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# RESPONSE OF SOME INDIGENOUS BONAVISTA BEAN TYPES AT VARIOUS SEEDING RATES

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## ABSTRACT

Two field experiments were carried out at the Experimental Research Center, Faculty of Agriculture, Moshtohor, Benha University, Kalubia Governorate during two summer growing seasons (2007 and 2008) to investigate the response of three indigenous-native Bonavista bean types of different seed-coat colors (White, Black and Brown) grown at various population densities (10, 20 and 30 kg/fed). Experiments were designed and implemented to evaluate their fresh and dry forage yield, vegetative growth behaviour, and quality determinations.

Experiments were designed and layed out as split plot design where Bonavista bean types were randomly distributed in the main plots and seeding rates in the split plots. Two individual cuts were obtained during each of the two growing seasons and their total yield. Results could be concluded as follows:

White type was of the highest significant total fresh and dry yield with the highest number of shoots/$m^2$ when planted at the densed seeding rates.

Meanwhile, Brown type was the largest significant stem diameter, leaf area/plant and leaf/stem ratio when planted at the lowest seeding rate. Whereas, Black type was of the tallest plants.

## INTRODUCTION

Among the national plane of increasing food and feed potentialities in Egypt is to pay attention to enhance agricultural production and quality at a reasonable alternative sustainable agronomic practices. In this regard, the severe lack of production of forage crops especially during summer seasons, where there is no source of leguminous high protein fodder plants to be grown.

In this respect, it is of great need to find out herbaceous leguminous forage plants from the indigenous-native nature, where plants energy will be expenditured in growth, yield and quality rather than for survival under environmental stress. Collection and selection of such adapted plants expected to be naturally grown Upper Egypt in Aswan governorate where we got it.

Combining the advantages of the adapted indigenous native legumes and finding out its appropriate plant population density were considered in this study.

Jilani *et al.* (2001) investigated four legume species included lablab. Foster *et al.* (2009) evaluated 3 forage legumes (soybean, cowpea and pigeonpea). Leaf / stem ratio decreased with maturity and was greater for cowpea than the other legumes. Also, several workers (Hintz *et al.*, 1992; Shehu *et al.*, 2001 and El-Karamany, 2006) agreed that increasing seeding rates caused linear increases in fresh and dry forage yield of legumes. Meanwhile, number of branches / plant was decreased.

The main target of this investigation is to test and evaluate the specific properties of growth and forage production of such indigenous native types of Bonavista bean planted with various seeding rates.

## MATERIALS AND METHODS

Two field experiments were carried out at the Experimental Research Center, Faculty of Agriculture, Moshtohor, Benha Univ., Kalubia Governorate during two summer growing seasons (2007 and 2008) to investigate response of some Bonavista bean types for various population densities ( seeding rates ).

### Bonavista bean types

Bonavista bean (Dolichos lablab, L.): Three types of different seed coat colors (White, Black and Brown) were found and brought from their indigenous native region in Upper Egypt (Aswan).

### Seeding rates:

Three plant population densities of 10, 20 and 30 kg seed /feddan were selected for this study.

This study included 9 treatments which were the combinations of 3 Bonavista bean types x 3 seeding rates. Experiments were designed in a split- plot design with four replicates in two subsequent seasons. Bonavista bean types were distributed randomly in the main plots, and plant population densities were assigned randomly in the sub plots.

The experimental unit area of each -sub plot was 10.5 $m^{2,}$ contained 5 rows constructed from the North to South direction which were 60 cm apart and 3.5 meters length. The distance between hills was about 40 cm apart. Seeded were sown on the east side of the ridges for all of the studied B. bean types.

The other recommended agronomic practices of growing forage legumes were applied regularly as practiced in the region.

Phosphorus fertilizer was applied in form of calcium super phosphate (15.5% $P_2O_5$) at a rate of 150 kg/feddan during soil preparation before sowing. Magnesium fertilizer was applied in form of magnesium sulfate (20% Mg) as abase treatment at a rate of 20 kg/feddan after sowing.

### Studied parameters:

Two cuts were obtained for each of the two growing seasons. The first cuts were obtained at 60 days from sowing and the second cuts were obtained after 40 days from the first cut.

**A-Vegetative growth characteristics:** Ten plants were randomly selected from each experimental unit in each of the two seasons for studying the following parameters: Plant height (cm); Stem diameter (cm); Leaf area per plant ($cm^2$) was measured using electronic planemeter (Cl 202 AREA METER, manufactured by CID, Inc., U.S.A.); Leaf / stem ratio was estimated on fresh weight basis and Number of shoots/$m^2$.

**B- Fresh and dry forage yield:** Fresh forage yield in each experimental unit of the grown forage crop plants under study was determined for each of the subsequent cuts, for each of the two

studied seasons and recorded in ton / feddan using field scale of 0.5 kg sensitivity then forage yield was estimate and recorded in ton / fed.

Dry forage yield productivity was estimated as follows: samples of about 200 gm of fresh forage were selected randomly from each experimental unit just before, accurately weighted using an electric balance of 0.01 gm sensitivity. Such obtained fresh samples were dried in an air forced drying oven at 105°C for 3 hours till constant weight to determine the dry matter content. Then, dry yield per feddan was estimated, accordingly.

**Statistical analysis:** The analyses of variance for each of the two seasons and their combined analysis was conducted to study seasonal behaviour, and each of the two cuts and total production in each season and over the combined analysis were carried out according to the procedure described by **Steel and Torrie (1981).** The **L.S.D**. test at 5% level was used in means comparison.

## RESULTS AND DISCUSSION

### Fresh and Dry yield

Combined analysis generally showed that the White type of Bonavista bean was the highest fresh and dry forage yield followed by the Black, then the Brown type with significant differences. The respective ranking order was 22.25, 19.06 and 19.03 ton/fed. for fresh yield, being 3.62, 3.04 and 2.83 ton/fed. for dry yield. This trend was obviously clear for dry yield during each of the two growing seasons and cuts of dry yield and during the second season and the second cut for fresh forage yield (Tables, 1&2). This result could give a signal of heat simulation of vegetative growth for such grown B.bean types are along the same line as these of **Hintz *et al.* (1992)** in soybean, **Jilani *et al.* (2001)**, **Shehu *et al.* (2001)**, **Valenzuela and Smith (2002**), **Cameron(2003)** and **Ewansiha and Singh (2006)** in Bonavista bean and **El Karamany (2006)** in mung bean.

**Table (1): Fresh yield productivity of the studied B. bean types at various seeding rates.**

| Types (T) | Density (D) kg / fed | First summer season ( 2007) | | | Second summer season (2008 ) | | | Combined (over growing seasons) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1st cut | 2nd cut | Total | 1 st cut | 2nd cut | Total | 1 st cut | 2nd cut | Total |
| | | ..... (ton / fed.)..... | | | | | | | | |
| White | 10 | 9.60 | 9.60 | 19.20 | 10.20 | 9.50 | 19.70 | 9.90 | 9.55 | 19.45 |
| | 20 | 10.50 | 10.50 | 21.0 | 12.50 | 11.20 | 23.70 | 11.5 | 10.85 | 22.35 |
| | 30 | 11.50 | 12.30 | 23.80 | 13.60 | 12.50 | 26.10 | 12.55 | 12.40 | 24.95 |
| Mean | | 10.53 | 10.80 | 21.33 | 12.10 | 11.07 | 23.17 | 11.32 | 10.93 | 22.25 |
| Black | 10 | 5.50 | 7.70 | 13.20 | 9.30 | 9.90 | 19.20 | 7.40 | 8.80 | 16.20 |
| | 20 | 9.0 | 9.70 | 18.70 | 9.90 | 10.80 | 20.70 | 9.45 | 10.25 | 19.70 |
| | 30 | 9.30 | 10.90 | 20.20 | 10.30 | 12.10 | 22.40 | 9.80 | 11.50 | 21.30 |
| Mean | | 7.93 | 9.43 | 17.36 | 9.83 | 10.93 | 20.76 | 8.88 | 10.18 | 19.06 |
| Brown | 10 | 7.20 | 8.70 | 15.90 | 8.40 | 9.40 | 17.80 | 7.80 | 9.05 | 16.85 |
| | 20 | 8.30 | 10.20 | 18.50 | 9.40 | 10.30 | 19.70 | 8.85 | 10.25 | 19.10 |
| | 30 | 9.90 | 10.70 | 20.60 | 10.20 | 11.50 | 21.70 | 10.05 | 11.10 | 21.15 |
| Mean | | 8.47 | 9.87 | 18.34 | 9.33 | 10.40 | 19.73 | 8.90 | 10.13 | 19.03 |
| 10 | | 7.43 | 8.67 | 16.10 | 9.30 | 9.60 | 18.90 | 8.36 | 9.13 | 17.49 |
| 20 | | 9.27 | 10.13 | 19.40 | 10.60 | 10.77 | 21.37 | 9.93 | 10.45 | 20.38 |
| 30 | | 10.23 | 11.30 | 21.53 | 11.37 | 12.03 | 23.40 | 10.80 | 11.67 | 22.47 |
| Mean | | 8.98 | 10.03 | 19.01 | 10.42 | 10.80 | 21.22 | 9.70 | 10.42 | 20.12 |
| L.S.D at: 5% for : | | T = 1.87, D = 1.11 | T= 1.09, D= 1.67 | D= 1.97, | T=1.63, D=0. 6, TD=1.046 | D = 0.59 | T= 1.57, D= 0.82, TD= 1.42 | T= 1.10, D=0.61, TDY=1.49 | T= .67, D= 0.60 | T= 1.12, D= 0.90 |

**Table (2): Dry yield productivity of the studied B.bean types at various seeding rates.**

| Types (T) | Density (D) Kg / fed | First summer season ( 2007) | | | Second summer season (2008 ) | | | Combined (over growing seasons) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1st cut | 2nd cut | Total | 1 st cut | 2nd cut | Total | 1 st cut | 2nd cut | Total |
| | | ……. (ton / fed.)…… | | | | | | | | |
| White | 10 | 1.45 | 1.94 | 3.39 | 1.57 | 1.51 | 3.08 | 1.51 | 1.73 | 3.24 |
| | 20 | 1.66 | 1.94 | 3.60 | 1.80 | 1.88 | 3.68 | 1.73 | 1.91 | 3.64 |
| | 30 | 1.77 | 2.15 | 3.92 | 1.95 | 2.10 | 4.05 | 1.86 | 2.13 | 3.99 |
| Mean | | 1.62 | 2.01 | 3.63 | 1.77 | 1.83 | 3.60 | 1.70 | 1.92 | 3.62 |
| Black | 10 | 0.96 | 1.34 | 2.30 | 1.18 | 1.53 | 2.71 | 1.07 | 1.43 | 2.50 |
| | 20 | 1.45 | 1.86 | 3.31 | 1.55 | 1.78 | 3.33 | 1.56 | 1.82 | 3.38 |
| | 30 | 1.43 | 1.90 | 3.33 | 1.42 | 1.84 | 3.26 | 1.43 | 1.87 | 3.30 |
| Mean | | 1.28 | 1.70 | 2.98 | 1.38 | 1.72 | 3.10 | 1.33 | 1.71 | 3.04 |
| Brown | 10 | 1.11 | 1.45 | 2.56 | 1.09 | 1.45 | 2.54 | 1.10 | 1.45 | 2.55 |
| | 20 | 1.17 | 1.68 | 2.85 | 1.25 | 1.49 | 2.74 | 1.21 | 1.58 | 2.79 |
| | 30 | 1.43 | 1.76 | 3.19 | 1.30 | 1.76 | 3.06 | 1.36 | 1.77 | 3.13 |
| Mean | | 1.23 | 1.63 | 2.86 | 1.21 | 1.57 | 2.78 | 1.23 | 1.60 | 2.83 |
| 10 | | 1.17 | 1.58 | 2.75 | 1.28 | 1.50 | 2.78 | 1.23 | 1.58 | 2.81 |
| 20 | | 1.43 | 1.82 | 3.25 | 1.53 | 1.72 | 3.25 | 1.48 | 1.77 | 3.25 |
| 30 | | 1.54 | 1.94 | 3.48 | 1.56 | 1.91 | 3.47 | 1.55 | 1.92 | 3.47 |
| Mean | | 1.38 | 1.78 | 3.16 | 1.46 | 1.71 | 3.17 | 1.42 | 1.76 | 3.18 |
| L.S.D at: 5% for : | | T= 0.31, D= 0.20 | T= 0.23, D= 0.24 | T= 0.26, D= 0.34 | T= 0.17, D= 0.12 | T= 0.19, D= 0.14 | T= 0.22, D= 0.19 | T= 0.16, D= 0.11 | T= 0.13, D= 0.13 | D= 0.19 |

Over the types of Bonavista bean, fresh and dry forage yield were generally increase as seeding rates increased with significant differences of various magnitudes. The respective fresh yield was 17.94, 20.38 and 22.47 ton/fed and dry yield was 2.81, 3.25 and 3.74 ton/fed as seeding rates increased from 10 to 20 and up to 30 kg/fed. This result clearly that the higher plant population density is more productive than the lower density. Such result could be due to the more efficient physiochemical processes due to creating better microenvironment within plant canopies in respect of light temperature and humidity under the hot-dry summer conditions.

## Vegetative growth characteristics:

**- Plant height:**

Over seeding rates, it is generally noticed in Table (3) that the Black type of Bonavista bean was of tallest plants (165.15cm) while Brown type was of the shortest (91.03cm) ones, and the White plants were half-way in between (109.87cm). It looks to be true that plant height acted in a similar manner for each of the two seasons and cuts. Similar results were reported by **Mokoboki *et al.* (2000)** in Bonavista bean.

Over the growing types, increasing seeding rates caused continuous decrease in plant heights of Bonavista bean types significantly. Such decrease was noticed during seasons and cuts. This is could be due to the created soft convenient microenvironmental conditions with plant canopies which enhance the biophysiological functions for production of healthy plant structure during the hot-dry summer seasons.

**Table (3): Plant height of the studied B. bean types at various seeding rates.**

| Types (T) | Density (D) kg / fed | First summer season (2007) | | | Second summer season (2008) | | | Combined (over growing seasons) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1st cut | 2nd cut | Mean | 1 st cut | 2nd cut | Total | 1 st cut | 2nd cut | Mean |
| | | ..... (Cm)..... | | | | | | | | |
| White | 10 | 135.0 | 120.10 | 127.55 | 116.75 | 86.37 | 101.56 | 125.88 | 103.24 | 114.56 |
| | 20 | 136.25 | 116.50 | 126.37 | 114.25 | 80.40 | 97.32 | 125.25 | 98.45 | 111.85 |
| | 30 | 110.25 | 113.48 | 111.86 | 113.0 | 76.10 | 94.55 | 111.63 | 94.79 | 103.21 |
| Mean | | 127.17 | 116.69 | 121.93 | 114.66 | 80.91 | 97.78 | 120.92 | 98.82 | 109.82 |
| Black | 10 | 215.75 | 200.0 | 207.87 | 218.75 | 177.0 | 197.88 | 217.25 | 188.50 | 102.88 |
| | 20 | 196.0 | 145.32 | 170.66 | 161.75 | 171.75 | 166.75 | 178.88 | 158.54 | 168.71 |
| | 30 | 142.25 | 135.95 | 139.10 | 132.25 | 85.0 | 108.63 | 137.26 | 110.48 | 123.86 |
| Mean | | 184.67 | 160.42 | 172.54 | 170.92 | 144.58 | 157.75 | 177.79 | 152.50 | 165.15 |
| Brown | 10 | 115.0 | 111.77 | 113.38 | 97.25 | 91.57 | 94.41 | 106.13 | 101.68 | 103.90 |
| | 20 | 82.75 | 90.45 | 86.60 | 82.75 | 94.20 | 88.47 | 82.75 | 92.33 | 87.54 |
| | 30 | 73.0 | 108.40 | 90.70 | 79.25 | 66.0 | 72.63 | 76.13 | 87.20 | 81.66 |
| Mean | | 90.25 | 103.54 | 96.90 | 86.42 | 83.93 | 85.18 | 88.33 | 93.73 | 91.03 |
| 10 | | 155.25 | 143.96 | 149.60 | 144.25 | 118.32 | 131.28 | 149.75 | 131.14 | 140.44 |
| 20 | | 138.33 | 117.43 | 127.88 | 119.58 | 115.45 | 117.51 | 128.96 | 116.44 | 122.70 |
| 30 | | 108.50 | 119.28 | 113.89 | 108.17 | 75.70 | 91.93 | 108.33 | 96.49 | 102.91 |
| Mean | | 134.03 | 126.89 | 130.45 | 124.0 | 103.15 | 113.57 | 129.01 | 115.02 | 122.02 |
| L.S.D at: 5% for : | | T= 23.27, D= 15.14, TD= 26.22 | T= 6.96, D= 14.18, TD= 26.23 | T= 12.97, D= 11.03, TD= 19.11 | T= 18.24, D= 11.19, TD= 19.38 | T= 24.62, D= 19.36, TD= 33.53 | T= 17.12, D= 11.90, TD= 20.62 | D= 9.10, TD= 15.76 | T= 11.38, D= 11.60, TD= 16.40, DY= 20.08 | T= 9.48, D= 7.84, TD= 13.58 |

**- Stem Diameters:**

Results evidentiated that white type of Bonavista bean was of the thinnest stems (0.81cm) compared to Brown (0.91cm) or Black types (0.91cm) with significant differences, whereas, there was no difference in between for the later two types. Similar significant trend was observed during the second cuts (Table, 4).

**Table (5): Stem diameter per plant of the studied B. bean types at various seeding rates.**

| Types (T) | Density (D) kg / fed | First summer season (2007) | | | Second summer season (2008 ) | | | Combined (over growing seasons) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1stcut | 2nd cut | Mean | 1 st cut | 2nd cut | Total | 1st cut | 2nd cut | Mean |
| | | ..... (Cm)..... | | | | | | | | |
| White | 10 | 0.88 | 0.90 | 0.89 | 1.10 | 0.93 | 1.01 | 0.99 | 0.91 | 0.95 |
| | 20 | ٠.٧١ | 0.88 | 0.79 | 0.9 | 0.83 | 0.86 | 0.80 | 0.86 | 0.83 |
| | 30 | ٠.٦٠ | 0.66 | 0.63 | 0.67 | 0.64 | 0.65 | 0.64 | 0.65 | 0.64 |
| Mean | | ٠.٧٣ | 0.81 | 0.77 | 0.89 | 0.80 | .84٠ | .81٠ | 0.81 | 0.81 |
| Black | 10 | ٠.٧٨ | 1.05 | 0.91 | 1.33 | 1.83 | 1.53 | 1.06 | 1.44 | 1.25 |
| | 20 | ٠.٨٦ | 0.85 | 0.85 | 0.80 | 0.85 | 0.82 | 0.83 | 0.85 | 0.84 |
| | 30 | 0.66 | 0.50 | 0.58 | 0.75 | 0.60 | 0.67 | 0.71 | 0.55 | 0.63 |
| Mean | | 0.77 | 0.80 | 0.79 | 0.96 | 1.09 | 1.02 | 0.87 | 0.95 | 0.91 |
| Brown | 10 | 0.75 | 1.17 | 0.96 | 1.23 | 1.15 | 1.19 | 0.99 | 1.16 | 1.07 |
| | 20 | 0.71 | 1.02 | 0.86 | 1.10 | 0.83 | 0.96 | 0.91 | 0.92 | 0.91 |
| | 30 | .68٠ | 0.80 | 0.74 | 0.80 | 0.74 | 0.77 | 0.74 | 0.77 | 0.75 |
| Mean | | 0.71 | 0.99 | 0.85 | 1.04 | 0.90 | 0.97 | 0.88 | 0.95 | 0.91 |
| 10 | | 0.80 | 1.04 | 0.92 | 1.22 | 1.30 | 1.26 | 1.01 | 1.17 | 1.09 |
| 20 | | 0.76 | 0.92 | 0.84 | 0.93 | 0.83 | 0.88 | 0.85 | 0.88 | 0.86 |
| 30 | | 0.65 | 0.65 | 0.65 | 0.74 | 0.66 | 0.70 | 0.69 | 0.65 | 0.67 |
| Mean | | 0.74 | 0.87 | 0.80 | 1.03 | 0.93 | 0.95 | 0.85 | 0.90 | 0.87 |
| L.S.D at: 5% for : | | D= 0.1 | T= 0.08, D= 0.09 | D= 0.06 | T= 0.05, D= 0.08, TD= 0.14 | T= 0.05, D= 0.13, TD= 0.22 | T= 0.04, D= 0.08, TD= 0.14 | D= 0.06, TY= 0.1, DY= 0.09, TDY= 0.15 | T= 0.04, D= 0.08, TY= 0.06, TD= 0.13, DY= 0.11, TDY= 0.18 | T= 0.04, D= 0.05, TY= 0.06, TD= 0.09, DY= 0.07, TDY= 0.12 |

Stem diameters of Bonavista bean types were significantly decrease as seeding rates increased from 10 to 20 and up to 30 kg/fed. where the respective stems were 1.09, 0.86 and 0.67cm. So, more relative plant population densities produced an observed decrease in stem diameters of plants. Such thin-stem plants may have tender texture which lack roughness of higher total digestable nutrients and/or crude protein (CP) and carbohydrates (NFE).

**- Leaf area/plant:**

Inspite of the non significant differences in leaf area/plant between the grown Bonavista bean types (over seeding rates), Brown types was the largest value (923.7 $cm^2$) and White type was of the lower value (911.92 $cm^2$) and Black type of the lowest value (857.96). this ranking order was notice for the cuts with significant differences (Table, 5).

**Table (5):Leaf area per plant of the studied B.bean types at various seeding rates.**

| Types (T) | Density (D) kg / fed | First summer season ( 2007) | | | Second summer season ( 2008 ) | | | Combined ( over growing seasons) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1st cut | 2nd cut | Mean | 1 st cut | 2nd cut | Total | 1 st cut | 2nd cut | Mean |
| | | ..... ($Cm^2$)..... | | | | | | | | |
| White | 10 | 1420.35 | 1265.60 | 1342.98 | 2085.34 | 645.14 | 1365.24 | ١٧٥٢.٨٥ | 955.37 | 1354.11 |
| | 20 | 582.43 | 996.98 | 789.71 | 1116.56 | 543.82 | 830.19 | 849.50 | 770.40 | 809.95 |
| | 30 | 517.92 | 532.62 | 525.27 | 880.58 | 355.75 | 618.16 | 699.50 | 444.19 | 571.72 |
| Mean | | 840.23 | 931.73 | 885.77 | 1360.83 | 514.90 | 937.86 | 1100.53 | 723.32 | 911.92 |
| Black | 10 | 846.70 | 774.46 | 797.08 | 1893.43 | 1066.72 | 1480.07 | 1370..06 | 907.09 | 1138.58 |
| | 20 | 773.64 | 308.21 | 540.93 | 1210.70 | 921.74 | 1066.22 | 992.17 | 614.97 | 803.57 |
| | 30 | 615.25 | 281.10 | 448.18 | 1082.22 | 548.38 | 815.30 | ٨٤٨.٧٣ | 414.97 | 631.74 |
| Mean | | 745.20 | 445.59 | 595.40 | 1395.45 | 845.61 | 1120.53 | 1070.32 | 645.60 | 857.96 |
| Brown | 10 | 652.16 | 817.08 | 734.62 | 1796.66 | 1558.48 | 1677.57 | 1224.41 | 1187.78 | 1206.10 |
| | 20 | 647.46 | 745.03 | 696.25 | 1652.27 | 941.52 | 1296.90 | 1149.87 | 843.28 | 996.57 |
| | 30 | 329.71 | 419.84 | 374.78 | 708.11 | 816.56 | 762.33 | 518.91 | 618.20 | 568.56 |
| Mean | | 543.11 | 660.65 | 601.88 | 1385.68 | 1105.52 | 1245.60 | 964.40 | 883.08 | 923.74 |
| 10 | | 973.07 | 943.38 | 958.23 | 1925.15 | 1090.11 | 1507.63 | 1449.11 | 1016.75 | 1232.93 |
| 20 | | 667.84 | 683.40 | 675.65 | 1326.51 | 802.32 | 1064.41 | 997.18 | 742.88 | 870.03 |
| 30 | | 487.63 | 411.19 | 449.44 | 890.30 | 573.56 | 731.93 | 688.96 | 492.38 | 590.67 |
| Mean | | 709.51 | 679.32 | 694.44 | 1380.65 | 822.0 | 1101.32 | 1045.08 | 750.67 | 897.88 |
| L.S.D at: 5% for : | | T= 111.33, D= 125.06, TD= 216.60 | T= 116.67, D= 140.46, TD= 243.29 | T= 95.03, D=102.16, TD=176.95 | D= 98.08, TD= 168.88 | T= 95.85, D=131.57, TD=227.88 | T= 124.18, D= 72.51, TD= 125.6 | D= 76.99, DY= 108.0, TDY= 188.1 | T= 67.21, D= 92.99, TY= 95.04, TDY= 227.8 | D= 60.53, TY= 98.43, DY= 85.61, TD=104.84, TDY= 148.3 |

Seeding rates (over types) general caused significant decrease in leaf area/plant which were 1232.9, 870.0 and 590.6 $cm^2$/plant for 10 to 20 and up to 30kg/fed., respectively. During each of the two seasons and cuts similar trend was observed.

**- Lea/stem ratio:**

Over seeding rates, the Black type of Bonavista bean was of the lowest (0.67) leaf/stem ratio as compared with either Brown (0.84) or White (0.81) types with significant differences as shown in Table (6). Such pattern was repeated in the first season and first cuts significantly. Whereas during the second season and second cuts, this was not the situation, where the descending ranking order was for White, Brown and Black types (Table, 6). **Foster *et al.* (2009)** in Bonavista bean reported similar results.

No significant response was recognized for the effect of various seeding rates on leaf/stem ratio over the tested Bonavista bean types inspite of the recorded differences in the response of leaf/stem ratios of plants.

**Table (6):Leaf / Stem ratio per plant of the studied B. bean types at various seeding rates.**

| Types (T) | Density (D) Kg / fed | First summer season (2007) | | | Second summer season (2008 ) | | | Combined (over growing seasons) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1st cut | 2nd cut | Mean | 1 st cut | 2nd cut | Total | 1 st cut | 2nd cut | Mean |
| | | ..... (% on fresh weight basis)..... | | | | | | | | |
| White | 10 | 0.70 | 0.76 | 0.73 | 0.89 | 1.13 | 1.01 | 0.79 | 0.94 | 0.87 |
| | 20 | 0.57 | 0.73 | 0.65 | 0.88 | 0.97 | 0.93 | 0.73 | 0.85 | 0.79 |
| | 30 | 0.69 | 0.90 | 0.80 | 0.52 | 0.99 | 0.76 | 0.61 | 0.94 | ٠.٧٧ |
| Mean | | 0.65 | 0.79 | 0.72 | 0.76 | 1.03 | 0.90 | 0.71 | 0.91 | 0.81 |
| Black | 10 | 0.65 | 0.70 | .68٠ | 0.90 | 0.64 | 0.77 | 0.78 | 0.67 | 0.72 |
| | 20 | 0.54 | 0.51 | 0.53 | 0.72 | 0.79 | 0.76 | 0.63 | 0.65 | 0.64 |
| | 30 | 0.60 | 0.66 | 0.63 | 0.59 | 0.72 | 0.65 | 0.59 | 0.69 | 0.64 |
| Mean | | 0.59 | 0.62 | 0.61 | 0.74 | 0.71 | 0.73 | 0.67 | ٠.٦٧ | 0.67 |
| Brown | 10 | 0.83 | 0.76 | 0.80 | 0.82 | 0.71 | 0.76 | 0.82 | 0.73 | 0.78 |
| | 20 | 1.00 | 0.92 | 0.96 | 0.74 | 1.00 | 0.87 | 0.87 | 0.96 | 0.92 |
| | 30 | 0.64 | 0.69 | 0.67 | 0.76 | 1.20 | 0.98 | 0.70 | 0.95 | 0.82 |
| Mean | | 0.82 | 0.79 | 0.81 | 0.77 | 0.97 | 0.87 | 0.80 | 0.88 | 0.84 |
| 10 | | 0.72 | 0.74 | 0.73 | 0.87 | 0.83 | 0.85 | 0.80 | 0.78 | 0.79 |
| 20 | | 0.70 | 0.72 | 0.71 | 0.80 | 0.92 | 0.86 | 0.74 | 0.82 | 0.78 |
| 30 | | 0.64 | 0.75 | 0.70 | 0.62 | 0.97 | 0.80 | 0.63 | 0.86 | 0.75 |
| Mean | | 0.69 | ٠.٧٤ | ٠.٧١ | 0.76 | 0.91 | 0.84 | 0.72 | 0.82 | 0.77 |
| L.S.D at: 5% for : | | T= 0.08, TD= 0.20 | T= 0.10, TD= 0.15 | T= 0.07, TD=0.15 | T= 0.06, TD= 0.10 | T= 0.11, TD= 0.29 | T= 0.06, TD= 0.12 | T= 0.05, D= 0.06, TY= 0.08, DY= 0.09, TDY= 0.15 | T= 0.07, TDY=0.23 | T=0.05, TD= 0.09, TDY= 0.13 |

## - Number of shoots/$m^2$:

Differences in number of shoot/$m^2$ did not reach the level of significant for the Bonavista bean types (over seeding rates), whereas, the ranking order was for Black (14.8), Brown (18.3) and White types (19.8 shoots/$m^2$), similar ranking order was noticed in the second season and the first cut as presented in Table (7). **El-Karamany (2006)** in local mung bean reported similar results

**Table (7): Number of shoots per sq. meter of the studied B.bean types at various seeding rates.**

| Types (T) | Density (D) kg / fed | First summer season (2007) | | | Second summer season (2008 ) | | | Combined (over growing seasons) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1st cut | 2nd cut | Mean | 1 st cut | 2nd cut | Total | 1 st cut | 2nd cut | Mean |
| | | ..... (# of shoots/$m^2$)..... | | | | | | | | |
| White | 10 | 10.0 | 10.0 | 10.0 | 15.0 | 11.0 | 13.0 | 12.5 | 10.5 | 11.5 |
| | 20 | 14.0 | 13.0 | 13.5 | 36.0 | 16.0 | 26.0 | 25.0 | 14.5 | 19.8 |
| | 30 | 20.0 | 19.0 | 19.5 | 54.0 | 19.0 | 36.5 | 37.0 | 19.0 | 28.0 |
| Mean | | 14.7 | 14.0 | 14.4 | 35.0 | 15.3 | 25.2 | 24.8 | 14.7 | 19.8 |
| Black | 10 | 6.0 | 9.0 | 7.5 | 9.0 | 9.0 | 9.0 | 7.5 | 9.0 | 8.8 |
| | 20 | 10.0 | 10.0 | 10.0 | 15.0 | 14.0 | 14.5 | 12.5 | 12.0 | 12.3 |
| | 30 | 44.0 | 14.0 | 29.0 | 20.0 | 18.0 | 19.0 | 32.0 | 16.0 | 24.0 |
| Mean | | 20.0 | 11.0 | 15.5 | 14.7 | 13.7 | 14.2 | 17.3 | 12.3 | 14.8 |
| Brown | 10 | 10.0 | 13.0 | 11.5 | 13.0 | 14.0 | 13.5 | 11.5 | 13.5 | 12.5 |
| | 20 | 13.0 | 15.0 | 14.0 | 32.0 | 13.0 | 22.5 | 22.5 | 14.0 | 18.3 |
| | 30 | 18.0 | 20.0 | 19.0 | 36.0 | 23.0 | 29.5 | 27.0 | 21.5 | 24.8 |
| Mean | | 13.7 | 16.0 | 14.9 | 27.0 | 16.7 | 21.9 | 20.3 | 16.3 | 18.3 |
| 10 | | 8.7 | 10.7 | 9.7 | 12.3 | 11.3 | 11.8 | 10.5 | 11.0 | 10.8 |
| 20 | | 12.3 | 12.7 | 12.5 | 27.7 | 14.3 | 21.0 | 20.0 | 13.5 | 16.8 |
| 30 | | 27.3 | 17.7 | 22.5 | 36.7 | 20.0 | 28.4 | 32.0 | 18.8 | 25.4 |
| Mean | | 16.1 | 13.7 | 14.9 | 25.2 | 14.9 | 20.4 | 20.8 | 14.4 | 17.6 |
| L.S.D at: 5% for : | | N.S | T= 3.28, D= 2.31 | D= 8.9 | T= 4.05, D= 3.11, TD= 5.39 | D= 1.84, TD= 3.18 | T= 2.49, D= 1.84, TD= 3.18 | TY= 12.95, D= 8.32 | T= 1.87, D= 1.43 | TY= 6.34, D= 4.39 |

As seeding rates increased (over types), the number of shoot/$m^2$ increased significantly, the respective number of shoots/$m^2$ was noticed when seeding rates were 10 to 20 and 30 kg/fed was 12.3, 16.8 and 25.4 shoots/$m^2$. Similar pattern was repeated for each of the two seasons and cuts.

**Table (8): Summary of growth behavior of Bonevista bean types (as an indigenous-native legumes).**

| No. | Characters | Types | Seeding rates |
|---|---|---|---|
| **1** | **Fresh forage yield (ton / fed)** | 16.9% BW >BB >BBr | 28.5% 30 >20 >10 |
| **2** | **Dry forage yield (ton / fed)** | 27.9% BW >BB >BBr | 23.5% 30 >20 >10 |
| **3** | **Plant height (cm)** | 81.4% BB >BW > BBr | 36.5% 10 >20 > 30 |
| **4** | **Stem diameter (cm)** | 12.3% BBr >BB >BW | 62.7% 10 >20 > 30 |
| **5** | **Leaf area/plant ($cm^2$)** | N.S BBr > BW > BB | 109% 10 >20 > 30 |
| **6** | **Leaf : Stem ratio** | 25% BBr > BW > BB | N.S 10 >20 > 30 |
| **7** | **Of shoots/$m^2$#** | N.S BW > BBr > BB | 135.2% 30 >20 > 10 |

## The Interactions

The interaction effect of types and seeding rates was significant on the following parameter:

- Fresh yield, dry yield and number of shoots/$m^2$ where the highest values were recorded for White type planted at 30kg seeding rate/fed.
- Stem diameter, leaf area/plant, leaf/stem ratio per plant where their highest values were reported for the Brown type when planted at the lowest seeding rate (10kg/fed).
- Plant heights were obtained for Black type at seeding rate of 10kg/fed.

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# إستجابة بعض طرز الكشرنجيج لمعدلات تقاوى مختلفة

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**قسم المحاصيل – كلية الزراعة – جامعة بنها**

أقيمت تجربتان حقليتان بمزرعة مركز البحوث والتجارب الزراعية بكلية الزراعة بمشتهر – جامعة بنها وذلك خلال موسمي الزراعة الصيفي ٢٠٠٧ ، ٢٠٠٨ م بهدف تقييم الإنتاجية المحصولية (المحصول الأخضر والجاف) وقياسات النمو لثلاث طرز علفية من الكشرنجيج النامية فى بيئتها الطبيعية و الاصلية بأعلى صعيد مصر و القصرة المختلفة الالوان ( الابيض– الاسود– البنى ) تحت ثلاث معدلات من التقاوى (١٠– ٢٠– ٣٠ كجم/ف) واستخدم تصميم القطع المنشقة مرة واحدة بأربعة مكررات.

**ويمكن تلخيص أهم النتائج المتحصل عليها فيما يلي :**

١– أوضحت النتائج ان طراز الكشرنجيج ذو البذورالبيضاء كان افضل الطرز الثلاثة فى محصول العلف و الجاف، عدد الفروع / م٢ بينما كان طراز الكشرنجيج البنى اللون افضل الطرز الثلاثة فى سمك الساق/ نبات ، مساحة الورقة / نبات ، نسبة الاوراق للسيقان، كما أن طراز الكشرنجيج الاسود البذوركان أطول الطرز الثلاثة.

٢– أدت الزراعة الكثيفة بمعدل ٣٠ كجم / ف الى الحصول على أكبر محصول علف أخضر و جاف ، و كذلك أعلى نسبة من عدد الفروع / م٢ .بينما أدى إستخدام معدل التقاوى ١٠ كجم / ف الى الحصول على أطول نباتات ، أكبر سمك ساق / نبات ، أكبر مساحة للاوراق / نبات ، اعلى نسبة اوراق للسقان.

بناء على ذلك فإنه يوصى بزراعة طراز الكشرنجيج الابيض بمعدل تقاوى ٣٠ كجم / ف اذا ما قورن بالاصناف البنية و السوداء البذور و الكثافات النباتية الاخرى.