Influence of Some Nitrogen Fertilization and Dry Yeast Extract Levels on Growth and Pod Yield of Snap Bean (*Phaseolus vulgaris* L.)

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**ABSTRACT**

This investigation was carried out during two successive summer seasons of 2015 and 2016 in a private farm at Al-Harsha, Zawia region, Libya, to examine the effect of N-Fertilization (in the form of ammonium sulphate, 20.5% N; 0, 50 and 100kg/ha”) and foliar application with dry yeast extracts (0.2 and 4 g/l), and its combined effect on growth, yield and its attributes, as well as, quality traits of snap bean (bronco cultivar). The experiment was laid out as split plot arrangement in randomized complete blocks design (RCBD) with three replications. The results showed that applying N-Fertilizer and foliar application with dry yeast extract gave significant differences in all studied traits compared to the control (untreated) in favor of 100kg/ha, N and 4g/l dry yeast extract in both seasons. Concerning the combined effect between N-Fertilization and dry yeast extract, there were significant effects in most of studied traits in both seasons. The combination of 100kg N/ha, and 4 g/l dry yeast extract recorded the highest mean values of vegetative growth characters yield components, total yield and pod quality in the both seasons. Conclusively: it could be concluded that the treatment of N-Fertilization in the form of ammonium sulphate (20.5% N) at 100 kg N/ha and foliar application with dry yeast extract at the level of 4 g/l, as well as, the combined effect between 100 kg N/ha and 4 g/l dry yeast extract enhancing the studied characters of snap bean.

**Keywords**: snap bean, pod quality, N-Fertilizer, dry yeast extract.

**Introduction**

Snap bean plants (*Phaseolus vulgaris* L.) is one of the important vegetable crops in Libya after pea plants for local market. However, the bean plants are relatively sensitive to environmental stresses that occur in the field under the Libyan soil conditions compared to most vegetable crops.

Legumes were the major direct source of proteins for both man and livestock, they also supplied fat, carbohydrates, minerals and essential vitamins for bones construction and to be healthy (Pores et al., 2003).

The important of legumes is that can fix nitrogen helping symbiotic association with rhizobia, and so they increased the soil nitrogen content and soil fertility (Poth et al., 1986).

The nitrogenous nutrition of legumes was difficult to study because it resulted from the combination of two very different pathways, the fixation of the atmospheric nitrogen ant the assimilation of the mineral nitrogen. Beans are capable of fixing atmospheric nitrogen through Rhizobium species living in root nodules.

Inoculation of beans with Rhizobium increased plant height, leaf area, photosynthetic rate and dry matter production (Amos et al., 2001 and Elkhatib, 2009).

The plant N requirement may not be met during early vegetative and later productive phases by N-fixation, at these critical times, mineral N becomes the most important source of N for grain legumes (Amos et al., 2001).

Many investigators indicated that N-fertilizer increased bean growth, chemical composition, pod yield and quality (Ouslim et al., 2015, and Elkhathib, 2009). The addition of chemical fertilizers containing nitrogen are necessary for the plant and activation the Rhizobia bacteria, but the negative
The effects of chemical fertilizers led to the search for other methods with positive impact on the soil microorganisms (Al-Amery and Mohammed, 2017).

The studies have illustrated the bread yeast or dry yeast fungi resistant the high levels of temperature and salinity (Omar, 2003 and Samra et al., 2014).

Yeast is a natural source of cytokinins and protein that enhance cell division and enlargement (Barnett et al., 1990, Yeo et al., 2000, and Mahmoud et al., 2013) and increased vegetative growth, chemical composition, yield and quality of legumes crops (Al-Amery and Mohammed, 2017, Abo-Hamad, 2016, and Neama et al., 2014).

The objective of this study to evaluate the response of snap bean plant grown under Libyan soil to yeast extract and N-fertilizer levels on growth, chemical composition, total yield and its contents of nutritional values of green pods.

Materials and Methods

Two experiments were conducted in two successive growing seasons of 2015 and 2016 at Al-Harsha Region, Zawia City, Libya to investigate the effect of nitrogen fertilizer levels and yeast extract and its combined effect on growth, chemical composition, pod yield and quality of snap bean cv-Bronco.

The chemical and physical properties of soil and water analysis are shown as presented in Tables (1 and 2).

Table 1: The physical and chemical properties of the farm soil in Al- Harsha region

| Physical properties          | Values |
|-----------------------------|--------|
| Sand %                      | 55     |
| Silt %                      | 26     |
| Clay %                      | 19     |
| Soil texture                | Sandy loam |
| Organic matter (%)          | 0.5    |
| pH                          | 7.8    |
| CEC ( Cation Exchangeable Capacity) | 7.7 (meq /100 g soil) |

Table 2: Analysis of the used water irrigation in experimental soil

| Characters          | Concentration |
|--------------------|---------------|
| Total salts        | 1300 ppm      |
| Ca ++ ( meq / L   )| 17.0          |
| Mg ++ ( meq / L   )| 16.8          |
| Na ( meq / L      )| 13.6          |
| K + (meq / L      )| 2.01          |
| SO4 -- ( meq / L  )| 4.29          |
| HCO3 - ( meq / L  )| 3.05          |
| EC ( Electric Conductivity) | 0.60 dS / m  |

The experiment included 9 treatments with three replication, which were three levels of nitrogen fertilizer (0, 50 and 100kg/ha in the form of ammonium sulphate (20, 5% N) and three foliar application levels of dry yeast extract (0, 2 and 4/L). The experimental layout was a split-plot design with three replications. Nitrogen levels were arranged in the main plots, and yeast extracts were assigned to sub-plots. The plot area was 10.5 m², which were formed by three rows of 5 m length, and 0.7 m width. Snap bean (Phaseolus vulgaris L.) Bronco cultivar was used in both years of investigations (summer of 2015 and 2016 seasons).

All bean seed inoculations were done with the symbiotic N-fixing bacteria of genus Rhizobium by coating the seeds at the rate of 20 gms of Oqadin/kg of seeds, (which preparing from Ministry of
Agriculture, Agricultural Research Center, Giza, Egypt, Microbiology Unit), and using staking substance (Arabic gum 5%) just before sowing and then directly sown on one side of the row at 15 cm intra-row spacing at 15 and 17 March in 2015 and 2016, respectively. Nitrogen was applied by hand as ammonium sulphate (20.5%N) at two equal doses, 3 and 5 weeks after sowing, for the chosen plots from the treatments. Phosphorus and potassium fertilizations were also applied to all plots of treatments in doses of 72 kg P₂O₅/ha, and 115 kg K₂O/ha, as calcium super phosphate (15.5%P₂O₅) and potassium sulphate (48% K₂O), respectively. Yeast extract was prepared from brewer's yeast (Saccharomyces cerevisiae), dissolved in water followed by adding sugar at a ratio of 1:1, and kept 24 hours in a warm place for reproduction according to the methods of Morsi et al. (2008). Chemical analysis of activated yeast is shown in Table 3 from Tartoura, (2001).

Table 3: Dry yeast composition

| Natural Element | %    | Natural Element | %    |
|-----------------|------|-----------------|------|
| N               | 1.2  | Cu              | 0.04 |
| P               | 0.13 | B               | 0.015|
| K               | 1.2  | Mo              | 0.0003|
| Mn              | 0.013| Total Protein   | 5.3  |
| Ca              | 0.02 | Carbohydrates   | 4.7  |
| Na              | 0.01 | Auxin IAA       | 0.5  |
| Mg              | 0.07 | Gibberellin     | 0.03 |
| Zn              | 0.04 |                 |      |

Data recorded:
Vegetative growth characters:

The data of vegetative growth characters were recorded using five random chosen plants from each treatment, 60 days after seed sowing. The following measurements were recorded; plant height (cm), Number of leaves, Number of branches, and plant fresh and dry weight (9).

Total chlorophyll of leaves:

The total chlorophyll of leaves was determined at 60 days from seed sowing by chlorophyll meter spade 501, according to Yakava (1986).

Green pod yield and its components:

At harvesting time, plants of the second row was allocated to measure the following data: number of green pods/plant, average of green pod weight (9), green pod yield/plant (9), and green pod yield/ha (ton).

Pod quality:

a) Physical pod characters:

Pod length and pod diameter (cm.) were measured at – harvesting time too.

b) Chemical pod constituents:

At harvesting time, wet digestion was performed on pod according to Chapman and Pratt (1978). Total nitrogen was determined using new micro Kjeldahl according to Ling (1963). Potassium was determined according to (FAO, 1980), as well as, protein content was determined according to the same reference. Carbohydrates of pods were determined according to the methods described by Shaffer and Hartman, (1921).

Statistical analysis:

The obtained data were statistically analyzed using SAS software program (2002). Comparisons among the means of different treatments were conducted using least significant difference procedure at p = 0.0.5 level as illustrated by snedecor and Cochran (1980).
Results and Discussion

Vegetative growth parameters:

a) Effect of N-fertilizer levels:
   Data presented in tables (4) and (5), illustrated that nitrogen application rates had a significant
effects on the plant height, number of leaves and number of branches (table 4) and plant fresh weight
and plant dry weight (table 5), in the two growing seasons of the study compared to the control
treatment.
   Increasing nitrogen levels up to 100 kg/ha, reflected appositive growth parameters. The treatment
of 100 kg/ha, being the most effective in both growing seasons of all vegetative growth parameters.
   Respecting the role of nitrogen on plants, Edmond et al. (1981), concluded that the favorable
effect and indispensable elementary constituent of numerous organic compounds of general
impotence (amino acids, protein, and nucleic acid), which are needed in the formation protoplasm and
new cells, and thus increased fresh and dry weight of different parts of plant.
   Obtained results are in accordance with those reported by Amos et al. (2001), Ouslim et al.
(2015) and El Kharib, (2009). They concluded that N-fertilization increased plant height, number of
branches, leaves, plant fresh and dry weight of different legumes plant.

b) Effect of yeast extract:
   Regarding the vegetative growth a characters of snap beans plants, i.e. plant height, number of
leaves, number of branches, plant fresh weight, and total plant dry weight showed observed responses
to different yeast concentration (tables 4 and 5). Whereas, the highest values of the above mentioned
findings were recorded with the highest yeast concentration (4g/L) However, the highest level of yeast
extract (4g/L) significantly increased all vegetative growth parameters compared to low level (2g/L).
   Meanwhile, the lowest values were obtained with the corresponding untreated plants by yeast
treatment. These findings were true in both growing seasons of the study.
   It could be concluded that, the improving of the vegetative growth parameters of snap beans
plants by increasing the level of yeast extract application may be due to that, yeast extracts are natural
components contain many of the nutrient element and cytokinins which had an important role in cell
elongation and division, consequently increased the plant growth (Amer, 2004).
   The trends of obtained results are in good accordance to the previous investigators, such as
shafeeck, (2015) Neama et al. (2014), and Attala et al. (2000), they illustrated that yeasts play critical
role in synthesis of compounds such as, vitamins and cytokinins and are regarded as important factor
in metabolite transportation from leaves to reproductive organs.
   These results are agreement with those obtained by Al-Amery and Mohammed, (2017). Who
illustrated that yeast or yeast extraction is the natural source of hormones which increased the
vegetative growth characters of legumes planets.

c) The combined effect of N-fertilization and yeast extract:
   The vegetative growth characters of snap beans plants are presented by the combined effect of
N-fertilization and yeast extracts. with respect to the combined effect of N-Fertilizers rate (0, 50 and
100kg/ha) and yeast extracts (0, 2 and 4 g/L), data reveal that there was an increase with increasing N
- fertilizer rate up to 100 kg/ha with increasing yeast extract up to 4 g/l on all vegetative growth
characters of snap bean, i.e. plant height, number of leaves and branches, fresh dry weight of plant.
   These results are in partial agreement with those obtained by Gewaily et al. (1996) and Abou
El-salehien et al. (2004).

Total chlorophyll:

a) Effect of N-fertilization:
   Data in Table (5) revealed that the rates of N-fertilizer (50 and 100 kg/ha, significantly
increased total chlorophyll of snap bean leaves in both growing seasons compared with the control
treatment.
Table 4: Effect of N fertilization and dry yeast extract and its interaction on vegetative growth of snap bean plants during 2015 and 2016 seasons.

| Treatments | Characters | 2015 | 2016 | 2015 | 2016 | 2015 | 2016 |
|------------|-----------|------|------|------|------|------|------|
| Fertilizers: (A) N(kg/ha) | Plant height | No. of Leaves/plant | No. of branches/plant | No. of branches/plant | No. of branches/plant |
| 0 | 20.18 | 20.25 | 11.61 | 11.27 | 6.13 | 6.19 |
| 50 | 24.37 | 24.45 | 15.18 | 15.25 | 6.57 | 6.61 |
| 100 | 25.15 | 25.19 | 15.38 | 15.44 | 6.62 | 6.69 |
| LSD(0.05) | 3.25 | 3.36 | 0.19 | 0.17 | 0.03 | 0.05 |
| Dry yeast extract: (B) N(kg/ha) | No. of Leaves/plant | No. of branches/plant | No. of branches/plant |
| 0 | 21.78 | 21.96 | 12.80 | 12.81 | 6.25 | 6.31 |
| 2 | 23.70 | 23.67 | 14.54 | 14.61 | 6.46 | 6.52 |
| 4 | 24.13 | 24.25 | 14.82 | 14.84 | 6.61 | 6.66 |
| LSD(0.05) | 0.29 | 0.33 | 0.23 | 0.21 | 0.11 | 0.09 |
| Interaction: (A*B) N(kg/ha) | No. of Leaves/plant | No. of branches/plant | No. of branches/plant |
| 0 | 18.87 | 18.98 | 10.11 | 9.97 | 5.75 | 5.93 |
| 2 | 20.49 | 20.41 | 12.33 | 12.33 | 6.22 | 6.27 |
| 4 | 22.43 | 22.51 | 13.98 | 14.07 | 6.49 | 6.64 |
| 50 | 25.17 | 25.21 | 15.64 | 15.69 | 6.55 | 6.61 |
| 100 | 24.33 | 24.41 | 14.33 | 14.39 | 6.49 | 6.64 |
| LSD(0.05) | 6.64 | 11.66 | 0.11 | 0.23 | 0.3 | 0.3 |

Table 5: Effect of N fertilization and dry yeast extract and its interaction on fresh and dry weight and total chlorophyll of snap bean plants during 2015 and 2016 seasons.

| Treatments | Characters | 2015 | 2016 | 2015 | 2016 | 2015 | 2016 |
|------------|-----------|------|------|------|------|------|------|
| Fertilizers: (A) N(kg/ha) | Plant fresh weight (g) | Plant dry weight (g) | Total chlorophyll (mg/g. Fresh weight) |
| 0 | 83.17 | 84.24 | 2.70 | 2.76 | 1.60 | 1.67 |
| 50 | 111.25 | 107.99 | 5.54 | 5.54 | 1.81 | 1.82 |
| 100 | 119.92 | 121.52 | 5.80 | 5.97 | 1.86 | 1.86 |
| LSD(0.05) | 6.64 | 11.66 | 0.11 | 0.23 | 0.3 | 0.3 |
| Dry yeast extract: (B) N(kg/ha) | Plant fresh weight (g) | Plant dry weight (g) | Total chlorophyll (mg/g. Fresh weight) |
| 0 | 92.44 | 93.07 | 3.41 | 3.48 | 1.63 | 1.70 |
| 2 | 104.36 | 102.17 | 4.90 | 4.97 | 1.77 | 1.79 |
| 4 | 117.54 | 118.57 | 5.62 | 5.82 | 1.87 | 1.86 |
| LSD(0.05) | 10.5 | 9.55 | 0.62 | 0.64 | 0.05 | 0.06 |
| Interaction: (A*B) N(kg/ha) | Plant fresh weight (g) | Plant dry weight (g) | Total chlorophyll (mg/g. Fresh weight) |
| 0 | 71.55 | 72.17 | 1.59 | 1.68 | 1.41 | 1.57 |
| 2 | 84.39 | 85.12 | 3.15 | 3.22 | 1.69 | 1.70 |
| 4 | 93.57 | 95.45 | 3.36 | 3.39 | 1.71 | 1.74 |
| 50 | 98.33 | 97.95 | 3.91 | 3.97 | 1.74 | 1.77 |
| 100 | 111.55 | 101.87 | 5.68 | 5.76 | 1.80 | 1.82 |
| LSD(0.05) | 10.5 | 9.55 | 0.62 | 0.64 | 0.05 | 0.06 |

The highest rate of 100 kg/ha, being the most effective on total chlorophyll of snap bean leaves. Meanwhile lowest value of total chlorophyll was obtained by the control treatment. Concerning the effect of nitrogen, Edmond et al., 1981, illustrated that nitrogen has an important role in increasing photosynthesis in plants and thus increased the total chlorophyll. Obtained results are confirmed with the results obtained by Ouslim et al. (2015).
b) Effect of dry yeast extract:

Foliar application of dry yeast extracts levels resulted in higher total chlorophyll of snap bean leaves (Table: 5).

The level of 4g/L dry yeast extract significantly increased total chlorophyll of snap bean leaves compared with the level of 2 g/L dry yeast extract and 0 g/l (control treatment). Regarding the effect of yeast extract on legumes pigments, Al-Amery and Mohammed, (2017), concluded that dry yeast extract, increased the pigments of plants which contains a natural sources of cytokinins and some hormones that increased the pigments of plant leaves.

These results are agreement with those obtained by Abo Hamad, (2016).

c) The combined effect of N-fertilization dry yeast extract:

Illustrated data in Table(5) reveal that total chlorophyll of snap bean leaves was affected significantly by the combined effect of 100kg N/ha with 4 g/L dry yeast extract, while, the lowest value of total chlorophyll was recorded as a result of without any addition of N-fertilizer rate and without any foliar application of dry yeast extract.

Pod yield and its components:

a) Effect of N-fertilization:

The effect of N-fertilizer levels on green pod yield and its components of snap bean in both growing seasons of 2015 and 2016, ie. Number of green pods/plant, average green pod weight, green pod yield/plant, and green pod yield/ha, are approaching in Table (6). Data show that pod yield characters and its components of snap bean significantly affected by increasing affected byN-fertilizer up 100 kg/ha. However, N-fertilizer of 100 kg/ha, generated the height pod yield and its components of snap been. Respecting the role of nitrogen on yield of plants, El-khatib, 2009, demonstrated that nitrogen is an important in formation of protoplasm and building new cells and thus increased the store organs, like pods.

As well as, the increase in fresh pod yield of snap bean and its components, as a result of N-fertilizer levels to plants, might be attributed to the increase in its vegetative growth and dry matter accumulation (Tables, 4 and 5).

These results are in accordance with those obtained by Ouslim et al., (2015) and Epkhatib, (2009), who stated that N-fertilization increased pod yield of bean plants.

b) Effect of dry yeast extract:

Data presented in Table (6), show the effect of dry yeast concentrations on green pod yield and its components of snap bean in the two growing seasons. Thus, the number of green pods/plant, average green pod weight, green pod yield/plant and green pod yield/ha, was affected significantly by foliar application of different concentrations in both growing seasons. The highest values of green pod yield and its components were obtained from 4 g/L of dry yeast extract.

Regarding the important role of yeast extract on increasing the snap bean pod yield, Shehata et al. 2012, reported that the optimistic effects of spraying yeast extract was qualified to its own contents of different nutrients, high percentage of protein, large amount of vitamin B, and natural plant growth regulators, such as cytokinines. As well as, physiological roles of vitamins and amino acids in the yeast extract which increase the metabolic processes role and levels of endogenous hormones that may indorsed the vegetative growth parameters (Tables 4 and 5), and reflected on enhancing yield.

These findings are supported by Barnett et al., (1990), Yeo et al., (2000), Mahmoud et al., (2013), Al-Amery and Mohammed, (2017).

c) The combined effect of N- fertilization and dry yeast extract:

Exhibited data in Table, 6, exhibit that green pod yield and is components were affected significantly by the combined effect of N- fertilization and dry yeast extract levels in both growing seasons.

The high rate of 100 kg N/ha with high level of dry yeast extract (4 g/L), being the most effective on snap bean pod yield and its components.
Table 6: Effect of N fertilization and dry yeast extract and its interaction on pod yield and its components of snap bean plants during 2015 and 2016 seasons.

| Treatments Fertilizers: (A) N(kg/ha) | Characters | No. of green pods/plant Season | Average green pod weight(g) Season | green pod yield/plant (g) Season | green pod yield/ha (ton) Season |
|--------------------------------------|------------|--------------------------------|-----------------------------------|-------------------------------|-------------------------------|
|                                      | 2015       | 2016                           | 2015                              | 2016                          | 2015                          | 2016                          |
| 0                                    | 8.26       | 8.62                           | 2.78                              | 2.76                          | 23.01                         | 23.3                          | 3.815                         | 3.823                         |
| 50                                   | 12.85      | 12.86                          | 3.12                              | 3.16                          | 40.36                         | 39.24                         | 4.845                         | 4.844                         |
| 100                                  | 13.30      | 13.36                          | 3.19                              | 3.25                          | 42.70                         | 43.76                         | 4.967                         | 4.972                         |
| LSD (0.05)                           | 0.34       | 0.44                           | 0.05                              | 0.07                          | 1.31                          | 1.39                          | 0.011                         | 0.013                         |

Dry yeast extract: (B)

| N(kg/ha) | 0          | 2          | 4          | 0          | 2          | 4          | 0          | 2          | 4          |
|----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| LSD (0.05) | 0.29      | 0.31       | 0.04       | 0.08       | 5.09       | 5.11       | 0.021      | 0.023      |

Interaction: (A*B)

| N(kg/ha) | Dry yeast extract | 0          | 2          | 4          | 0          | 2          | 4          | 0          | 2          | 4          |
|----------|-------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| LSD (0.05) | 0.10        | 0.17       | 0.03       | 0.03       | 0.04       | 0.07       | 0.11       | 0.12       |

Physical and nutritive value of pod:

a) Effect of N fertilization:

All studied physical and nutritive value of snap bean pod were significantly increased by N-fertilization rate as presented in Tables (7 and 8). Presented data in Table 7 (physical pod characters, i.e. pod length and pod diameter) and Table 8 (the nutritive value of pod, i.e. N, P, K, protein content and total carbohydrates) denote that the highest rate of N-fertilization (100 kg N/ha) were affected significantly of all studied characters of physical and nutritive value of snap bean pod. On the other hand, the lowest values of pod quality of snap bean were recorded as a result from the control treatment.

The increase in pod quality of snap bean as a result of N-fertilization might be attributed to the increase in its vegetative growth and dry matter accumulation (Tables 4 and 5), and pod yield and its components (Table 6) and thus increased the pod quality (Tables 7 and 8).

These results are going in agreement with those obtained by Ouslim et al. (2015), and Khalifeh et al., (2016), who pointed out that N-fertilization increased the yield of plants with increasing its rate.

b) Effect of dry yeast extract:

It is clearly evident from data in Tables (7 and 8) that dry yeast extract levels (2 and 4 g/L) as foliar spray had significantly increased in pod quality of snap bean (Physical and nutritive value). The foliar application of dry yeast extract at the rate of 4 g/L, being the most effective on pod quality of snap bean. Meanwhile, the lowest values of pod quality of snap bean were recorded as a result of the treatment of control.

Increments of pod quality of snap bean with 4 g/L dry yeast extract may be attributed to the vigorous vegetative plant growth as shown in Tables (4 and 5), and increased pod yield and its component (Table 6), and to improving effect of dry yeast extract, which contained on many nutrients and hormones that important for the activity of photosynthesis and the accumulation of metabolites in reproductive organs, and this reflects on the pod and consequently improving the pod quality (Abou El-Sulehein et al., 2019).
Similarly results were obtained by Neama et al., (2014) and Abo-Hamad, (2016) who concluded that yeast extract increased the yield quality of legumes.

Table 7: Effect of N fertilization and dry yeast extract and its interaction on the physical characters of snap bean pod during 2015 and 2016 seasons.

| Treatments Fertilizers: (A) N(kg/ha) | Characters       | Pod length (cm) | Season | Pod diameter (cm) | Season |
|--------------------------------------|------------------|-----------------|--------|-------------------|--------|
| 0                                    |                  | 9.56            | 2015   | 10.62             | 2016   |
| 50                                   |                  | 12.02           | 2015   | 11.55             | 2016   |
| 100                                  |                  | 12.48           | 2015   | 11.91             | 2016   |
| LSD(0.05)                            |                  | 0.41            | 2015   | 0.36              | 2016   |
| Dry yeast extract: (B)               |                  |                 |        |                   |        |
| 0                                    |                  | 10.48           | 2015   | 9.51              | 2016   |
| 2                                    |                  | 11.59           | 2015   | 12.16             | 2016   |
| 4                                    |                  | 11.99           | 2015   | 12.40             | 2016   |
| LSD(0.05)                            |                  | 0.34            | 2015   | 0.17              | 2016   |
| Interaction: (A*B)                   |                  |                 |        |                   |        |
| N(kg/ha)                             | Dry yeast extract|                 |        |                   |        |
| 0                                    |                  | 9.11            | 2015   | 9.13              | 2016   |
| 2                                    |                  | 9.44            | 2015   | 9.36              | 2016   |
| 4                                    |                  | 10.13           | 2015   | 10.05             | 2016   |
| 0                                    |                  | 10.55           | 2015   | 11.07             | 2016   |
| 50                                   |                  | 12.64           | 2015   | 12.61             | 2016   |
| 4                                    |                  | 12.88           | 2015   | 12.82             | 2016   |
| 100                                  |                  | 11.79           | 2015   | 11.66             | 2016   |
| LSD (0.05)                           |                  | 0.11            | 2015   | 0.13              | 2016   |

Table 8: Effect of N fertilization and dry yeast extract and its interaction on the nutritive value of snap bean pod during 2015 and 2016 seasons.

| Treatments Fertilizers: (A)N(kg/ha) | Characters      | N % | Protein % | P % | K % | Total Carbohydrates % |
|-------------------------------------|-----------------|-----|-----------|-----|-----|-----------------------|
| 0                                   |                 | 2.29| 2.35      | 14.30| 14.68| 0.231                 |
| 50                                  |                 | 3.06| 3.10      | 19.16| 19.37| 0.292                 |
| 100                                 |                 | 3.17| 3.20      | 19.81| 20.01| 0.304                 |
| LSD(0.05)                           |                 | 0.06| 0.09      | 0.54 | 0.57 | 0.006                 |
| Dry yeast extract: (B)              |                 |     |           |     |     |                       |
| 0                                   |                 | 2.63| 2.70      | 16.43| 16.87| 0.261                 |
| 2                                   |                 | 2.87| 2.89      | 17.93| 18.08| 0.281                 |
| 4                                   |                 | 3.02| 3.06      | 18.91| 19.12| 0.292                 |
| LSD(0.05)                           |                 | 0.09| 0.08      | 0.66 | 0.59 | 0.006                 |
| Interaction: (A*B)                  |                 |     |           |     |     |                       |
| N(kg/ha)                            | Dry yeast extract|     |           |     |     |                       |
| 0                                   |                 | 2.17| 2.26      | 13.56| 14.12| 0.231                 |
| 2                                   |                 | 2.27| 2.30      | 14.18| 14.37| 0.239                 |
| 4                                   |                 | 2.43| 2.49      | 15.18| 15.56| 0.243                 |
| 0                                   |                 | 2.76| 2.83      | 17.25| 17.68| 0.269                 |
| 50                                  |                 | 3.15| 3.17      | 19.68| 19.81| 0.296                 |
| 4                                   |                 | 3.29| 3.30      | 20.56| 20.62| 0.313                 |
| 100                                 |                 | 3.19| 3.19      | 19.93| 20.06| 0.309                 |
| LSD (0.05)                          |                 | 0.11| 0.08      | 0.06 | 0.22 | 0.006                 |

c) The combined effect of N-fertilization and dry yeast extract:

Data given in Tables (7 and 8) revealed that pod quality (Physical and nutritive value) of snap bean were responded significantly to the combined effect between 100 kg N/ha, and foliar application

980
with dry yeast extract at the level of 4 g/L. On the other hand, this treatment did not refer any significant on pod diameter in both growing seasons.

Conclusively: it could be concluded that the treatment of N-fertilizer in the form of ammonium sulphate (20.5%N) at the rate of 100 kg N/ha, and foliar application with dry yeast extract at the level of 4 g/L, as well as, the combined effect between 100 kg N/ha, and 4 g/L, enhancing the studied characters of snap bean

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