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EFFECT OF CONVENTIONAL AND BIO FERTILIZERS ON GROWTH AND PEST CONTROL OF COMMON BEAN PLANTS, *PHASEOLUS VULGARIS* L. UNDER TWO CLIMATIC ECO SYSTEM

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ABSTRACT: A field experiment was conducted under open field and net-covered greenhouse at El-Qanater Research Station Farm in Qalubiya Governorate, affiliated to Horticulture Research Institute, ARC Egypt, along two successive early summer seasons of 2020 and 2021 to investigate the effect of different types of bio fertilizers, compost and NPK on growth and yield of common bean (*Phaseolus vulgaris* L.). The population fluctuation of sap-sucking insect pests as aphid, *Aphid gosspyii* (Glov.), and white fly, *Bemisia tabaci* (Genn.) attacking common bean were studied. The obtained results indicated that the maximum air temperature (ºC) was decreased, but minimum air temperature (ºC) and the relative humidity % were increased under net-covered greenhouse compared with open field. The growth parameters i.e., plant length, number of leaves, number of branches, leaf area, stem diameter, fresh and dry weight were increased under net-covered greenhouse compare to open field. NPK content of leaves as well as yield and its components were increased compared with open field conditions. The half dose of NPK (50%) and nitrobein or Phosphoren gave the highest values of growth, nutrient content and yield, followed by the full dose of mineral fertilizer (100% NPK) compared with compost and control treatments. Using bio-fertilizers enhanced nutrients absorption for plants duo to the ability of those microorganism to solubilize the unavailable minerals in the soil and increased the efficiency of mixed dose of NPK fertilizer compared to individual full dose of NPK. The statistical analysis of the obtained data revealed that there were significant differences in white fly and aphid stages among most of the tested treatments under field conditions and green house. The highest infestation rates by whitefly and aphids were recorded at NPK fertilizer treatment, and the lower rates infestation were recorded at B.t and half recommended rate of NPK + Nitrobein treatments, under field conditions of 2020/2021 season. The highest reduction percentages of whitefly and aphid populations were recorded in the treatments of B.t, resulting 66.35, 59.71, 63.78 and 75.82 % under open field and green house conditions of the first and second seasons, for white fly, and 70.76, 69.66, 51.39 and 89.9 % for aphid respectively, followed by the treatments of half recommended rate of NPK + Nitrobein and half recommended rate NPK + Phosphoren. On the other hand, the lowest reduction percentages were recorded in treatments of one recommended rate of NPK and compost under open field and green house conditions of the first and second seasons.

Key words: Common bean, Nitrobein, Phosphoren, Compost, NPK, Aphids, Whitefly.

INTRODUCTION

Common bean, *Phaseolus vulgaris* L. is an important vegetable crop in Egypt. It`s a rich source of protein as an alternative source for vegetarian people instead meat or chicken. So, almost of the poors depend on it as a suitable food. The total cultivated area of common bean in Egypt is 126,404 feddan produce about 136,046 tons of dry seeds (MALR, 2019).

Climatic factors play an essential role for plant growth, yield as well as plant protection from pests either in open field or under greenhouse conditions. Common bean is annual crop and prefer the warm climate, the optimum temperatures are 18-24, 30 and 20 ºC for growth, flowering and yield, respectively (du Plessis *et al*., 2009). Temperature is an essential factor in plant living process such as growth and

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development due to its effect on soil microorganism's activation and metabolism processes in the plant i.e., photosynthesis and respiration Mondal *et al*. (2016). Net covered greenhouse affected the microclimate which decreased maximum temperatures and increased minimum temperatures and relative humidity as well and led to enhancing the growth parameters (Mortensen, 1986 and Medany *et al.*, 2009). Maintaining an optimum average daily air temperature as well as relative humidity are crucial for pollen development also for maintaining a good anther for almost vegetable plants so, greenhouse technology is a flexible solution for sustainable year-round cultivation of almost vegetable crops (Shamshiri *et al*., 2018).

Nowadays, food security and sustainable agricultural production are important agricultural issues which need to provide an alternative method of plant nutrition instead chemical fertilizers to produce safe food for humans, maintain of soil fertility and preserve of environment from pollution. Using compost with the mineral fertilizers not only enhanced the growth parameters and yield of beans but also enhanced the nutrients availability in the soil. Application of vermicompost or compost with only 50% of mineral fertilizer gave the highest yield and equaled full dose of mineral fertilizer (Fouda *el al.* (2017) and Abou El-Hassan *et al*. (2017). Using Rhizobium, Azotobacter and phosphorus solubilizing weather individual or combined enhanced the plant growth, flowering and yield of bean plants and save high amount of nitrogen fertilization led to increase the economic return Ganie *et al*. (2009) and Abdel-Aziz and Ismail (2016). Common bean plants received chicken manure and NPK fertilizers gave the highest yield and using chicken manure only produced a good yield Alhrout *et al*. (2016). There were a strong relation between yield of beans and the leaf nutrients content and the regression value was 0.943 Almaliotis *et al*. (2007).

High temperature affected directly on pest spread and population dynamics as interaction between pests and environment Prakash *et al.*, (2014). Aphids and whitefly commonly encountered as serious pests of various crops in the open field and greenhouses Oliverira, 2001 and Roll, 2004. Aphid and whitefly cause two types of damage, direct damage and indirect damage Berlinger, (1986), where the direct damage happened by sucking plant sap from the plant foliage, while, indirect damage due to the accumulation of honeydew the good media for sooty mold fungi growth. Sap sucking are considered serious pests due to vectoring of plant viruses, so a small population of these pests is sufficient to cause considerable damage to the important crops *(*Francki, 1979, Cohen & Berlinger 1986, Conte 1998, Devasahayam 1998, Stansly *et al*., 2004 and Baiomy, 2008).

Therefore, our study directed to investigate the effect of different climatic conditions in open field and under greenhouse as well as the effect of bio and organic fertilizers on common bean growth and yield and their impact in controlling sap-sucking pests.

MATERIALS AND METHODS

Experimental layout

Experiments were carried out under field and greenhouse conditions on common bean, *Phaseolus vulgaris* L. plants cultivated at mid of February, during the two successive growing early summer seasons of 2020 and 2021 at El-Qanater Research Station Farm in Qaluobia Governorate, affiliated to Horticulture Research Institute, ARC Egypt. The experiments were carried out to investigate the effect of different bio, organic and chemical fertilizers on growth and productivity of common been plants as well as the population of pests under different climatic conditions. Eight fertilizers treatments were applied: 100% NPK (F1), 50% NPK + Nitrobein (F2), 50% NPK + Phosphoren (F3), Compost (F4), Nitrobein + Phosphoren (F5), Nitrobein (F6), Phosphoren (F7) and Control, no fertilizers application (C). Soil samples were collected from the experimental area two weeks before cultivation. The different samples were mixed in the laboratory and one sample was taken. The soil sample was dried in the open air and the physical properties were determined Table (1). Another sample was dried in the oven (105 ^{o}C) for three days and then chemical composition were determined and presented in Table (2). Soil was consists of Sand 14%, Silt 33%, Clay 53% classified as Clay.

The experiments were arranged as randomized complete block design (RCBD) with three replicates, where eight fertilizer treatments randomly distributed and replicated three times. There were 48 plots where 24 plots in open field and others in greenhouse (3 replicates x 8 treatments) where each plot area was 6.5 m^2 (1 m width x 6.5 m length). The total cultivated area in open field was 160 m^2 and the area under white net covered greenhouse was 360 m^2 (9 m x 40 m x 3.25 m). Agricultural practices were done as usual in greenhouse and open field. Drip irrigation system has been used during the experiment, the drip irrigation lines were GR and the distance between drippers was 30 cm and the flow rate was 4 L / h, each ridge bed included two drip lines 0.5 m a part. The fertilizer applications were implemented, where the bio-fertilizers were mixed with the seeds before cultivation, while the compost was mixed with the soil also before cultivation. Whereas, mineral fertilizers (N-P-K) whether 50% or 100% doses were applied to the soil beside the drippers at three times with 20 day intervals. The method of cultivation in open field was the same in greenhouse. Two seeds of beans were cultivated for each dripper so, the total number of plants in each plot was 60 plants. The total number of plants in greenhouse as well as open field were 2880 plants.

Experimental material:

Common beans (*Phaseolus vulgaris* L.) Giza 6 cultivar seeds provided from Agricultural Research Center (ARC).

Chemical fertilizers used as N-P-K 20%, N-20%, P_2O_5-20% , K_2O20% compound fertilizer which provided from commercial market of agricultural equipment and applied at the rate of 60 kg / feddan. The amount of chemical fertilizers were divided into three doses and were added during the growing season at 20 days interval.

Nitrobein and Phosphoren as bio-fertilizers provided from Ministry of Agriculture and Land Reclamation (MALR). Nitrobein is a complex biotic fertilizer contains Azotobacter which fixed the atmospheric nitrogen and a large group of microorganism which produce a growth promoters for roots system and applied at the rate of 5.7 g / plot. Phosphoren fertilizer contains very active species of bacterium which able to convert insoluble triple calcium phosphate to soluble calcium monophosphate in soil, and applied at the rate of 3.6 g / plot, and added as soil treatment

Compost is an organic material consists of a mixture from farm yard manure, field plant residues and effective microorganism which mixed and wetted by water and covered with a plastic sheet for about 3- 6 months depends on the season. The mixture was plowing weekly and used by the rate of 0.2 m^3 / plot. The analysis of used compost is shown in Table (2).

Table (1): Physical and chemical properties of experimental soil

pH (1:2.5)	EC (dS/m)	$CaCo_3$ (%)	OM%	Cations and anions (meq /L)					
				Ca	Mg	Na	K	Cl	HCO_3
8.1	2.2	14	0.4	6	3.1	18.4	1.3	12	2.5

Table (2): Chemical composition of used compost

EC (dS / m)	PH (1: 2.5)	OM (%)	C/N ratio	N (%)	P (%)	K (%)
2.1	8.2	27.3	19:1	0.61	0.42	0.63

Recorded data

Climatic data

Maximum and minimum air temperature (ºC) as well as relative humidity (%) were measured daily during the growing seasons, under greenhouse and open field by the meteorological station which follows Central Laboratory for Agricultural Climate (CLAC).

Growth pattern

Three bean plants were collected from each plot in three replicates after 60 days from sowing to measure the following characters i.e., plant length (cm), number of leaves, number of branches, stem diameter. In addition, the fourth leaf from apical growth tip of plant was collected and the leaf area (cm^2) was measured using (CI-203 LASER AREA METE). Plant fresh weight (g) and plant dry weight (g) were also measured. The average dry weight of plant sample was dried at 70 ºC in the oven. Besides, flower numbers / plant was estimated after 45 days from sowing.

Chemical composition

Samples of the fourth leaf from the apical growth tip of plant were dried at 70 ºC for three days, then it digested to determine N, P and K contents as follows: total nitrogen (%) in leaves was determined using the micro kjeldahl by A.O.A.C. (1990), Phosphorus (%) was determined calorimetrically at 550 nm and Potassium (%) was determined by flame photometer as described by Ranganna (1979).

Yield and its components

Number of pods per plant, average pod weight (g), average seed number per pod, average seed weight (g) per pod, average 100 seed weight (g) and the total yield of dry seeds in each treatment were estimated after harvesting (g / plant) as well as (kg / feddan) in both growing seasons.

Population dynamics of whitefly and aphid infesting common bean

This study was conducted under greenhouse and open field conditions, where weekly leaf samples were collected and transferred to laboratory to count whitefly *Bemisia tabaci*, and Aphid, *Aphis gossypii* stages. Samples of five leaves were chosen randomly early in the morning before the whitefly adults tend to be more active, Gameel (1973).

Effect of the bio pesticide, DiPel 20 DF, *Bacillus thuringiensis* on aphids and white fly

DiPel (*Bacillus thuringiensis*, var. *kurstaki*) 3200 International unit 6.4% WP (5.71 g/plot). The bio pesticide, DiPel 20 DF (Active ingredient: *Bacillus thuringiensis*, var. *kurstaki* strain ABTS-351 fermentation solids, spores, and insecticidal toxins. 57.0% *Potency: 32,000 Cabbage Looper Units (CLU) per mg (32 billion CLU per kg) was sprayed at the rate of 1 g/10 liter , three times every 30 days from planting with the aid of calibrated Hand-Held compression sprayer (Kwazar). Leaf composite samples were collected 30, 60, 90 days after pesticide application to count whitefly and aphid stages using dissecting stereomicroscope.

Statistical analysis

All obtained data were subjected to statistical analysis for variance by using Randomized complete blocks design (RCBD) as mentioned by Gomez and Gomez (1983) for calculating the least significant differences between treatments.

RESULTS

1- Climatic data

Air Temperature (ºC)

Maximum and minimum air temperatures (ºC) were measured by metiorological station nearby experemintal site under open field and greenhouse conditions as shown in (Figures 1 and 2). The obtained data observed that both of maximum and minimum air temperatures were slightly affected by different environmental conditions. In addition, maximum air tempertaures were decreased under greenhouse conditions compared with open filed in both growing seasons. On the contrery, minimum air temperatures were increased under greenhouse comparing with open field conditions in both growing seasons.

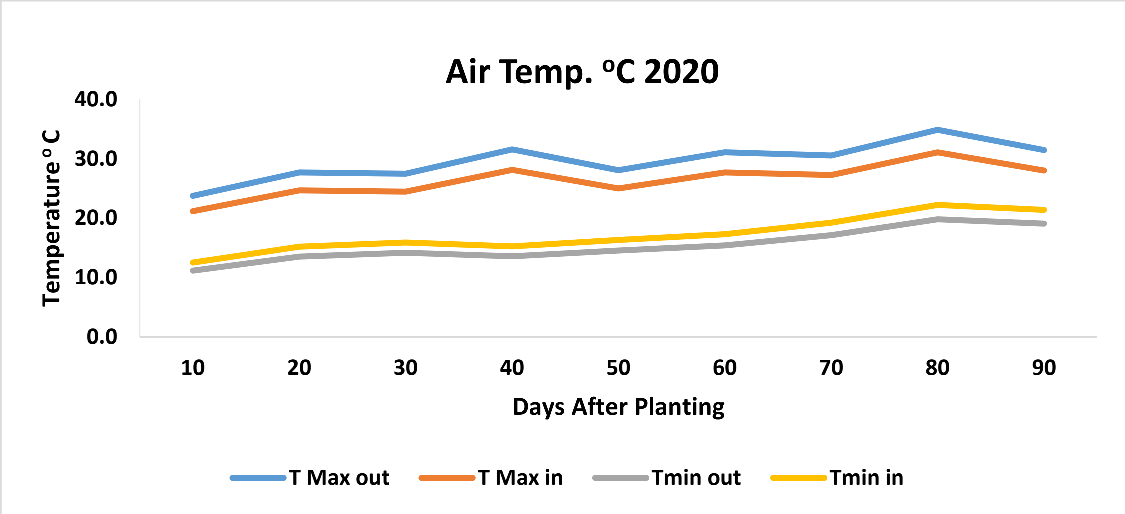

Figure 1: Maximum and Minimum air temperature under open field and greenhouse conditions during 2020 season

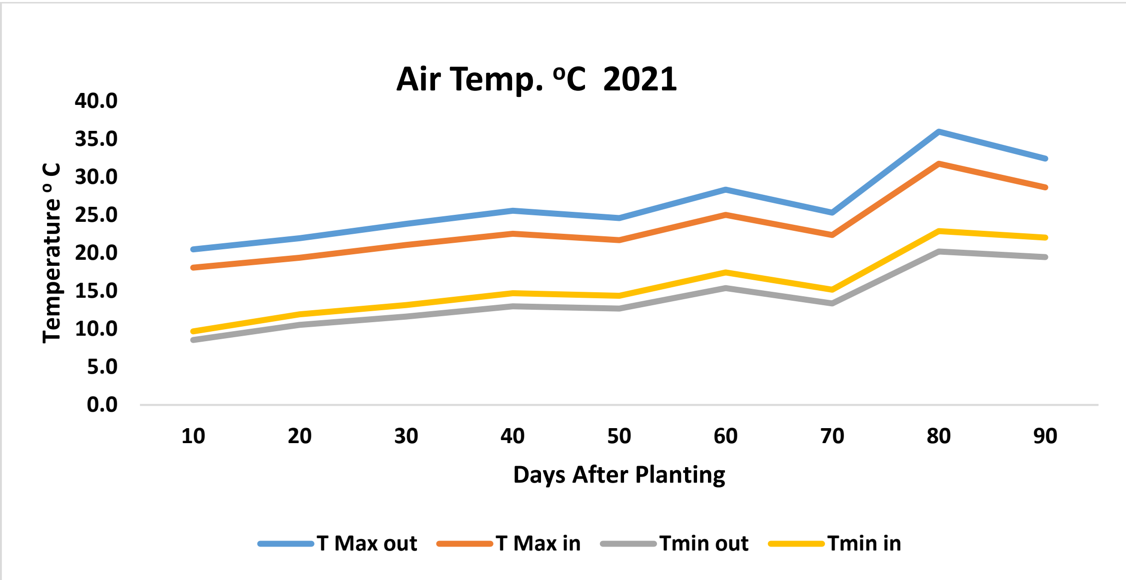

Figure 2: Maximum and Minimum air temperature under open field and greenhouse conditions during 2021 season.

Relative humidity (% RH)

Relative humidity (%) also measured in open field as well as greenhouse conditions during both growing seasons (Figures 3 and 4). Data cleared that relative humidity significantly increased under greenhouse conditions compared with open field during both growing seasons.

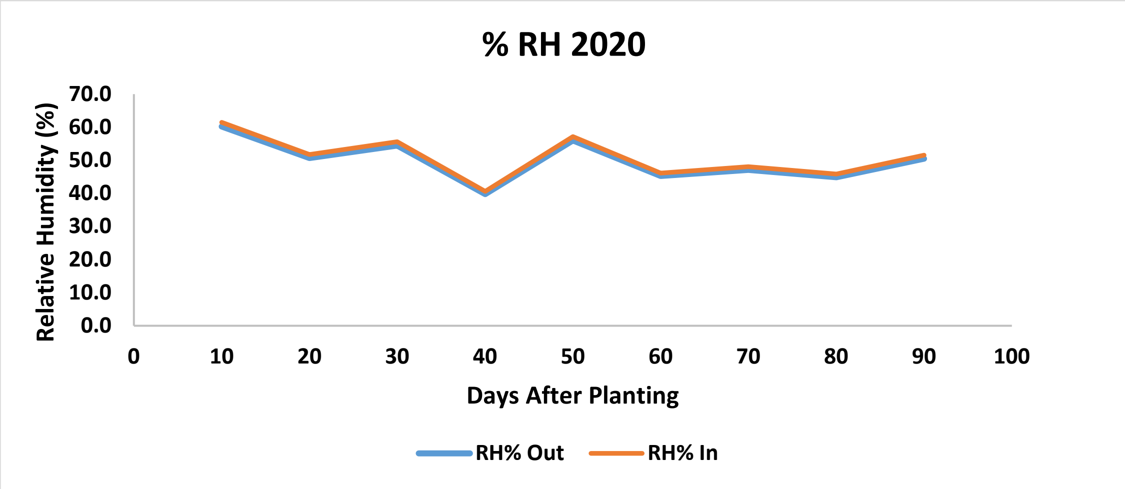

Figure 3: Relative humidity (%) under open field and greenhouse conditions during 2020 season.

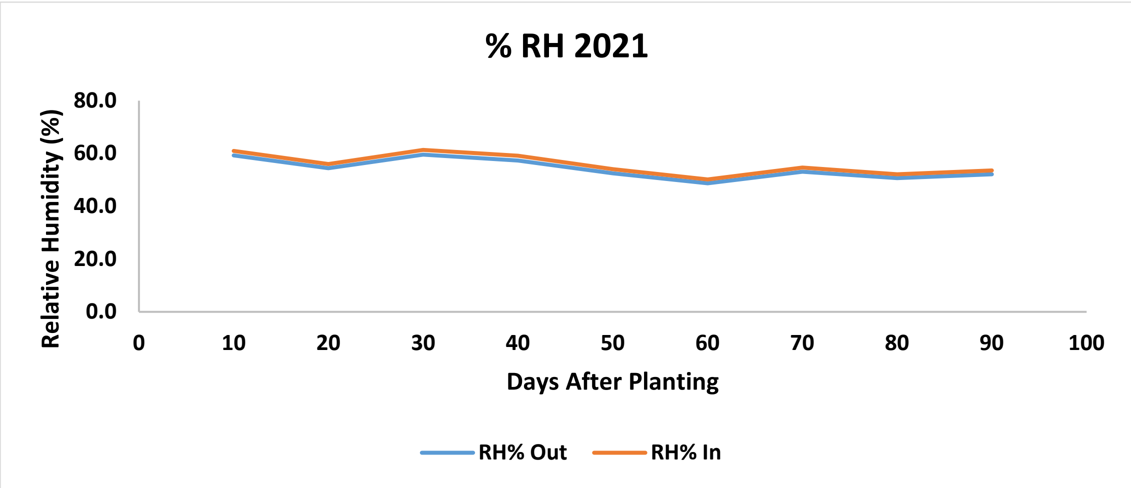

Figure 4: Relative humidity %in open field and greenhouse conditions during 2021 season.

Growth pattern

The growth parameters of common bean plants such as plant length, number of leaves, stem diameter, number of branches, leaf area and fresh and dry weight of plant were measured 60 days from sowing (DAS) in both growing seasons. Data in Table 3 (a, b & c) show the effect of climatic conditions and fertilizers on growth of common bean plants. Regarding to climatic conditions, growth parameters were better under greenhouse than open field conditions.

On the other hand, plants showed a different response for the type of used fertilizers. In this concern, application of 50% NPK + Nitrobein as well as 50% NPK + Phosphoren gave the highest values of growth parameters followed by Phosphoren then nitrobein. The treatment of 100% NPK ranked after those. The interactions between climate and fertilizers types had a significant effect on plant growth parameters. The best treatments were 50% NPK + Phosphoren or Nitrobein under greenhouse conditions which gave the highest values for growth parameters, whereas, the lowest values were obtained in the control of open field conditions.

Table (3-a): The effect of fertilizer types and climatic conditions on plant length (cm), No. of leaves and stem diameter (mm) of snap bean plants after 60 days from sowing date during two growing seasons.

Treatments	Plant length (cm)								
	F1	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**control**	**Mean**
	2020 season								
Open field	49.0 l	54.1 i	51.6 j	47.6 m	46.6 n	51.4 j	50.5 k	45.9 o	49.6 B
Greenhouse	59.0 e	65.1 a	61.8 b	56.9 f	56.0 g	61.1c	60.3 d	55.3 h	59.5 A
Mean	54.0 E	59.6 A	56.7 B	52.3 F	51.3 G	56.2C	55.4 D	50.6 H	
	2021 season								
Open field	44.93 l	55.16 i	52.66 j	48.53 m	47.5 n	52.36 j	51.5 k	46.76 o	5056 B
Greenhouse	60.8 e	67.03 a	63.7 b	58.63 f	57.7 g	62.93 c	62.13 d	57 h	61.24 A
Mean	55.35 E	61.08 A	58.18 B	53.58 F	52.61 G	57.67 C	56.82 D	51.9 H	
	No. of leaves								
	2020 season								
Open field	16.8 k	23.3 d	22.7 e	16.6 l	15.2 l	20.3 h	17.4 j	12.2 n	18.1 B
Greenhouse	20.6 g	28.5 a	27.1 b	19.8 h	18.4 i	24.5 c	21.0 f	14.5 m	21.8 A
Mean	18.7 E	25.9 A	24.9 B	18.2 F	16.8 G	22.4 C	19.2 D	13.3 H	
	2021 season								
Open field	17.26 k	23.96 d	23.36 e	17.1 l	15.7 l	20.93 h	17.86 j	12.6 n	18.59 B
Greenhouse	21.16 g	29.37 a	27.93 b	20.4 h	18.9 i	25.16 c	21.63 f	14.9 m	22.45 A
Mean	19.23 E	26.67 A	25.65 B	18.74 F	17.29 G	23.07 C	19.77 D	13.8 H	
	Stem diameter (mm)								
	2020 season								
Open field	16.6 k	23.4 d	22.7 e	16.7 l	15.5 l	20.4 h	17.5 j	12.1 n	18.1B
Greenhouse	20.6 g	28.5 a	27.1 b	19.8 h	18.4 i	24.5 c	21.0 f	14.5 m	21.8A
Mean	18.6 E	26.0 A	24.9 B	18.3 F	16.9 G	22.4 C	19.3 D	13.3H	
	2021 season								
Open field	16.8 k	23.6 d	22.87 e	16.9 l	15.67 l	20.6 h	17.73 j	6.5 n	18.29 B
Greenhouse	20.77 g	28.83 a	27.43 b	20 h	18.57 i	24.67 c	21.23 f	12.2 m	21.01 A
Mean	18.78 E	26.22 A	25.14 B	18.44 F	17.09 G	22.66 C	19.47 D	9.37 H	

F1= 100% NPK, F2= 50% NPK + Nitrobein, F3= 50% NPK + Phosphoren,
F4= Compost, F5= Nitrobein + Phosphoren, F6= Nitrobein, F7= Phosphoren and.
Means followed by different letters (upper or low) for each character means significant difference at 5%

Table (3-b): The effect of fertilizer types and climatic conditions on no. of branches and leaf area (cm^2) of common bean after 60 days from sowing date during two growing seasons.

Treatments	No of branches								
	F1	F2	F3	F4	F5	F6	F7	control	Mean
	2020 season								
Open field	6.8 e	8.4 ab	7.5 cd	6.6 ef	5.8 f	7.4 d	7.3 d	5.8 f	6.9 B
Greenhouse	7.9 d	9.7 a	8.7 b	8.1 bc	7.9 d	8.6 b	8.7 b	7.0 e	8.3 A
Mean	7.4 C	9.1 A	8.1 B	7.3 C	6.8 D	8.0 B	8.0 B	6.4 E	
	2021 season								
Open field	6.9 e	8.53 ab	7.57 cd	6.7 ef	5.9 f	7.47 d	7.37 d	5.9 f	7.02 B
Greenhouse	8.0 d	9.77 a	8.76 b	8.17 bc	7.97 d	8.73 b	8.77 b	7.1 de	8.39 A
Mean	7.42 C	9.15 A	8.15 B	7.42 C	6.91 D	8.08 B	8.05 B	6.47 E	
	Leaf area (cm^2)								
	2020 season								
Open field	226.7 j	342.5 c	287.6 d	221.1 k	207.8 l	245.2 i	225.9 j	182.4 l	242.4 B
Greenhouse	267.4 g	410.7 a	347.9 b	265.8 g	250.5 h	294.4 d	272.0 f	220.9 k	291.2 A
Mean	247.1 D	376.6 A	317.8 B	243.5 E	229.2 E	269.8 C	249.0 D	201.7 F	
	2021 season								
Open field	272.1 j	410.96 c	345.13 d	265.37 k	249.33 l	294.3 i	271.13 j	218.83 l	290.9 B
Greenhouse	320.92 g	492.88 a	417.52 b	318.9 g	300.64 h	353.28 d	326.4 f	265.12 k	349.5 A
Mean	296.46 D	451.92 A	381.32 B	292.16 E	274.98 E	323.78 C	298.76 D	241.98 F	

F1= 100% NPK, F2= 50% NPK + Nitrobein, F3= 50% NPK + Phosphoren,
F4= Compost, F5= Nitrobein + Phosphoren, F6= Nitrobein, F7= Phosphoren.
Means followed by different letters (upper or low) for each character means significant difference at 5%

Table (3-c): The effect of fertilizer types and climatic conditions on fresh and dry weight (g) of common bean plants after 60 days from sowing date during two growing seasons.

Treatments	Plant fresh weight (g)								
	F1	F2	F3	F4	F5	F6	F7	control	Mean
	2020 season								
Open field	33.7 e	66.7 b	54.0 c	54.0 c	25.5 f	45.9 d	46.1 d	21.5 f	40.4 B
Greenhouse	40.9 d	80.0 a	64.9 b	64.9 b	30.7 e	55.7 c	55.6 c	25.9 f	48.7 A
Mean	37.3 DE	73.3 A	59.4 B	59.4 E	28.1 F	50.8 D	50.9 C	23.7 G	
	2021 season								
Open field	37.1 e	73.33 b	59.4 c	32.57 e	28.06	50.47 d	50.73 d	23.56 f	44.40 B
Greenhouse	45.0 d	88.03 a	71.37 b	39.57 e	33.73 e	61.23 c	61.17 c	28.47 f	53.56
Mean	41.05 DE	80.66 A	65.37 B	36.05 E	30.89 F	55.85 D	55.95 C	26.03 G	
	Plant dry weight (g)								
	2020 season								
Open field	20.1 d	28.8 b	28.7 b	18.3 d	17.0 d	25.7 b	23.8 bc	14.4 e	22.1 B
Greenhouse	24.1 b	34.9 a	34.6 a	21.8 d	20.7 d	30.8 b	28.4 b	17.3 d	26.6 A
Mean	22.1D	31.9 A	31.7 A	20.1DE	18.8E	28.2BC	26.1C	15.8E	
	2021 season								
Open field	22.1ef	31.67bc	31.63bc	20.13f	18.7f	28.23cd	26.23d	15.83g	24.31 B
Greenhouse	26.47d	38.43 a	38.1 a	24.03	22.76ef	33.93 b	31.2bc	18.96f	29.23
Mean	24.29D	35.04A	34.84A	22.08DE	20.71E	31.07BC	28.72C	17.40F	

F1= 100% NPK, F2= 50% NPK + Nitrobein, F3= 50% NPK + Phosphoren,
F4= Compost, F5= Nitrobein + Phosphoren, F6= Nitrobein, F7= Phosphoren.
Means followed by different letters (upper or low) for each character means significant difference at 5%

Nutrient content of leaves (%)

Data in Table (4) represented the impact of climate conditions as well as different fertilization types on leaves content of N, P and K of Common bean during the both growing seasons. Climatic conditions under greenhouse enhanced the plant absorption of nutrients from the soil compared with open field. Data in Table (4) stated that the nutrients content in beans plant leaves gave the highest values in greenhouse compared with open field during both growing seasons.

Table (4): The effect of fertilizer types and climatic conditions on N, P and K content (%) of leaves during two growing seasons.

Treatments	N (%)								
	F1	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**control**	**Mean**
	2020 season								
Open field	2.55 j	4.32 b	3.85 d	2.43 l	2.15 n	3.25 f	2.94 h	1.16 p	2.21 B
Greenhouse	2.61 i	4.41 a	3.93 c	2.48 k	2.19 m	3.21 e	3.00 g	1.18 o	2.87 A
Mean	2.58 E	4.36 A	3.88 B	2.45 F	2.17 G	3.18 C	2.97 D	1.17 H	
	2021 season								
Open field	2.58 j	4.36 b	3.89 d	2.45 l	2.17 n	3.18 f	2.97 h	1.17 p	2.84 B
Greenhouse	2.65 i	4.49 a	4.01 c	2.53 k	2.24 m	3.28 e	3.06 g	1.21 o	2.93 A
Mean	2.62 E	4.42 A	3.94 B	2.49 F	2.20 G	3.23 C	3.02 D	1.18 H	
	P (%)								
	2020 season								
Open field	0.62f gh	0.84 c	0.95 b	0.61 h	0.63 fg	0.76 e	0.80 d	0.31 l	0.69 B
Greenhouse	0.63 fg	0.85 c	0.96 a	0.62 gh	0.63 f	0.77 e	0.81 d	0.31 i	0.70 A
Mean	0.62 E	0.84 B	0.95 A	0.61 F	0.63 E	0.77 D	0.81 C	0.31 G	
	2021 season								
Open field	0.62 jk	0.84 d	0.95 b	0.61 k	0.63 j	0.76 h	0.81 f	0.31 l	0.69 B
Greenhouse	0.63 ij	0.86 c	0.97 a	0.62j k	0.64 i	0.78 g	0.82 e	0.32 l	0.71 A
Mean	0.63 E	0.85 B	0.96 A	0.62 F	0.64 E	0.77 D	0.81 C	0.32 G	0.69 B
	K (%)								
	2020 season								
Open field	2.56 j	3.42 b	3.16 d	1.96 m	1.94 n	2.71 f	2.62 g	1.31 p	2.46 B
Greenhouse	2.61 i	3.49 a	3.22 c	2.00 k	1.98 l	2.76 e	2.67 g	1.34 o	2.51 A
Mean	2.58 E	3.45 A	3.19 B	1.98 F	1.96 G	2.73 C	2.65 D	1.32 H	
	2021 season								
Open field	2.61 j	3.46 b	3.22 d	2.00 m	1.98 n	2.76 f	2.67 h	1.34 p	2.51 B
Greenhouse	2.66 i	3.56 a	3.29 c	2.04 k	2.02 l	2.82 e	2.73 g	1.36 o	2.56 A
Mean	2.63 E	3.52 A	3.25 B	2.02 F	2.00 G	2.79 C	2.71 D	1.34 H	

F1= 100% NPK, F2= 50% NPK + Nitrobein, F3= 50% NPK + Phosphoren,
F4= Compost, F5= Nitrobein + Phosphoren, F6= Nitrobein, F7= Phosphoren.
Means followed by different letters (upper or low) for each character means significant difference at 5%

On the other hand, fertilization type had a significant impact on plant nutrients absorption and the concentration in plant leaves. Concerning the N content (%), the highest values were obtained when 50% NPK + Nitrobein treatment was applied followed by using 50% NPK + Phosphoren treatment. Treatment of nitrobein ranked as the third one. Concerning the P content (%), the best treatment was obtained by using 50% NPK + Phosphoren because of the enhancement impact of phosphor availability microorganisms which exist in the Phosphoren, it can convert some of soil phosphor from triple phosphate (unavailable to plant), to mono phosphate (available to plant). Potassium content (%) in leaves has the same trend of nitrogen content, the highest values of K content obtained by applying 50 % NPK + Nitrobein followed by 50% NPK + Phosphoren then 100% NPK. The compost and control (no application) treatments ranked at the end of the list.

So, the recommended treatment is using the mixture of 50% NPK fertilizer with Phosphoren or Nitrobein under greenhouse conditions which gave the highest content of minerals in plant leaves.

Flowering

Flowering in common bean plants responded to climatic conditions as well as fertilizer type. Data in Table (5) cleared that the highest no. of flowers of plant were obtained in greenhouse cultivated plants compared with those cultivated in the field during both growing seasons.

In addition, data illustrated that different types of fertilizer had a significant effect on plant flowering. In this concern, the highest number of flowers were observed when 50% NPK + nitrobein or Phosphoren treatments were applied followed by nitrobein then, Phosphoren. The full dose of NPK treatment ranked after that and defiantly, the control treatment occupied the last rank and gave the lowest number of flowers/plant.

The interactions between greenhouse conditions and application of 50% NPK + nitrobein as well as Phosphoren gave the highest values of no. of flowers per plant through both growing seasons.

Table (5): The effect of fertilizer types and climatic conditions on no. of flowers / plant during two growing seasons.

Treatments	Ave. no. of flowers / plant								
	F1	F2	F3	F4	F5	F6	F7	control	Mean
	2020 season								
Open field	19.7 j	35.9 d	31.0 e	19.7 k	18.3l l	25.8 f	23.4 g	17.7 o	23.9 B
Greenhouse	20.7 g	40.9 a	35.4 b	20.7 h	18.5 i	27.0 c	25.5 e	18.5 l	25.9 A
Mean	20.2 D	38.4 A	33.2 B	20.2 E	18.4 F	26.4 B	24.5 C	18.1 G	
	2021 season								
Open field	22.1 j	31.67 d	31.63 e	20.13 k	18.7 l	28.23 f	26.23 g	15.83 o	24.31 B
Greenhouse	26.47 g	38.43 a	38.1 b	24.03 h	22.77 i	33.93 c	31.2 e	18.97 l	29.23 A
Mean	24.29 D	35.04 A	34.84 B	22.08 E	20.71 F	31.07 B	28.72 C	17.40 G	

F1= 100% NPK, F2= 50% NPK + Nitrobein, F3= 50% NPK + Phosphoren,
F4= Compost, F5= Nitrobein + Phosphoren, F6= Nitrobein, F7= Phosphoren.
Means followed by different letters (upper or low) for each character means significant difference at 5%

Yield and its components

Data in Table 6 (a, b & c) showed the impact of climatic conditions and fertilizer types on the yield (g / plant and kg / feddan) and its components of common bean such as no. of pods / plant, ave. pod weight (g), ave. seeds no. / pod, ave. seeds weight (g)/ pod and ave. 100 seed weight (g). Generally, there was a significant effect of climatic conditions as well as fertilizer types on all yield characteristics. Concerning the effect of climatic conditions, growing common bean under greenhouse condition provided a suitable conditions to enhance the yield of the plants in both growing seasons and took the same trend as mentioned in the previous characteristics compared with open field conditions.

Table (6 a): The effect of fertilizer types and climatic conditions on no. of pods/ plant, pod weight (g) and seeds no. / pod during both growing seasons.

Treatments	No. of pods / plant								
	F1	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**control**	**Mean**
	2020 season								
Open field	8.03 gh	12.64 h	13.81 gh	7.17 gh	7.10 i	10.46 e	10.86 f	5.00 k	8.18 B
Greenhouse	9.63 f	15.17 b	16.53 a	8.60 g	8.50 g	12.53 d	13.03 c	5.90 j	11.25 A
Mean	8.83 C	13.90 B	15.19 A	7.88 C	7.80 D	11.48 B	11.94 AB	5.46 E	
	2021 season								
Open field	8.16 i	12.90 de	14.10 c	7.31 j	7.23 j	10.66 f	11.10 f	5.03 l	9.56 B
Greenhouse	9.83 g	15.406 b	16.90 a	8.8 h	8.7 h	12.8 e	13.3 d	6.06 k	11.47 A
Mean	9.01 E	14.18 B	15.48 A	8.04 F	7.94 F	11.71 D	12.18 C	5.57 G	
	pod weight (g)								
	2020 season								
Open field	3.53 fgh	4.80 c	5.13 c	3.33 gh	3.26 h	4.13 e	4.26 de	2.90 i	3.92 B
Greenhouse	3.90 f	5.30 b	5.65 a	3.67 fg	3.59 fgh	4.55 d	4.69 c	3.20 i	4.31 A
Mean	3.71 D	5.04 B	5.39 A	3.5 D	3.43 D	4.34 C	4.48 C	3.04 E	
	2021 season								
Open field	3.61 efg	4.90 c	5.24 b	3.43 fgh	3.36 gh	4.23 d	4.36 d	3.00 i	3.99 B
Greenhouse	3.96 e	5.4 b	5.73 a	3.73 ef	3.66 efg	4.63 c	4.76 c	3.26 h	4.39 A
Mean	3.78 D	5.14 B	5.49 A	3.57 D	3.49 D	4.42 C	4.56 C	3.11 E	
	seeds no. / pod								
	2020 season								
Open field	4.20 f	5.00 d	5.70 c	3.83 g	3.80 g	4.27 f	4.76 e	3.53 h	4.39 B
Greenhouse	5.03 d	6.00 b	6.83 a	4.63 e	4.57 e	4.13 d	5.73 c	4.23 f	5.27 A
Mean	4.62 D	5.50 B	6.27 A	4.22 E	4.18 E	4.69 D	5.24 C	3.88 F	
	2021 season								
Open field	4.30 g	5.10 e	5.80 b	3.93 h	3.90 h	4.36 g	4.86 f	3.63 i	4.47 B
Greenhouse	4.70 f	5.60 c	6.40 a	4.33 g	4.30 g	4.76 f	5.36 d	3.96 h	4.92 A
Mean	4.49 D	5.35 B	6.10 A	4.11 E	3.18 D	4.56 D	4.01 E	3.78 F	

F1= 100% NPK, F2= 50% NPK + Nitrobein, F3= 50% NPK + Phosphoren,
F4= Compost, F5= Nitrobein + Phosphoren, F6= Nitrobein, F7= Phosphoren.
Means followed by different letters (upper or low) for each character means significant difference at 5%

Table (6 b): The effect of fertilizer types and climatic conditions on ave. seeds weight (g) / pod and 100 seed weight (g) during both growing seasons.

Treatments	Ave. seed weight (g) / pod								
	F1	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**control**	**Mean**
	2020 season								
Open field	3.2 fgh	4.4 c	4.7 b	3.0 ghi	4.0 hi	3.7 de	3.9 d	2.6 j	3.6 B
Greenhouse	3.5 ef	4.9 b	5.2 a	3.3 fg	3.3 fgh	4.2 c	4.4 c	2.9 i	4.0 A
Mean	3.4 D	4.6 B	4.9 A	3.2 D	3.1 D	4.0 C	4.1 C	2.8 E	
	2021 season								
Open field	3.26 ghi	4.46 c	4.73 b	3.13 ghi	3.06 hi	3.83 de	3.96 d	2.7 j	3.6 B
Greenhouse	3.63 ef	4.9 b	5.23 a	3.43 fg	3.36 fgh	4.23 c	4.3 6c	3.00 i	4.0 A
Mean	3.44 D	5.67 B	5.00 A	3.24 D	3.18 D	4.03 C	4.15 C	2.82 E	
	Ave.100 seed weight (g)								
	2020 season								
Open field	44.0 bede	48.6 abc	49 abc	43.5 cde	42.63 de	45 .bcde	45.6 bcde	41.5e	45.01 B
Greenhouse	46.0 bcde	52.4 a	52.9 a	46.9 bcd	47.5 bcd	48.9 abc	49.20 ab	44.9 bcd	48.58 A
Mean	45.0 C	50.5 AB	51.0 A	45.2 C	45.0C	47.1BC	47.4 BC	43.2 C	
	2021 season								
Open field	46.0 c	52.4 ab	53.0 a	47.5 abc	46.9 bc	48.9 abc	49.2 abc	44.9 c	48.58 A
Greenhouse	47.5 abc	52.4 ab	52.9 a	46.0 c	46.9 ab	48.9 abc	49.2 abc	44.76 c	48.56 A
Mean	46.7 C	522.4 AB	52.9 A	46.7 C	46.9 C	48.9 BC	49.2 BC	44.8 C	

F1= 100% NPK, F2= 50% NPK + Nitrobein, F3= 50% NPK + Phosphoren,
F4= Compost, F5= Nitrobein + Phosphoren, F6= Nitrobein, F7= Phosphoren.
Means followed by different letters (upper or low) for each character means significant difference at 5%

Table (6 c): The effect of different fertilizer types and climatic conditions on total yield (kg / plot), (kg / feddan) during both growing seasons.

Treatments	Total seed yield (kg) / plot								
	F1	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**control**	**Mean**
	2020 season								
Open field	25.8 g	55.2 d	64.5 c	21.7 h	21.0 h	39.3 e	42.2 e	13.1 j	35.4 B
Greenhouse	34.4 f	73.7 b	86.1 a	29.0 g	28.1 g	52.4 d	56.3 d	17.5 i	47.2 A
Mean	30.1 E	64.4 B	75.3 A	25.4 F	24.6 F	45.9 D	49.2 C	15.31 G	
	2021 season								
Open field	26.9 i	57.4 d	67.1 c	22.6 j	21.9 j	40.9 g	43.9 f	13.7 l	36.8 B
Greenhouse	35.4 h	75.8 b	88.6 a	29.9 i	28.9 i	53.9 e	57.9 d	18.1 k	48.6 A
Mean	31.1 E	66.6 B	77.8 A	26.2 F	25.4 F	47.4 D	50.9 C	15.9 G	
	Total seed yield (kg) / feddan								
	2020 season								
Open field	1032 g	2208 d	2580 c	870 h	843 h	1572 e	1687 e	525 j	1888 A
Greenhouse	1378 f	2947 b	3443 a	1161 g	1124 g	209 8	2251 d	700.4 i	1415 B
Mean	1205 E	2578 B	3012 A	1015 F	983 F	835 D	1969 C	613 G	
	2021 season								
Open field	1074 i	2298 d	2684 c	905 j	877 j	1634 g	1754 f	548 l	1475 B
Greenhouse	1418 h	3032 b	3543 a	1194 i	1156 i	2157 e	2316 d	723 k	1942 A
Mean	1246E	2665 B	3114 A	1049 F	1016 F	1896 D	2035 C	635 G	

F1= 100% NPK, F2= 50% NPK + Nitrobein, F3= 50% NPK + Phosphoren,
F4= Compost, F5= Nitrobein + Phosphoren, F6= Nitrobein, F7= Phosphoren.
Means followed by different letters (upper or low) for each character means significant difference at 5%

On the other hand, the combination between 50% NPK and Nitrobein as well as Phosphoren gave the highest values for all previous yield characteristics, followed by individual treatment of nitrobein or Phosphoren. The treatment of full dose of chemical fertilizer (100% NPK) ranked as fourth then compost as fifth and the control treatment occupied the last rank. Both of climate and nutrition affected common bean plants. The suitable climatic conditions under greenhouse which protected the common bean plants during the growing season as well as the best nutrition formula (50% NPK + Nitrobein or Phosphoren) enhanced the production of yield compared with all other studied treatments. So, using bio fertilizers in nutrition has two targets, first is economical by decreasing used amount of chemical fertilizers and the second is environmental by saving soil fertility and human health.

2- Effect of convential and bio fertilizers on population dynamics of whitefly and aphid stages infesting common bean leaves.

The statistical analysis of the obtained data Tables (7&9**)** revealed that there were significant differences in white fly stages among most of the tested treatments under field conditions and green house (LSD 5% = 12.9, 12.3 and 12.3, 13.1 respectively.

The statistical analysis of the obtained data Tables (8&10**)** clarified that there were significant differences in aphid stages among most of the tested treatments under field conditions and green house (LSD 5% = 5.5, 5.8 and 5.2, 5.6 respectively

Data in Tables (7,9**)** revealed that the higher infestation rates by whitefly were recorded at NPK fertilizer treatment , and the lower rates infestation were recorded at B.t and half recommended rate of NPK + Nitrobein treatments , under field conditions of 2020/2021 season.

Data in Tables (8&10**)** reported that **the** highest infestation rates by aphid were recorded in NPK fertilizer treatment, and the lowest infestation rates were recorded at B.t and half recommended rate of NPK + Nitrobein treatments, under field conditions of 2020/2021 season.

Table (7): Average numbers of whitefly stages infesting common bean leaves as affected by tested fertilizers comparing with bio pesticide under filed conditions (2020/2021):

Treatments	Mean number of Whitefly stages / 5 leaves 2020					Mean number of White fly stages/ 5 leaves 2021				
	Pre	**Feb.**	**Mar.**	**Apr.**	**Mean**	**Pre**	**Feb.**	**Mar.**	**Apr.**	**Mean**
recommended rate NPK	96	86	93	89	89.3 a	96	78	89	99	88.6 a
½ recommended rate NPK + Nitrobein	70	51	53	60	54.6 bc	66	43	58	63	54.6bc
½ recommended rate NPK + Phosphoren	59	46	50	57	51.0 c	62	40	53	58	50.3c
Compost	71	57	69	66	64.0 b	69	53	61	64	59.3bc
Nitrobein+ Phosphoren	72	59	67	65	63.6 bc	67	50	56	61	55.6bc
Nitrobein	65	52	55	59	55.3 bc	72	57	59	73	63.0b
Phosphoren	67	54	53	58	55.0 bc	68	58	57	64	59.6bc
B.t	61	15	22	32	23.0 d	68	25	34	39	32.6d
Control	88	92	101	103	98.6 a	79	83	97	102	94.0a
LSD 5%					12.9					12.3

Means followed by different letters for each character means significant difference at 5%

Table (8): Average numbers of aphid stages infesting common bean leaves as affected by tested fertilizers comparing with bio pesticide under filed conditions (20/21).

Treatments	Mean no. of Aphid stages 2020					Mean number of Aphid stages 2021				
	Pre	**Feb.**	**Mar.**	**Apr.**	**Mean**	**Pre**	**Feb.**	**Mar.**	**Apr.**	**Mean**
recommended rate NPK	42	15	43	35	31.0 b	49	27	49	46	40.6a
½ recommended rate NPK+ Nitrobein	35	9	27	31	22.3c	45	18	28	29	25.0b
½ recommended rate NPK+ Phosphoren	31	7	29	29	21.6c	37	16	25	32	24.3b
Compost	39	12	35	34	27.0bc	39	21	28	39	29.3b
Nitrobein+ Phosphoren	36	11	33	32	25.3c	34	14	27	31	24.0b
Nitrobein	37	10	36	29	25.0c	35	11	29	29	23bc
Phosphoren	34	12	37	27	25.3c	39	15	26	30	23.6b
B.t	40	10	14	18	14.0d	39	8	10	13	10.3d
Control	32	19	49	47	38.3a	54	25	57	59	47.0a
LSD 5%					5.5					5.8

Means followed by different letters for each character means significant difference at 5%

Table (9): Average numbers of whitefly stages infesting common bean leaves as affected by tested fertilizers comparing with bio pesticide under greenhouse conditions (20/ 21).

Treatments	Mean no. of Whitefly stages 2020					Mean number of white fly stages 2021				
	Pre	**Feb.**	**Mar.**	**Apr.**	**Mean**	**Pre**	**Feb.**	**Mar.**	**Apr.**	**mean**
recommended rate NPK	85	58	71	73	67.3 b	75	55	63	81	66.3 b
½ recommended rate NPK + Nitrobein	60	38	43	50	43.6 c	67	41	44	54	46.3 c
½ recommended rate NPK + Phosphoren	61	37	41	52	43.3 c	68	38	43	56	45.6 c
Compost	74	46	54	61	53.6 c	69	49	58	64	57 bc
Nitrobein+ Phosphoren	62	41	52	59	50.6 c	65	43	52	57	50.6 c
Nitrobein	66	46	51	58	51.6 c	66	48	53	60	53.6 bc
Phosphoren	71	43	52	60	51.6 c	69	45	55	62	54 bc
B.t	52	12	22	24	19.3 d	70	16	18	22	18.7 d
Control	81	76	81	92	83 a	82	82	91	99	90.6 a
LSD 5%					13.4					13.1

Means followed by different letters for each character means significant difference at 5%

Table (10): Average numbers of aphid stages infesting common bean leaves as affected by tested fertilizers comparing with bio pesticide under greenhouse conditions (20/21).

Treatments	Mean number of Aphid stages 2020					Mean number of Aphid stages 2021				
	Pre	Feb	Mar	Apr	Mean	Pre	Feb	Mar	Apr	Mean
recommended rate NPK	33	11	35	39	28.3ab	32	9	27	35	23.6a
½ recommended rate NPK + Nitrobein	33	7	21	29	19.0 c	25	3	18	23	14.6c
½ recommended rate NPK + Phosphoren	22	9	23	25	19.0 c	26	0	15	21	12.0c
Compost	32	19	38	32	29.6 ab	34	10	23	32	21.6ab
Nitrobein+ Phosphoren	34	12	37	34	27.6 ab	30	7	19	34	17.6bc
Nitrobein	26	11	32	27	23.3 bc	25	6	21	27	18.0b
Phosphoren	28	10	31	29	23.3 bc	29	8	19	29	18.6b
B.t	18	4	10	16	10.0 d	31	1	4	6	3.7d
Control	28	15	39	42	32.0 a	22	11	28	39	26.0a
LSD 5%					5.2					5.6

Means followed by different letters for each character means significant difference at 5%

Data in Table (11) declared that the highest reduction percentages of whitefly populations were recorded in the treatments of B.t, resulting 66.35, 59.71, 63.78 and 75.82 % under open field and green house conditions of the first and second seasons, respectively, followed by the treatments of half recommended rate of NPK + Nitrobein and half recommended rate NPK + Phosphoren.

On the other hand, the lowest reduction percentages were recorded in treatments of one recommended rate of NPK and compost under open field and green house conditions of the first and second seasons.

Data in Table (12) resulted that the highest reduction percentages of aphid populations were recorded in the treatments of B.t, resulting 70.76, 69.66, 51.39 and 89.9 % under open field and green house conditions of the first and second seasons, respectively, followed by the treatments of half recommended rate of NPK + Nitrobein and half recommended rate NPK + Phosphoren.

On the other hand, the lowest reduction percentages were recorded in treatments of one recommended rate of NPK and compost under open field and green house conditions of the first and second seasons.

Table (11): Reduction percentages of whitefly stages as influenced by tested fertilizers comparing with bio pesticide.

Treatments	Reduction% of White fly			
	Open field		Greenhouse	
	2020 season	2021 season	2020 season	2021 season
recommended rate NPK	16.98	22.44	22.73	19.99
½ recommended rate NPK + Nitrobein	30.39	30.47	29.08	37.46
½ recommended rate NPK + Phosphoren	22.85	31.82	31.16	39.31
Compost	19.55	27.77	30.73	25.23
Nitrobein+ Phosphoren	21.16	30.26	20.35	29.54
Nitrobein	24.07	26.46	23.7	26.5
Phosphoren	26.74	26.34	29.08	29.17
B.t	66.35	59.71	63.78	75.82

Table (12): Reduction percentages of aphid stages as influenced by tested fertilizers comparing with bio Pesticide.

Treatments	Reduction % of Aphids			
	Open field		Greenhouse	
	2020 season	2021 season	2020 season	2021 season
recommended rate NPK	38.33	4.8	24.96	37.6
½ recommended rate NPK + Nitrobein	46.77	36.17	49.62	50.58
½ recommended rate NPK + Phosphoren	41.78	24.54	24.43	60.95
Compost	42.16	13.68	19.06	46.24
Nitrobein+ Phosphoren	41.28	18.9	28.97	50.36
Nitrobein	43.55	24.5	21.59	39.08
Phosphoren	37.83	30.47	27.19	45.37
B.t	70.76	69.66	51.39	89.9

Reduction % of pests were determined according to formula of Henderson and Tilton (1955)

R% = [1 – (n in C before T * n in T after T / n in C after T * n in T before T) *100]

Where, R = Reduction, C =control, T=treatment

Discussion

Climate became a determining factor for plant growth, production and protection success especially, under racently climate change impacts. The effect of white net cover of greenhouse was prevented the proportion of solar radiation during day hours and led to decrease maximum air temperature. Whereas, during night hours the net cover was prevented the heat lose under greenhouse conditions which led to increase the values of minimum air temperatures. On the other hands, the net cover was prevented the water evaporation from greenhouse atmosphere and that made the air under greenhouse conditions more saturated by water vapor than the atmosphere in open field conditions. These results of climatic factors such as air temperature and relative humidity are matched with those of Mortensen (1986), Medany *et al*. (2009) and Mondal *et al*. (2016). Greenhouse increased the plant protection from exceed wind speed and direct solar radiations and enhanced the plant growth of common bean plants. These results are matched with those of du Plessis *et al*. (2009) and Shamshiri *et al*. (2018). Utilization of different type of fertilizers depends on different rates of decomposition in the soil. NPK mineral fertilizer is fast release in the soil so, the plant absorbed some of it and the rest wasted by leaching with irrigation water. On the contrary, the microorganism which competed the plant at the beginning of the season, played a good role for plant nutrition whither its ability on nutrients salability or the plant utilized these organisms after it has died and decomposed in the soil. Although, compost is so important for enhancing soil properties but it is not enough to provide the plant nutrition during the growing season, it must combined with other mineral fertilizers. These results are matched with those of Mortensen, (1986), Ganie *et al*. (2009) du Plessis *et al*. (2009), Medany *et al*. (2009) and Mondal *et al.* (2016) and disagreed with those of Abou El-Hassan *et al*. (2017) and Fouda *et al*. (2017). On the other hand, Plant nutrients absorption efficiency depends on the microclimate surrounding plant whither root system or foliage parts so, the stability of climate conditions in the greenhouse gave the advantage to produce healthier plats than open field. Generally, all of N, P and K are macronutrients and the plant need a sufficient amount of them during the growing season. In addition, they are movable nutrients within plant so any deficit in the soil reflexed to the concentrate of nutrient in plant leaves. Although, the full dose of NPK was applied, but some of this amount leached by irrigation water away from the root zone and nothing else can compensate the deficiency of those nutrients whether microorganisms or organic material like compost. These results are matched with those of Abdel-Aziz and Ismail (2016).

The suitable climate under greenhouse enhanced the flowering of common bean plants whereas, the weather was hesitated in the field, as known the plant need stable suitable climate conditions to enhance different crop cycle such as vegetative, flowering and fruiting periods. So, these results is compatible with those of du Plessis *et al*. (2009). The good flowering of plants depends on the nutation status as fore mentioned results about leaves nutrients content especially potassium which enhancing the plant flowering in both growing seasons. These results are matched with those of Ganie *et al*. (2009). Suitable climate conditions led to increasing the yield of common bean and these results are matched with those of Mortensen (1986), Medany *et al*. (2009) and Mondal *et al*. (2016). These results is logical trend because the yield of plant depends on the health and nutrition statues during the growing season so, the plants which grew better and consisted on balanced nutrients produced the highest yield as well as its components characteristics.

As for the effect of different treatments on white fly and aphid population attacking common bean plants under open field and green house conditions, the obtained results are in harmony with those of Ganie *et al*. (2009) and Abdel-Aziz and Ismail (2016), in addition Chatterjee *et al.*, (2013) who indicated that the use of inorganic fertilizers with FYM, vermicomposting and bio fertilizers reduces the whitefly incidence in tomato. The indirect effects of fertilization practices acting through changes in the nutrient composition of the crop have been reported to influence of plant resistance to many insect pests. While, excessive and/or inappropriate use of inorganic fertilizers can cause nutrient imbalances and lower pest resistance (Rashid *et al.*, 2016). Phosphorus decreases the host suitability of potato plants against various insect-pests by changing secondary metabolites such as phenolic and terpenes and accumulation of phenolic (tannin, lignin) acts as barrier having deterring (antifeedant) or directly toxic (insecticidal) effects on herbivores (Facknath and Lalljee 2005). The major factors that regulate population dynamics of most pests are climate, natural enemies, initial population size, host-plant suitability, farming systems and management practices (Price *et al.*, 2011). Experiments considering prolonged exposure to constant temperatures and brief exposure to heat shock agree that elevated temperatures, above the optimum threshold, negatively affect life history of whiteflies. However with climate change, high thermo tolerance and the polyphagous nature of some whiteflies which contribute to their invasion success could possibly facilitate their population increase in some locations depending on the amount of heat stress experienced (Bellotti *et al.*, 2012; EFSA 2013; Gilioli *et al.*, 2014; Gamarra *et al.*, 2016). Recently, Alahyane *et al.*, 2022 declared that B.t (bio pesticide) have shown a great potential in integrated aphid management.

Conclusion

Common bean is the important source of protein and almost people all over the world are like it. Climate plays an essential role in plant growth, production and protection. The climate change impact shifting the time of sowing for different economic crops. One of adaptation strategy is growing the crops under protection conditions. Nowadays, the modern agriculture targeting to reduce and rationalize the using of chemical fertilizers as well as chemical pesticides to prevent both of health and environment challenges. On the other hand, the chemical fertilizers and pesticides material became so expensive for farmers. So that this study aimed to find alternatives for chemical material such as microorganism as well as compost. The recommendation of study that we have to depend on several types of fertilizers because there are an integration among them such as bio, organic and mineral fertilizers to gain the best results. The chemical fertilizer is important for plant growth and yield but we should reduce the amount we are used. Rates of infestation with white fly and aphids affected with using chemical fertilizer was higher, comparing with bio fertilizer that gave lowest rates of infestation and shad on bio pesticides B.t on reduce of infestation with target pests.

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تأثير الاسمدة العادية والبيولوجية على نمو ومكافحة الآفات لنباتات الفاصوليا تحت اثنان من الأنظمة البيئية للمناخ

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الملخص العربى

أجريت التجربة تحت ظروف الصوبة والحقل المفتوح بمحطة بحوث البساتين بالقناطر الخيرية محافظة القليوبية والتابعة لمعهد بحوث البساتين مركز البحوث الزراعية مصر ، لموسمين متتالين 2020 ، 2021 لدراسة تأثير أنواع مختلفة من الأسمدة الحيوية والسماد العضوي والنيتروجينى والبوتاسي على النمو والناتج النهائى لمحصول الفاصوليا . تم دراسة تعداد بعض الآفات الثاقبة الماصة التي تهاجم نباتات الفاصوليا وهى المن ، الذبابة البيضاء.

أشارت النتائج المتحصل عليها إلى أنه حدث انخفاض طبيعى فى درجة الحرارة العظمى ، بينما إرتفعت درجة الحرارة الصغرى وكذلك نسبة الرطوبة النسبية تحت ظروف الصوبة مقارنة بالحقل المفتوح . حدثت زيادة بمعدلات النمو مثل طول النبات وعدد الأوراق وعدد الفروع ومساحة الورقة وقطر الساق والوزن الطازج والجاف تحت ظروف الصوبة مقارنة بالحقل المفتوح ، وكذلك حدث زيادة فى محتوى NPK للأوراق وكذلك المحصول ومكوناته مقارنة بظروف الحقل المفتوح . أعطت نصف الجرعة من السماد المعدني NPK (**50**٪) والنتروبين أو الفوسفورين أعلى قيم للنمو والمحتوى الغذائي والمحصول ، تليها الجرعة الكاملة من السماد المعدني (100٪ NPK) مقارنة مع معاملات التسميد الأخرى . أدى استخدام الأسمدة الحيوية إلى تعزيز امتصاص العناصر الغذائية للنباتات ، لقدرة تلك الكائنات الحية الدقيقة على إذابة العناصر غير المتوفرة في التربة وزيادة كفاءة الجرعة المختلطة من سماد NPK مقارنة بالجرعة الكاملة الفردية من NPK .

أظهر تحليل البيانات المتحصل عليها وجود فروق معنوية في أطوار الذبابة البيضاء والمنّ بين معظم المعاملات المختبرة تحت الظروف الحقلية وظروف الصوبة. تم تسجيل أعلى معدلات الإصابة بالذباب الأبيض والمن في معاملة الأسمدة NPK ، وسجلت معدلات الإصابة الأقل عند معاملتي B.t والنصف الموصى به من NPK + Nitrobein ، تحت الظروف الحقلية لموسم 2021/2020.

تم تسجيل أعلى نسب خفض في تعداد الذبابة البيضاء والمن في معاملات B.t ، حيث سجلت **66.35** و **59.71** و **63.78** و **75.82**٪ تحت ظروف الحقل المفتوح والصوبة الزراعية في الموسمين الأول والثاني ، للذباب الأبيض وكانت نسب الخفض **70.76** ، **69.66** ، **51.39** و **89.9**٪ لحشرة المن على التوالي ، تليها معاملات نصف المعدل الموصى به من NPK + Nitrobein ونصف الموصى به NPK + Phosphoren . من ناحية أخرى ، سجلت أقل نسب خفض للآفات تحت الدراسة في معاملات المعدل الموصى به من NPK والكومبوست في ظروف الحقل المفتوحة والصوبة الزراعية في كل من الموسمين الأول والثاني.