a	12.53 d	24.56 b	232.9 d	136.2 ef	523.9 c
	NFB+PSB+KRB	152.7 a-c	0.4754 b	12.1 d	29.59 ab	370.8 a	278.9 a	631.2 bc

100% NPK = Chemical fertilizer as 150 kg. of ammonium sulphate; 150 kg. of Super phosphate and 75 kg. of potassium sulphate/fed. BI = bacteria inoculation, NFB = Nitrogen Fixing Bacteria, PSB = "Phosphate Solving Bacteria, KRB = Potassium release Bacteria and 100% ChM = Organic fertilizer as chicken manure 20 m^3/fad.

Table (8): Effect of chemical fertilizer, chicken manure and bacteria inoculation treatments on chemical constituents of *Brassica alba*, L. plant during successive seasons (2008/2009 and 2009/2010).

Treatments		Characters				
		N %	P %	K %	Total carbohydrates %	Protein %
	BI	First season 2008/2009				
100 % NPK	O	3.200 ab	0.5333 b	2.801 ab	3.97 e	7.2 ab
50 % NPK	NFB	3.333 ab	0.5933 ab	2.535 ab	3.57 h	7.4 ab
	PSB	5.233 a	0.5800 ab	2.412 b	4.00 d	11.7 a
	KRB	3.367 ab	0.5700 ab	2.735 ab	2.94 i	7.65 ab
	NFB+PSB+KRB	3.733 ab	0.5200 b	2.821 ab	3.92 f	8.39 ab
50 % NPK+50%ChM	O	5.233 a	0.6467 ab	3.140 ab	4.15 b	12.6 a
100 % ChM	O	5.600 a	0.6667 ab	3.321 ab	3.65 g	12.7 a
50 % ChM	NFB	5.667 a	0.7033 ab	3.124 ab	2.65 k	12.9 a
	PSB	5.767 a	0.7433 a	3.907 a	5.06 a	12.9 a
	KRB	1.333 b	0.6267 ab	2.599 ab	4.13 c	8,0 b
	NFB+PSB+KRB	3.567 ab	0.6367 ab	2.730 ab	2.85 j	11.11 ab
		Second season 2009/2010				
100 % NPK	O	3.433 ab	0.5967 a-d	2.797 ab	2.37 k	7.72 ab
50 % NPK	NFB	3.333 ab	0.5833 b-d	2.663 ab	2.71 i	7.49 ab
	PSB	2.367 b	0.5433 cd	2.348 b	2.82 h	5.31 b
	KRB	3.467 ab	0.5133 d	2.907 ab	3.08 c	7.80 ab
	NFB+PSB+KRB	3.700 ab	0.5667 B-d	2.987 ab	2.99 f	8.325 ab
50 % NPK+50%ChM	O	4.933ab	0.6200 a-c	3.072 ab	3.45 b	11.92 ab
100 % ChM	O	5.300ab	0.6300 a-c	2.987 ab	2.96 g	13.65 ab
50 % ChM	NFB	6.067a	0.6567 ab	3.047 ab	3.06 d	10.72 a
	PSB	4.767ab	0.6900 a	3.413 a	3.98 a	13.42 ab
	KRB	5.967a	0.5567 b-d	2.630 ab	3.01 e	7.49 a
	NFB+PSB+KRB	3.333ab	0.5367 cd	2.637 ab	2.54 j	11.09 ab

100% NPK = Chemical fertilizer as 150 kg. of ammonium sulphate; 150 kg. of Super phosphate and 75 kg. of potassium sulphate/fed. BI = bacteria inoculation, NFB = Nitrogen Fixing Bacteria, PSB = "Phosphate Solving Bacteria, KRB = Potassium release Bacteria and 100% ChM = Organic fertilizer as chicken manure 20 m^3/fad.

Table (9): Effect of chemical fertilizer, chicken manure and bacteria inoculation treatments on fixed oil yield of *Brassica alba*, L. plant during successive seasons (2008/2009 and 2009/2010).

Treatments		Characters		
		oil Fixed %	oil yield/plant Fixed (ml)	oil yield/fed Fixed (L)
	BI		First season 2008/2009	
100 % NPK	O	26.00 a	12.75 c	272.1 b
50 % NPK	NFB	20. 99 ab	9.12 d	194.5 d
	PSB	26.14 a	8.63 d	183.2 d
	KRB	22.17 ab	9.20 c	196.2 d
	NFB+PSB+KRB	18.79 b	9.47 c	202.1 c
50 % NPK+50%ChM	O	24.50 ab	14.67 a	312.9 a
100 % ChM	O	20.35 ab	13.20 b	281.7 b
50 % ChM	NFB	25.38 a	17.25 a	139.9 e
	PSB	26.45 a	8.42 e	397.o a
	KRB	21.94 b	9.38 d	200.1 d
	NFB+PSB+KRB	24.85 ab	12.03 b	257.3 b
			Second season 2009/2010	
100 % NPK	O	24.35 a	7.31 b	156.0 b
50 % NPK	NFB	21.50 ab	5.47 e	116.6 c
	PSB	26.75 ab	5.64 c	137.6 c
	KRB	22.87 b	5.61 d	119.6 c
	NFB+PSB+KRB	19.96 b	6.40 c	136.5 bc
50 % NPK+50%ChM	O	25.18 ab	8.55 a	182.5 a
100 % ChM	O	25.52 ab	10.3 c	220.3 b
50 % ChM	NFB	27.43 ab	5.71 c	121.9 a
	PSB	28.15 a	12.56 a	275.0 a
	KRB	21.38 ab	5.25 d	112.0 c
	NFB+PSB+KRB	25.65 ab	7.58 b	225.0 b

100% NPK = Chemical fertilizer as 150 kg. of ammonium sulphate; 150 kg. of Super phosphate and 75 kg. of potassium sulphate/fed. BI = bacteria inoculation, NFB = Nitrogen Fixing Bacteria, PSB = "Phosphate Solving Bacteria, KRB = Potassium release Bacteria and 100% ChM = Organic fertilizer as chicken manure 20 m^3/fad.

Table (10): Effect Effect of chemical fertilizer, chicken manure and bacteria inoculation treatments on plant pigments of *Brassica alba*, L. plant during successive seasons (2008/2009 and 2009/2010).

Treatments		Characters			
		Chlorophyll A (mg/g)	Chlorophyll B (mg/g)	chlorophyll Total	Carotenoids (mg/g)
	BI	First season 2008/2009			
100 % NPK	O	0.545 d	0.832 de	1.37	3.388 c
50 % NPK	NFB	0.637 bc	1.053 b	1.69	2.370 e
	PSB	0.652 a-c	0.860 d	1.51	1.926 f
	KRB	0.135 fg	1.097 b	1.23	2.444 d
	NFB+PSB+KRB	0.608 c	0.885 d	1.49	1.831 g
50 % NPK+50%ChM	O	0.180 f	0.305 f	0.48	0.529 h
100 % ChM	O	0.479 e	0.970 c	1.44	3.505 b
50 % ChM	NFB	0.512 de	0.784 e	1.29	1.797 g
	PSB	0.703 a	1.888 a	2.59	3.566 a
	KRB	0.692 ab	1.054 b	1.74	0.550 h
	NFB+PSB+KRB	0.092 g	0.131 g	0.22	0.235 i
		Second season 2009/2010			
100 % NPK	O	0.523 d	0.576 g	1.09	2.522 g
50 % NPK	NFB	0.463 e	0.551 g	1.01	3.037 d
	PSB	0.253 f	1.268 cd	1.52	2.824 e
	KRB	0.254 f	1.274 b-d	1.52	2.460 h
	NFB+PSB+KRB	0.637 ab	1.329 b	1.96	3.079 d
50 % NPK+50%ChM	O	0.463 e	0.463 h	0.92	3.309 b
100 % ChM	O	0.611 b	1.078 e	1.68	2.672 f
50 % ChM	NFB	0.540 cd	0.923 f	1.46	2.181 i
	PSB	0.681 a	1.445 a	2.12	3.523 a
	KRB	0.506 de	1.310 bc	1.81	3.204 c
	NFB+PSB+KRB	0.592 bc	1.228 d	1.82	3.205 c

100% NPK = Chemical fertilizer as 150 kg. of ammonium sulphate; 150 kg. of Super phosphate and 75 kg. of potassium sulphate/fed. BI = bacteria inoculation, NFB = Nitrogen Fixing Bacteria, PSB = "Phosphate Solving Bacteria, KRB = Potassium release Bacteria and 100% ChM = Organic fertilizer as chicken manure 20 m^3/fad.

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تاثير معاملات التسميدالكيماوى وسبلة الدواجن والتلقيح البكتيرى على انتاجية نباتات الخردل الابيض تحت ظروف شمال سيناء

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تم اجراء هذا العمل خلال مواسم الشتاء من 2009/2008 و2010/2009 بمزرعة تجارب الزينة والنباتات الطبية ، كلية العلوم الزراعية البيئية بالعريش ، جامعة قناة السويس، شمال سيناء ، لدراسة تأثير أنواع مختلفه من الأسمدة ، وهى الأسمدة الكيماوية جرعة كامله (150 كجم سلفات الامونيوم و150 كجم سوبر فوسفات الكالسيوم و 75 كجم سلفات بوتاسيوم(NPK)/فدان وسماد ألدواجن (CHM) 20 م3/فدان جرعه كامله و ثلاثة أنواع من التلقيح البكتيري وهى التلقيح بالبكتيريا ألمذيبه للفوسفات (PSB) ، البكتيريا ألمثبته للنتروجين (NFB) والبكتيريا الميسره للبوتاسيوم (KRB) ونصف الجرعه من التسميد الكيماوى مضافا اليها كل نوع من البكتريا على حده بالإضافه الى نصف الجرعه مضافا اليها خليط من ألثلاث أنواع من البكتريا ، ونصف الجرعه من سماد الدواجن 10 م3/فدان مضافا اليها كل نوع من البكتريا ونصف الجرعه من سماد الدواجن 10 م3/فدان مضافا إليها خليط من الثلاث أنواع من البكتريا ودراسة تأثير هذه المعاملات على النمو وانتاجية البذور والزيت الثابت لنبات الخردل الأبيض *Brassica alba*. حيث أظهرت النتائج المتحصل عليها:

أن اضافة سماد الدواجن 20م3/فدان (الجرعة الكاملة) وحدها ،اواضافة سماد ألدواجن 10 م3/فدان. (نصف الجرعة) بالاضافة الى البكتيريا المثبته للنتروجين (NFB) اواضافة سماد الدواجن (نصف الجرعة) بالاضافه الى التلقيح بالبكتيريا المذيبه للفسفور ادت الى زيادة جميع صفات النمو الخضرى والبدور والزيت الثابت والمكونات الكيميائيه بالنبات مقارنه بالتسميد الكيماوى منفردا

أيضا أدت إضافة نصف الكميه من سماد ألدواجن مع البكتريا المذيبه للفوسفور إلى زياده كل قياسات النمو مثل الأوزان الطازجه والجافه لكلا من الأوراق والجذور والسيقان وكذلك عدد تفرعات ساق النبات . ايضا سجلت نفس المعامله السابقه اعلى محتوى للصبغات فى الأوراق ومحتواها من النتروجين والفسفور والبوتاسيوم والكربوهيدرات . أيضا، اضافة سماد الدواجن مع البكتريا المذيبه للفسفور اعطت اعلى محصول للبذور والزيت الثابت حيث اتضح تاثير معاملات اضافة نصف الجرعه من سماد الدواجن بالاضافه الى البكتيريا المثبته للنتروجين بزيادة عدد ووزن الثمار للنبات والفدان فى كلا الموسمين .

من النتائج السابقة يتضح أنة لإنتاج محصول عالى من بذور نبات الخردل الابيض ذات محتوى عالى من الزيت الثابت ينصح بإستخدام السماد الحيوى بتلقيح التربه بإضافة البكتريا المذيبه للفوسفات مع نصف الكميه الموصى بها من السماد العضوى او سماد الدواجن تليها المعامله باستخدام التسميد العضوى بسبلة الدواجن 10 م3/فدان مضافا اليه البكتريا المثبته للنتروجين بهدف انتاج نباتات طبيه خاليه من بقايا المواد الكيميائيه .