

RESPONSE OF COMMON BEAN (*Phaseolus vulgaris* L.) TO ORGANIC AND BIO-FERTILIZERS UNDER DIFFERENT LEVELS OF NITROGEN MINERAL FERTILIZER.



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ABSTRACT

Two field experiments in randomized complete block design with three replicates were carried out at Shandweel Agriculture Research Station, during 2013 and 2014 seasons. The objective of the the present study is to evaluate the application of organic fertilizer (FYM), biofertilizers (Microbien), humic acid and fulvic acid as substitutions of all or part of the nitrogen chemical fertilizer in fertilizing common bean variety Paulista. The obtained results indicated that any treatemnt of adding FYM, microbien and humic and fulvic acids with the recommended dose of nitrogen increased values of plant height, fresh root weight at 50 and 70 days from planting, nitrogen content fresh pods (%), leaf area and number of pods/pant more than vaules the N rocommended dose (RD) only, and then with $\frac{3}{4}$ N RD and $\frac{1}{2}$ N RD, especially with adding humic and fulvic acids. Adding FYM, microbien and humic and fulvic acids with the recommended dose of nitrogen increased pod length, fresh pod yield (ton/fed) and exportable fresh pods yield (ton/fed) more than the N values rocommended dose (RD), and then with $\frac{3}{4}$ N RD and $\frac{1}{2}$ N RD, especially with adding FYM. Adding FYM was effective on nitrogen content in leaves (%) at the high levels of nitrogen (rocommended dose (RD) and $\frac{3}{4}$ N RD), while, the effect of adding humic and fulvic acids were realized at the level of $\frac{1}{2}$ recommended dose of nitrogen fertilizer. The highest fresh pods yield, i.e., (3.985 and 3.961 ton/fed) were recorded by the combination between the recommended dose of chemical nitrogen plus the farm yard manure in the first and second season, respectively. No significant effect between $\frac{3}{4}$ RD (N) + FYM, $\frac{3}{4}$ RD (N) + Microbien and $\frac{3}{4}$ RD (N) + humic and fulvic acids compared with the recommended dose of chemical nitrogen of the most studied traits. It is clear that the application of organic and biofertilizer with $\frac{3}{4}$ chemical fertilizer not only improve crop productivity but also decrease of mineral frtilizer and reduce environmental hazards.

Keywords: Common bean, nitrogen fertilization, FYM, microbien, humic and fulvic acids.

INTRODUCTION

Common bean (*Phaseolus vulgaris* L.) is economically one of the major vegetable crops in Egypt for local consumption as well as for the exportation. The significant role of chemical fertilizers in increasing crop 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 according to their high prices. To confront this problem, it was necessary to develop alternative methods of supplying nutrients to the growing plant. The use of natural organic manure is recommended by

farmers and investigators to substitute all or part of the chemical fertilizers as it improves physical and chemical properties of soil and it is the way to achieve minimum pollution effects and reduce agriculture cost. Biofertilizers mainly comprise nitrogen fixer, phosphate solubilizers or vesicular arbuscular mycorrhizae fungi (VAM) and silicate bacteria. Moreover, biofertilizers are used in biological control of soil-borne diseases and stimulate plant growth by producing growth regulators (El-Akabawy, 2000; De Silva and Cook, 2003 and Wu *et al.*, 2005). It is considered a good source of plant nutrients and has a positive effect for improving of the soil physical structure (El-Akabawy, 2000 and Shen and Shen, 2001). Many investigators studied the effect of organic fertilizers and biofertilizers on both crop production and improvement of physical and chemical properties of soil. Mel'nikova *et al.*, (2002) studied the effects of bacteria belonging to the genera *Azotobacter* and *Bacillus* in a mixed culture with *Bradyrhizobium japonicum* strains on the formation and function of the legume-rhizobium symbiosis for soybean plants. The data show that the bacterial compositions *B. japonicum* 634b + *B. subtilis* 5, *B. japonicum* 634b + *A. chroococcum* 20, and *B. japonicum* 10k + *A. vinelandii* 56 with a cell ratio of 1 : 0.1 increased the number and weight of root nodules as well as the height and weight of the aboveground plant parts in almost cases by 22–105% compared with the control treatments. These binary microbial cultures may be used for the development of combined bacterial preparations for soybean. Abraham and Lal (2003) studied the effects of NPK fertilizer (100% and 33% of the recommended Dose), organic manures (farm compost + vermicompost and farm compost + poultry manure) and biofertilizers (phosphate solubilizing bacteria (PSB) + *Rhizobium/Azospirillum* and PSB + 2 foliar applications of 33% cow's urine) on the productivity of the soybean-mustard-fodder cowpea cropping system. Farm compost + poultry manure or vermicompost in combination with inorganic fertilizers showed synergistic effects on the growth and yield of the crops. The values obtained for most of the parameters with 100% recommended fertilizer dose were higher than those with lower dose of fertilizers, but the latter were statistically at par with the former. PSB + cow's urine recorded higher values of dry matter accumulation than dual inoculation of PSB and *Rhizobium* in fodder cowpea. The percentage of organic carbon and available nutrient status of P_2O_5 and K_2O in the soil also increased due to the integration of organic and inorganic sources of nutrients. Araújo (2007) studied the effect of composted textile sludge on growth, nodulation and nitrogen fixation of cowpea was evaluated in a greenhouse experiment. The compost was incorporated into soil at 0, 9.5, 19 and 38 t ha⁻¹ (based upon the N requirement of the crops, i.e., 0, 50, 100 and 200 kg available N ha⁻¹). Composted textile sludge did not show negative effects on nodule number and weight, Nitrogen accumulation in dry matter of shoots in cowpea was higher than other treatments with application of 19 t ha⁻¹ of compost. Composting can be an alternate technology for the management of solid textile mill sludge. This study verifies that the composted textile sludge was not harmful to growth, nodulation and nitrogen fixation of cowpea. Khalilzadeh, *et al.*, (2012) study the effect of ten treatments (Urea, Nitroxin, Amino acid, Green hum, Biocrop L-45, Nutriman N24 and Mas Raiz, cattle

manure, water and control) foliar spraying on root and vegetative growth of mung bean (*Vigna radiata* L.) in a greenhouse condition. Results showed that all traits were significantly affected by treatments except the number of second roots. Foliar application of urea and organic manure substantially improved the plant height, leaf area, shoot and root dry weights, root and shoot length, volume and number of roots. Similarly shoot and leave number and nodules root were also improved by the foliar spraying of green hum and amino acid, respectively. While the lowest nodules root was observed in plants treated by nutriman N24 and urea. This improved growth of mainly due to nutrient availability in bio-organic fertilizer and uptake by plants.

Humic acid increases the permeability of plant membranes and enhance the uptake of nutrients. Humic acid is also improves soil nitrogen uptake and encourage the uptake of potassium, calcium, magnesium and phosphorus, making these more mobile and available to plant root system. Additionally, the influence of humic material on plant growth, have been investigated on numerous studies have shown that humic substances enhance root, leaf and shoot growth but also stimulate the germination of various crop species (Piccolo *et al.*, 1997, Singer *et al.*, 1998 and Pascual *et al.*, 1999). Using Humic and fulvic acids are considered to be compounds increasing permeability of cellular membranes in plants to vitamins within the cell (Kaya *et al.*, 2005).

Common bean crop normally fertilized with chemical fertilizers, which may have hazardous effect on soil environment and crop quality. Therefore, the present study aimed to evaluate the application of organic matter, biofertilizers and humic and fulvic acid as substitution of all or a part of chemical fertilizer needed for fertilizing common bean plants.

MATERIALS AND METHODS

The present study was carried out at Shandweel Agric Res. Stat., Agric. Res. Center, Ministry of Agric., Egypt during 2013 and 2014 seasons. The objective of the present study is to evaluate the application of organic fertilizer (FYM), biofertilizers and humic and fulvic acid as substitution of all or part of the nitrogen fertilizers in fertilizing common bean variety Paulista.

The experiments were designed in randomized complete block design with three replicates. Soil physical and chemical analyses of the experimental sites for the two seasons are presented in Table 1 and were determined as Jackson (1967).

Table 1. Soil characterization for the experimental sites.

| Seasons | Texture | CaCO ₃ % | Soil pH | O.M% | Available nutrients in soil (ppm) | | |
|---------|------------|---------------------|---------|------|-----------------------------------|----|-----|
| | | | | | N | P | K |
| 2013 | Sandy loom | 7.50 | 7.9 | 0.6 | 18 | 25 | 120 |
| 2014 | Sandy loom | 7.55 | 7.7 | 0.8 | 21 | 27 | 130 |

Twelve treatments of three levels of chemical of nitrogen fertilizer combined with farm yard manure or biofertilized as well as humic and fulvic acids beside the control (untreated) were used as follows:

1. Control (untreated).
2. Recommended dose of nitrogen (33.5 kg N/fed) mineral fertilizer (RD).
3. Recommended dose of nitrogen + FYM (20m³/fed.).
4. Recommended dose of nitrogen + biofertilizer (Microbien).
5. Recommended dose of nitrogen + humic acid (humate potassium) and fulvic acid.
6. $\frac{3}{4}$ Recommended dose of nitrogen (25.125 kg N/fed).
7. $\frac{3}{4}$ Recommended dose of nitrogen + FYM (20m³/fed.).
8. $\frac{3}{4}$ Recommended dose of nitrogen + biofertilizer (Microbien).
9. $\frac{3}{4}$ Recommended dose of nitrogen + humic acid (humate potassium) and fulvic acid.
10. $\frac{1}{2}$ Recommended dose of nitrogen (16.75 kg N/fed).
11. $\frac{1}{2}$ Recommended dose of nitrogen + FYM (20m³/fed.).
12. $\frac{1}{2}$ Recommended dose of nitrogen + biofertilizer (Microbien).
13. $\frac{1}{2}$ Recommended dose of nitrogen + humic acid (humate potassium) and fulvic acid.

The area of experimental plot was 10.5 m² (5 ridges x 0.6 m width x 3.5 m length). Common beans seeds (cv. Paulista) were sown at 1st September in 2013 and 2014 seasons, in hills 10 cm apart on one side of ridges and two seeds per hill.

The recommended doses of NPK were added as follows: N-fertilizer was added at 60, 45 and 30 kg N/feddan and was applied as Ammonium nitrate (33.5% N) in one dose before the first irrigation. Phosphorus fertilizer was added as superphosphate (15.5% P₂O₅) at the rate of 22.5 kg P₂O₅/feddan before sowing, and potassium as potassium sulfate K₂SO₄ (48% K₂O) was added to the soil before the first irrigation at the rate of 24 kg K/feddan.

Farm Yard Manure (FYM) was added at the rate of 20 m³/feddan at land preparing. Chemical analysis of FYM was presented in Table (2).

Table (2): Chemical analysis of Farm Yard Manure (FYM) used in the experiments.

| Chemical composition | pH 1:2.5 | O.M % | C % | N % | C:N Ratio | P % | K % |
|----------------------|----------|-------|-------|------|-----------|------|------|
| Organic matter | | | | | | | |
| FYM | 7.7 | 21.04 | 12.64 | 0.52 | 20.69:1 | 0.26 | 1.13 |

Before planting, common bean seeds were inoculated with biofertilizer, using gum arabic solution as a sticking agent. Biofertilizers of Microbien (asymbiosis nitrogen-fixing bacteria and phosphate solubilizing microorganism) was obtained from Agric. Res. Center, Giza, Egypt. Humic acid has the average chemical formula C₁₈₇H₁₈₆O₈₉N₉S₁. Fulvic acid has the average chemical formula C₁₃₅H₁₈₂O₉₅N₅S₂. Plants were sprayed twice with freshly prepared solution of humic and fulvic acids at the rate of 4 cm³/L H₂O at 30 and 45 days after sowing.

The following characters were studied:

- 1- Plant height (cm): measured prior to harvesting for 10 plants from cotyledonary to the terminal.
- 2- Pod length (cm): measured as an average of 10 pods per plant.
- 3- Pod diameter (cm): measured as an average of 10 pods per plant.
- 4- Fresh root weight (g): it was determined, 50 and 70 days from planting.
- 5- Leaf area (dm²), it was determined by using C1-202 AREA METER/CID, INC.
- 6- Nitrogen content percentage: it was determined in leaves and fresh pods using the micro-kjeldahl method as outlined the total nitrogen (according to A.O.A.C. 1984).
- 7- Number of pods per plant: recorded as an average of 10 plants that were randomly taken from each plot.
- 8- Fresh pod yield (ton/fed): total fresh pod yield per feddan (ton/fed.).
- 9- Exportable fresh pods yield (ton/fed).

The obtained data were statistically analysis by Gomez and Gomez (1984) and the treatments means were compared using different litters according to Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Plant height (cm):

Data presented in Table (3) clearly show that applying mineral fertilizer nitrogen recommended dose or its parts combined with organic (FYM), bio-fertilizers (Microbein) or humic and fulvic acids significantly increased plant height as compared to untreated treatment (control), in the two seasons of study. Applying the recommended dose of mineral fertilizer nitrogen plus humic and fulvic acids gave the highest values of this trait, i.e., 29.37 and 31.77 cm, in the first and second seasons, respectively. However, the combination between the recommended dose of nitrogen and farm yard manure, microbien or humic and fulvic acids significantly increased plant height as compared to the recommended dose of nitrogen alone. The same trend was also observed under the parts of recommended dose of nitrogen fertilizer. Moreover, no significant defers $\frac{3}{4}$ RD (N) + FYM, $\frac{3}{4}$ RD (N) + Microbien or $\frac{3}{4}$ RD (N) + humic and fulvic acids compared with the recommended dose of chemical nitrogen in plant height. These results were true in the two seasons under study (2013 and 2014). These results may be due to the effect of farm yard manure, microbien and humic and fulvic acids in fixing atmospheric nitrogen and release phytohormones which encourage plant cell division (DeSilva and Cook, 2003 and Wu et al., 2005). Also, farm yard manure or humic and fulvic acids for play an important in improving the chemical and physical properties of soil, which positing reflect on plant growth. These results take the same trend with those found by El-Akabawy (2000) and Shen and Shen (2001).

Pod length and diameter:

Results illustrated in Table (3) indicate that values of pod length in all treatments of study were higher than those obtained by untreated treatment

(control). The same trend was obtained for pod diameter. The results also show that there were significant increases pod length by adding $\frac{3}{4}$ RD (N) + FYM, $\frac{3}{4}$ RD (N) + Microbien or $\frac{3}{4}$ RD (N) + humic and fulvic acids comparison with the recommended dose of nitrogen fertilizer. Meanwhile, the highest in values of pod length and diameter were produced by applying the recommended dose of nitrogen fertilizer plus spraying humic and fulvic acids, and the same trend was also found at the levels of parts of the recommended dose of nitrogen fertilizer ($\frac{3}{4}$ and $\frac{1}{2}$ N RD). These results are true in the two experimental seasons (2013 and 2014). These results may be attributed to the beneficial effect of organic matter on the availability of macro and micro nutrients, which positively reflected on pod length and diameter parameters. These results are in agreement with those reported by El-Akabawy (2000) and Shen and Shen (2001).

Table (3): Effect of nitrogen fertilizers, organic (FYM), biofertilizer (Microbien) and humic and fulvic acids on pod length, pod diameter and plant height of common bean in 2013 and 2014 seasons.

| Treatments | Plant height (cm) | | Pod length (cm) | | Pod diameter (cm) | |
|---------------------------------------|-------------------|-------------|-----------------|-------------|-------------------|-------------|
| | 2013 season | 2014 season | 2013 season | 2014 season | 2013 season | 2014 season |
| Control (untreated) | 18.00f | 17.20f | 10.67e | 10.97e | 0.66b | 0.64b |
| N Recommended Dose (RD) | 27.73b | 28.97b | 12.97cd | 13.09bcd | 0.79a | 0.81a |
| RD (N) + (FYM) | 29.17a | 31.90a | 14.03a | 14.18a | 0.82a | 0.83a |
| RD (N) + (Microbien) | 29.07a | 30.83a | 13.30bc | 13.47abc | 0.81a | 0.82a |
| RD (N) + (Humic&Fulvic) | 29.37a | 31.77a | 13.83ab | 14.07a | 0.82a | 0.84a |
| $\frac{3}{4}$ N Recommended Dose (RD) | 24.53d | 25.13d | 12.63d | 12.80cd | 0.78a | 0.79a |
| $\frac{3}{4}$ RD (N) + (FYM) | 27.71b | 28.87b | 13.47abc | 13.67ab | 0.81a | 0.82a |
| $\frac{3}{4}$ RD (N) + (Microbien) | 26.90bc | 28.20b | 13.93a | 13.95a | 0.81a | 0.81a |
| $\frac{3}{4}$ RD (N) + (Humic&Fulvic) | 27.03bc | 28.70b | 13.83ab | 13.87a | 0.82a | 0.83a |
| $\frac{1}{2}$ N Recommended Dose (RD) | 23.07e | 23.33e | 12.60d | 12.67d | 0.77a | 0.77a |
| $\frac{1}{2}$ RD (N) + (FYM) | 25.80cd | 26.07cd | 12.95cd | 13.10bcd | 0.79a | 0.79a |
| $\frac{1}{2}$ RD (N) + (Microbien) | 25.07d | 25.23d | 12.53d | 12.73cd | 0.78a | 0.79a |
| $\frac{1}{2}$ RD (N) + (Humic&Fulvic) | 26.47bc | 26.83c | 13.07cd | 13.07bcd | 0.80a | 0.80a |

Mean values among variants were compared by using different litters according to Duncan's multiple range test.

Fresh root weight at 50 and 70 days:

The effect of chemical nitrogen fertilizer, organic, biofertilizer and humic and fulvic acids on fresh root weight at 50 and 70 days from planting are presented in table (4). Data indicated that all studied treatments had significant effect compared with the untreated one, in the two seasons of study. Applying the recommended dose of nitrogen plus humic and fulvic acids produced the highest values for fresh root weight at 50 and 70 days from planting, in the two seasons under study. Applying farm yard manure, microbien or humic and fulvic acids with the recommended dose of nitrogen fertilizer significantly increased values of these characters as compared to the recommended dose of nitrogen alone, in the two seasons of study. The same

trends was found under the parts levels of nitrogen recommended dose of chemical fertilizer. The applications $\frac{3}{4}$ mineral nitrogen fertilizer plus humic and fulvic acids had the highest values fresh root weight at 50 days from planting compared with recommended dose mineral nitrogen fertilizer, while, the application of $\frac{3}{4}$ RD (N) plus FYM, microbial or humic and fulvic acids had the highest fresh root weight at 70 days from planting, in both seasons. These findings may be attributed to the effect of organic and biofertilizers for giving a good source of plant nutrients and their role in improving soil physical structure and stimulate plant growth by producing growth regulators. These results are in line with those found by Shen and Shen (2001), Abraham and Lal (2003) and Khalilzedh et al., (2012).

Table (4): Effect of nitrogen fertilizers, organic (FYM), biofertilizer (Microbial) and humic and fulvic acids on root weight at 50 days and 70 days and leaf area of common bean in 2013 and 2014 seasons.

| Treatments | Fresh root weight (g) at 50 days | | Fresh root weight (g) at 70 days | | Leaf area (dm ²) | |
|---------------------------------------|----------------------------------|-------------|----------------------------------|-------------|------------------------------|-------------|
| | 2013 season | 2014 season | 2013 season | 2014 season | 2013 season | 2014 season |
| Control (untreated) | 0.827g | 0.870h | 1.257g | 1.270e | 1.620e | 1.603E |
| N Recommended Dose (RD) | 1.403bcd | 1.437cd | 2.527e | 2.677bc | 2.513bcd | 2.577abc |
| RD (N) + (FYM) | 1.477b | 1.523bc | 2.623cde | 2.793ab | 2.707ab | 2.670ab |
| RD (N) + (Microbial) | 1.477b | 1.567b | 2.600de | 2.750bc | 2.593bc | 2.613abc |
| RD (N) + (Humic&Fulvic) | 1.743a | 1.803a | 2.887a | 2.903a | 2.917a | 2.887a |
| $\frac{3}{4}$ N Recommended Dose (RD) | 1.170f | 1.287f | 2.717bcd | 2.753bc | 2.373cd | 2.360bcd |
| $\frac{3}{4}$ RD (N) + (FYM) | 1.363cde | 1.403de | 2.733bc | 2.740bc | 2.540bc | 2.573abc |
| $\frac{3}{4}$ RD (N) + (Microbial) | 1.290e | 1.323ef | 2.787ab | 2.790ab | 2.437bcd | 2.517a-d |
| $\frac{3}{4}$ RD (N) + (Humic&Fulvic) | 1.443bc | 1.467bcd | 2.640cde | 2.707bc | 2.547bc | 2.590abc |
| $\frac{1}{2}$ N Recommended Dose (RD) | 1.147f | 1.133g | 2.270f | 2.290d | 2.237d | 2.183d |
| $\frac{1}{2}$ RD (N) + (FYM) | 1.323de | 1.393def | 2.610cde | 2.617c | 2.340cd | 2.327bcd |
| $\frac{1}{2}$ RD (N) + (Microbial) | 1.140f | 1.183g | 2.273f | 2.260d | 2.313cd | 2.253cd |
| $\frac{1}{2}$ RD (N) + (Humic&Fulvic) | 1.313de | 1.377def | 2.630cde | 2.657bc | 2.433bcd | 2.383bcd |

Mean values among variants were compared by using different litters according to Duncan's multiple range test.

Leaf area :

Results dealing with the effect of farm yard manure, microbial and humic and fulvic acids on leaf area (dm²) under the level of the recommended dose and levels of its parts are show in Table (4), results reveal that all studied combination significantly increased leaf area as compared to untreated one, in the two seasons under study. The highest values of this trait i.e., (2.917 and 2.887 dm²) were obtained by the combination between the recommended dose of chemical nitrogen with humic and fulvic acids. Also, this trend was found in the two seasons. Applying FYM, microbial or humic and fulvic acids at the rate of $\frac{1}{2}$ the recommended dose of nitrogen fertilizer obtained values of leaf area (dm²) less than those of similar treatment at the recommended dose of nitrogen fertilizer. While, the application of $\frac{3}{4}$ RD (N) plus FYM, microbial or humic and fulvic acids observed that values leaf area (dm²) were the higher than with application the recommended dose mineral

nitrogen fertilizer. The obtained data clear that the effects of applying FYM and humic and fulvic acids with the level of $\frac{3}{4}$ nitrogen recommended dose on leaf area (dm^2) were equal to those obtained by the recommended dose of nitrogen fertilizer alone during the two seasons under study. Khalizadeh et al., (2012) come to the same trend.

Nitrogen contents in the leaves and fresh pods :

Results in Table (5) clearly indicate that organic, biofertilizer and humic and fulvic acids and their interactions with nitrogen recommended dose or its parts significantly increased nitrogen contents percentage in both leaves and fresh pods as compared to untreated one, in the two seasons of study. The highest values of nitrogen contents (%) in leaves were produced in 2013 season by applying nitrogen recommended dose plus farm yard manure (3.357%), while, the highest values of nitrogen contents (%) in leaves at 2014 season was obtained by applying the recommended dose of nitrogen plus humic and fulvic acids (3.417%).

Table (5): Effect of nitrogen fertilizers, organic (FYM), biofertilizer (Microbien) and humic and fulvic acids on leaf and fresh pods N-contents and number of pods/plant of common bean in 2013 and 2014 seasons.

| Treatments | Leaves N-contents % | | Fresh pods N-contents % | | No. of pods/plant | |
|---------------------------------------|---------------------|-------------|-------------------------|-------------|-------------------|-------------|
| | 2013 season | 2014 season | 2013 season | 2014 season | 2013 season | 2014 season |
| Control (untreated) | 2.110e | 2.117h | 2.110e | 2.117h | 9.57j | 9.73h |
| N Recommended Dose (RD) | 3.327a | 3.303a | 3.327a | 3.303a | 26.28c | 26.03c |
| RD (N) + (FYM) | 3.357a | 3.373a | 3.357a | 3.373a | 28.35a | 28.56a |
| RD (N) + (Microbien) | 3.260a | 3.307a | 3.260a | 3.307a | 27.03b | 27.35b |
| RD (N) + (Humic&Fulvic) | 3.320a | 3.417a | 3.320a | 3.417a | 28.79a | 29.05a |
| $\frac{3}{4}$ N Recommended Dose (RD) | 2.807b | 2.740cd | 2.807b | 2.740cd | 19.82h | 20.08f |
| $\frac{3}{4}$ RD (N) + (FYM) | 2.958b | 2.920b | 2.958b | 2.920b | 26.23c | 25.91c |
| $\frac{3}{4}$ RD (N) + (Microbien) | 2.610c | 2.590de | 2.610c | 2.590de | 25.36d | 25.46c |
| $\frac{3}{4}$ RD (N) + (Humic&Fulvic) | 2.943b | 2.860bc | 2.943b | 2.860bc | 26.14c | 26.20c |
| $\frac{1}{2}$ N Recommended Dose (RD) | 2.417d | 2.227gh | 2.417d | 2.227gh | 16.70i | 16.89g |
| $\frac{1}{2}$ RD (N) + (FYM) | 2.487cd | 2.387fg | 2.487cd | 2.387fg | 23.65e | 23.81d |
| $\frac{1}{2}$ RD (N) + (Microbien) | 2.460cd | 2.350fg | 2.460cd | 2.350fg | 21.30g | 21.51e |
| $\frac{1}{2}$ RD (N) + (Humic&Fulvic) | 2.537cd | 2.460ef | 2.537cd | 2.460ef | 22.15f | 22.31e |

Mean values among variants were compared by using different litters according to Duncan's multiple range test.

The effect of adding farm yard manure was clearly shown at $\frac{3}{4}$ the recommended dose of nitrogen fertilizer and all the recommended dose of nitrogen fertilizer, while, the effect of adding humic and fulvic acids was noticed at the level of $\frac{1}{2}$ nitrogen recommended dose. Microbien gave the lowest values of nitrogen in leaves (%) at any of the recommended dose of nitrogen fertilizer and its parts. The highest values of fresh pods nitrogen contents were recorded by nitrogen recommended dose and its parts with adding humic and fulvic acids during the two seasons of study. These results could

be due to the role of the organic and biofertilizers in increasing the permeability of plant membranes and enhancing the uptake of nutrients especially nitrogen (Singer et al., 1998 and Pascual et al., 1999). Humic and fulvic acids are considered to be compounds increasing permeability of cellular membranes in plants (Kaya et al., 2005).

Number of pods per plant:

Data shown in Table (5) clearly reveal that all studied treatments gave number of pods/plant values significantly surpassed that produced by the untreated one, in the two seasons of study. Applying humic and fulvic acids with the level of recommended dose of nitrogen obtained the highest values of number of pods/plant, the same trend was found by applying humic and fulvic acids with $\frac{1}{2}$ the recommended dose of nitrogen fertilizer produced the higher values as compared to the values of number of pods/plant obtained by farm yard manure and microbien at the same level. Farm yard manure obtained the higher values of number of pods/plant as compared of those obtained by microbien and humic and fulvic acids at the level adding $\frac{3}{4}$ of nitrogen recommended dose under the two seasons under study. No significant effect between $\frac{3}{4}$ RD (N) + FYM, $\frac{3}{4}$ RD (N) + Microbien and $\frac{3}{4}$ RD (N) + humic and fulvic acids compared with the recommended dose of chemical nitrogen of number of pods/plant. The increments induced in number of pods/plant may be attributed to the many benefits of humic and fulvic acids and enhancing uptake of several essential nutrients. Kaya et al., (2005) reported that using humic and fulvic acids are considered to be compounds increasing permeability of cellular membranes in plants to vitamins within the cells.

Fresh pods yield :

Results listed in Table (6) revealed that increased fertilizing common bean plant with recommended dose of nitrogen or with its parts combining with farm yard manure, microbein and humic and fulvic acids significantly fresh pods weight (ton/fed) more than those obtained by the untreated treatment. These were true in both seasons of study. These results are in agreement with those reported by Abraham and Lal (2003). The highest values of fresh pods weight were recorded with applying farm yard manure plus the recommended dose of nitrogen fertilizer (3.985 and 3.961 ton/fed) in the first and second seasons, respectively. No significant effect were found between $\frac{3}{4}$ RD (N) + FYM, $\frac{3}{4}$ RD (N) + Microbien and $\frac{3}{4}$ RD (N) + humic and fulvic acids treatment and the recommended dose of chemical nitrogen in fresh pods yield.

Applying farm yard manure, microbien or humic and fulvic acids plus the recommended dose of nitrogen fertilizer, $\frac{3}{4}$ the recommended dose of nitrogen fertilizer or $\frac{1}{2}$ the recommended dose of nitrogen fertilizer obtained the higher values of fresh pods weight in comparison with those obtained by the single levels of nitrogen. Farm yard manure produced the highest pods yield as compared to either the recommended dose of nitrogen fertilizer or $\frac{1}{2}$ the recommended dose of nitrogen fertilizer, while, treating common bean with humic and fulvic acids plus $\frac{3}{4}$ the recommended dose of nitrogen fertilizer had the highest values of fresh pods yield as compared to the other treatments at the same level during the two seasons of study (2013 and

2014). The results clear that the application of $\frac{3}{4}$ the recommended dose of mineral nitrogen fertilizer plus FYM, microbial or humic and fulvic acids produced the highest values of fresh pods yield compared with those obtained by the application of the recommended dose of mineral nitrogen fertilizer. These results are in agreement with those reported by Abraham and Lal (2003). Whereas, the farm yard manure may be improve physical and chemical soil properties and nutrient content soil that may be reflect positively on the growth and yield.

Table (6): Effect of nitrogen fertilizers, organic (FYM), biofertilizer (Microbial) and humic and fulvic acids on fresh pods yield and exportable fresh pods yield of common bean in 2013 and 2014 seasons.

| Treatments | Fresh pods yield (ton/fed.) | | Exportable fresh pods yield (ton/fed) | |
|---------------------------------------|-----------------------------|-------------|---------------------------------------|-------------|
| | 2013 season | 2014 season | 2013 season | 2014 season |
| Control (untreated) | 1.231d | 1.259e | 1.120e | 1.146f |
| N Recommended Dose (RD) | 3.768ab | 3.749ab | 3.561abc | 3.562a-d |
| RD (N) + (FYM) | 3.985a | 3.961a | 3.865a | 3.846a |
| RD (N) + (Microbial) | 3.939a | 3.945a | 3.821a | 3.827a |
| RD (N) + (Humic&Fulvic) | 3.949a | 3.953a | 3.842a | 3.854a |
| $\frac{3}{4}$ N Recommended Dose (RD) | 3.219bc | 3.185bcd | 3.100c | 3.064d |
| $\frac{3}{4}$ RD (N) + (FYM) | 3.773ab | 3.771ab | 3.716ab | 3.718ab |
| $\frac{3}{4}$ RD (N) + (Microbial) | 3.696ab | 3.699abc | 3.648ab | 3.651abc |
| $\frac{3}{4}$ RD (N) + (Humic&Fulvic) | 3.874a | 3.870a | 3.831a | 3.831a |
| $\frac{1}{2}$ N Recommended Dose (RD) | 2.840c | 2.822d | 2.556d | 2.512e |
| $\frac{1}{2}$ RD (N) + (FYM) | 3.208bc | 3.175bcd | 3.176bc | 3.146cd |
| $\frac{1}{2}$ RD (N) + (Microbial) | 3.075c | 3.125cd | 3.050c | 3.097cd |
| $\frac{1}{2}$ RD (N) + (Humic&Fulvic) | 3.255bc | 3.265bcd | 3.245bc | 3.254bcd |

Mean values among variants were compared by using different litters according to Duncan's multiple range test.

Exportable fresh pods yield :

Data in Table (6) clearly show that the highest values of exportable fresh pods yield were recorded with applying farm yard manure plus the recommended dose of nitrogen fertilizer (3.865 and 3.846 ton/fed) in the first and second seasons, respectively. No significant differences among the treatments of applying farm yard manure, microbial or humic and fulvic acids plus $\frac{3}{4}$ the recommended dose of nitrogen fertilizer with the recommended dose of nitrogen fertilizer.

These results indicated that common bean can be fertilizing by $\frac{3}{4}$ the recommended dose of nitrogen fertilizer plus farm yard manure, microbial or humic and fulvic acids to improve the produce of common bean and also decrease the mineral hazard. These results are in agreement with those reported by Abraham and Lal (2003).

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إستجابة الفاصوليا للتسميد العضوى والحيوى تحت مستويات مختلفة من السماد النتروجينى.

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أجريت هذه الدراسة بمحطة بحوث جزيرة شندويل خلال موسمى نيلى ٢٠١٣ و ٢٠١٤م واستخدم تصميم القطاعات الكاملة العشوائية فى ثلاث مكررات. وكان الهدف من الدراسة هو دراسة تأثير إضافة التسميد العضوى (سماد المزرعة المتحلل) والحيوى (الميكروبيين) وأيضاً الرش الورقى بأحماض الهيومك والفلبيك كبديل لجزء أو كل جرعات التسميد الكيماوى (نصف وثلاثة أرباع التسميد النتروجينى الموصى به) عند تسميد نباتات الفاصوليا صنف بوليستا . وكانت أهم النتائج كالتالى :

جميع المعاملات المدروسة أعطت زيادة معنوية لجميع الصفات موضع الدراسة مقارنة بمعاملة المقارنة (بدون تسميد) خلال موسمى الدراسة .

أعطت إضافة الجرعة الموصى بها من السماد الكيماوى النتروجينى مع سماد المزرعة أو الميكروبيين أو أحماض الهيوميك والفلبيك زيادة معنوية لكل الصفات موضع الدراسة مقارنة بالجرعة الموصى بها من السماد الكيماوى النتروجينى فقط وكذلك أعطت ثلاثة أرباع ونصف الجرعة من السماد الكيماوى النيتروجينى الموصى بها نفس النتائج فى الموسمين .

أعطت صفات إرتفاع النبات ، الوزن الطازج للجذور عند أعمار ٥٠ و ٧٠ يوم من الزراعة ، النسبة المئوية للنتروجين فى القرون الخضراء ، مساحة سطح الورقة وعدد القرون للنبات أعلى القيم عندما تم تسميدها بالجرعة الموصى بها من التسميد النتروجينى مع أحماض الهيوميك والفلبيك ، بينما صفات طول القرن وعرض القرن ومحصول القرون الأخضر للفدان ومحصول القرون الخضراء القابلة للتصدير أعطت أعلى القيم عندما تم تسميدها بالجرعة الموصى بها من التسميد النتروجينى مع التسميد بسماد المزرعة المتحلل.

تم الحصول على أعلى محصول من القرون الخضراء (٣.٩٨٥ و ٣.٩٦١ طن/فدان) من التفاعل بين الجرعة الموصى بها من السماد النتروجينى الكيماوى مع سماد المزرعة فى الموسم الأول والثانى على التوالى، لا توجد إختلافات معنوية بين التسميد بالجرعة الموصى بها من السماد النتروجينى الكيماوى والتسميد بثلاثة أرباع الجرعة الموصى بها من السماد النتروجينى الكيماوى + التسميد بسماد المزرعة أو الميكروبيين أو أحماض الهيوميك والفلبيك للحصول على قرون فاصوليا خضراء للإستهلاك المحلى أو القابلة للتصدير.

يوضح هذا البحث أهمية إضافة الأسمدة العضوية أو الحيوية مع ثلاثة أرباع الأسمدة الكيماوية من أجل تحسين المحصول الناتج وخفض تكاليف السماد المعدنى وكذلك التلوث البيئى .