Effect of different irrigation levels on growth, yield and pods quality of green bean (*Phaseolus vulgaris* L.) under greenhouse conditions

M. M. Moustafa *, M. A. Wally, A. A. Abdou, and A. H. Abd El Wahed

Department of Horticulture, Faculty of Agriculture, Al-Azhar University, Cairo, Egypt

*Corresponding author E-mail: Mahmoud.mostafa21@azhar.edu.eg (M. Moustafa)

ABSTRACT

This experiment was conducted at Al-Sadat Experimental Farm of the Faculty of Agriculture, Al-Azhar University, Monoufia Governorate, Egypt, during the two consecutive growth seasons of 2017/2018 and 2018/2019 to evaluate the effect of different irrigation water levels, (60, 80, and 100%) of evapotranspiration crop (ETc) on growth, yield and pod quality of green bean cultivar Joya under the plastic greenhouse conditions. The obtained results showed that there were significant differences among the three levels of irrigation for the most tested parameters. It was obvious that irrigation water level at 100% of ETc significantly increased pod weight, length and diameter, in addition to stem internode length and leaf relative water content, as well as leaf fresh weight and area. Likewise, this irrigation level increased total pod yield in weight and in number of pods per plant and total protein content, while the lowest level of irrigation (60% of ETc.) improved some quality characters such as total chlorophylls, proline contents in leaf, total soluble solids, ascorbic acid, total sugars, and crude fiber contents in pods.

Key words: Green bean, greenhouse, irrigation and evapotranspiration.

INTRODUCTION

Green bean (*Phaseolus vulgaris* L.) is a major vegetable crop in Egypt for exportation and local consumption, where it is the third largest export of vegetable crops after potatoes and onions with an average about 20.44 thousand tons of exports during the period 1995-2017(Mohamed *et al.,* 2018). Also, fruits of this crop is considered a good protein source for humane nutrition, besides its role in improving soil fertility (Fabbri and Crosby, 2016 and Mahabal, 1986). In Egypt, the limited of water resources are the strong challenge which faces agricultural production and the expansion of reclaimed lands. Therefore, improving water use efficiency without any reduction in productivity can contribute towards minimized water consumption, reduced losses of irrigation water, increased cultivated area and satisfied present and future requirements of the increases of population from food supply (Saleh *et al.,* 2018). The irrigation management for green bean is achieved with supplying the plants by adequate moisture demands around root zone without excess or deficit to create good conditions for growth, development and yield (Ayas, 2015). Green bean is a sensitive plant to water stress at all growth stages especially flowering and pod development stages (Sezen et al., 2008). The previous studies showed that green bean cultivars differed significantly in their sensitivity to irrigation water levels. For instance, it was found that the treatment of 100% of field capacity was the most suitable for Giza cultivar, while 75% of field capacity treatment was favorable for Bronco cultivar with decreasing deformed pod percentage and total fiber content as well as the increase in total protein content (Singer *et al.,* 2003). In the current investigation, we evaluated green bean cultivar Joya grown under different levels of irrigation water in plastic greenhouse conditions, aiming to know the suitable water level and optimum productivity for plants.

MATERIALS AND METHODS

The experiment was conducted at Al-Sadat Experimental Farm of the Faculty of Agriculture, Al-Azhar University, Monoufia Governorate, Egypt, during the two consecutive growth seasons of 2017/2018 and 2018/2019 to study the effect of irrigation levels on the growth, yield and pod quality of green bean (*Phaseolus vulgaris* L.) under the plastic greenhouse conditions. The tested cultivar of our study is Joya, which is classified as indeterminate growth cultivar. The greenhouse (40 m. long, 9 m. wide and 3.5 height) was divided into six raised beds with 1.20 m. wide. GR drip irrigation type of 16 mm diameter with 30 cm spacing and 4 liter per hour flow rates at 1.5 bar working pressure were installed on the center of raised beds. Control valves were fixed at the entrance of the treatments to regulate the delivery amount of the irrigation water. Irrigation water was supplied from groundwater by pump and quality water properties are given in Table (1). The soil of this investigation was sandy loam.

The physical and chemical analyses of the trial soil took place in the Laboratory of Soil, Water and Environment, the Agricultural Research Center at Giza Governorate (Table 2).

Seeds were sown on November 10th in both seasons in the plastic greenhouse. The planting was on both sides of the drip line at 0.30 m between plants. Irrigation treatments were practiced after appearing of the third true leaf at every two days irrigation frequency. The recommended agricultural practices were followed whenever are needed according to the advices of the Ministry of Agriculture and Land Reclamation.

Applied irrigation treatments included 60, 80 and 100 % from crop evapotranspiration (ETc) that was calculated based on the following equation: ETc = ETo X Kc. Where, ETc = Crop evapotranspiration, (mm/day). ETo = Reference evapotranspiration, (mm/day) which was calculated from daily weather data by using the Penman-Monteith method equation (Allen et al., 1998). The value of ETo under the plastic greenhouse conditions was about 70% of value of ETo in the open field (Abou Hadid and El-Beltagy, 1992). Kc = Crop coefficient varies in plant green bean growth stages (Allen *et al*., 1998). The weather data of the studied area were obtained from the Central Laboratory of Agricultural Climate (Table 3). The different applied quantities of irrigation water in all the treatments were determined during the two growing seasons (Table 4).

Evaluated Parameters

***The plant characteristics*:**

Three plants randomized were taken from each plot at age of 60 days from sowing to measure leaf fresh weight and area as well as stem internode length as physical parameters. In addition, chemical constituents in leaf such as total chlorophylls were determined according to Lichtenthaler (1987) and total proline content was determined according to Bates *et al*. (1973).

***The pod characteristics*:**

The following pod parameters were recorded in the third picking at harvesting stage, where green beans are generally harvested at a physiologically immature stage of development. Physical parameters of pods including fresh weight, length and diameter were estimated. Also, chemical constituents in pods such as total soluble solids content were determined by method published in A.O.A.C. (1980). Ascorbic acid content was determined according to Rao and Deshpande (2006). Total sugars were determined according to Smith *et al*. (1956). Crude fibers percentage (%) were determined according to Sadasivam and Manickam, (1991) and total proteins percentage (%) were calculated by multiplying total nitrogen content by the factor 6.25 whereas total nitrogen content was determined in the dry weight of pods using the Kjeldahl apparatus according to Cottenie *et al*. (1982).

***Yield characteristics*:**

The immature pods of three plants from each experimental plot were labeled and picked up through the harvesting period and the total yield of pods for every picking was collected. It recorded the weight of pods in (g/ plant) and count of the number of pods per plant.

Relative water content (RWC):

The relative water content was determined in leaf according to Sepehri and Golparvar, (2011)

Statistical analysis:-

The design of the experiment was arranged in a randomized complete block design with three replicates. The obtained data were subjected to statistical analysis using Costat software to decompose the variance method. The means were compared by using the least significant differences (L.S.D) at the level of 0.05 of probability, as illustrated by Snedecor and Cochran, (1980).

RESULTS

The plant characteristics:

Effect of different irrigation levels on physical parameters of green beans plants are showed in Figure (1). The results indicated that leaf fresh weight, leaf area and stem internode length were significantly affected by irrigation levels. Hence, the highest significant values of all mentioned characters were obtained with the irrigation water level 100 % of ETc, whereas the lowest one was exerted from the level of 60% of ETc.

The influence of the irrigation levels applied on the contents of total chlorophylls and proline in leaf are presented in Figure (2). The obtained results illustrated that the irrigation level at 60 % of ETc was induced a significant increment in leaf total chlorophylls and proline contains compared with the other irrigation levels. Therefore, the highest significant values of total chlorophylls and proline contents were observed from using the irrigation level at 60% of ETc, whereas the lowest one was exerted from the level of 100% of ETc.

The pod characteristics:

Physical parameters of pod:

Data presented in Figure (3) showed the effects of different irrigation levels on pods physical parameters. It is worthy to mention that the pods parameters (pod fresh weight, pod length and pod diameter) were significantly increased with the increase of the irrigation water levels from 60 % up to 100 % of ETc. The highest values in the pod physical characteristic detected from using the 100% irrigation level of ETc, the lowest one was exerted from irrigation with the level 60% of ETc.

Chemical parameters of pod:

Concerning the possible interaction effects between the different irrigation levels and chemical parameters of pod, (Fig.4) illustrated that the decrease of the irrigation water levels from 100 % until 60 % ETc was correlated with significant increase in the pods contents of total soluble solids, ascorbic acid, total sugars and crude fibers percentage. Hence, the best results in the contents of total soluble solids, ascorbic acid, total sugars and crude fiber in pod was achieved from using the irrigation level at 60% of ETc and the opposite was true from using the irrigation level at 100% of ETc .

Regarding the content of protein in pod in (Fig.4), the results reflected a significant increase in the content of protein came from using the irrigation levels at 80% and 100% of ETc, but the difference resulted between them did not reach the significance in the first season only. Generally, the data cleared that the greatest quantity of pod protein was obtained when the plants received irrigation water at 100 % of ETc, while the lowest significant one was obtained from using the irrigation level at 60 % of ETc.

Yield characteristics:-

The results of the statistical analysis about the effect of the different irrigation levels on yield parameters of green beans are shown in Table (5). It seems possible to say that the highest significant values of pods total yield and number of pods per plant were obtained when the plants irrigated with 100 % from ETc. Conversely, the lowest level of irrigation water at 60% of ETc resulted in the lowest values of yield.

Relative water content (RWC):

The figure in Table (5) displays the results pertaining to the effect of the different applications of irrigation levels on leaf relative water content. The figure clearly indicated that the highest relative water content was observed when the plants were irrigated at 100 % from ETc. In contrast, 60% of ETc produced the lowest value of relative water content.

DISCUSSION

The present results on green bean plants Joya cultivar reported that the effect of various irrigation levels at 60, 80, and 100 % of ETc induced changes in the tested characteristics of all physical and chemical of both plant and pod. The data cleared that the physical parameters of plant and pod such as leaf fresh weight, leaf area, internode length of stem and pod weight, pod length and pod diameter were increased with increasing of irrigation levels up to 100% at ETc. These results may be due to the availability of water in the active root zone which in turn may increase the absorption of water and the uptake of nutritional elements, which eventually reflects on carbohydrates assimilation that are necessary for different plant growth processes (Marzouk *et al.*, 2016) and pod parameters (El-Nemr, 2006). The other scene indicated that these results may be attributed mainly to the effect of water efficiency on the quantitative and qualitative changes in certain metabolic processes in the plant cell which led to the enhancement of cell division and enlargement and this in turn might contribute in the effect all morphological parameters of growing plants and much for increasing in the pod characteristics and quality (Mahmoud, 2000). Our results are in harmony with the past studies which showed that increasing irrigation levels up to 100% revealed the highest values of vegetative growth (El-Noemani *et al*., 2015).

Concerning the change of the chemical parameters of plant and pod, it was shown that the leaf total chlorophylls content was increased with exposing the plants to the level of 60 % of ETc. These results may be related to the fact that the use of irrigation level at 60 % of ETc created suitable conditions for inhibition of chlorophylls degradation enzymes activity combination with osmotic adjustment in leaf tissue. These results are in accordance with other study which reported that the highest total chlorophylls in leaf of garlic plant content was obtained from the plants exposed to 60 % of ETc (Moustafa, 2017). Also, the data obtained appeared that the irrigation level at 60 % of ETc was induced by a significant increment in leaf proline content compared with the other irrigation levels at 80 % and 100% of ETc. This accumulation may be related to enhance activities of proline biosynthesis enzymes or inhibit of proline degradation enzymes under 60 % of ETc (Ramezani *et al.,* 2011). Here, the scientific fact indicates that accumulation of proline is one of the important facts in osmotic balance of the cell cytoplasm for protecting the plant from oxidative damage (Zadehbagheri, 2014). The studies of pod chemical parameters also showed that the best results in the contents of total soluble solids, ascorbic acid, total sugars and crude fibers percentage were achieved from using the irrigation level at 60% of ETc. This could probably be attributed to the use of the irrigation level at 60% ETc that pushed the plant to regulate certain metabolic activity by degradation of polysaccharides to simple sugars and thereby arise the content of TSS and the amount of the organic acids transformation rate (malic, citric and ascorbic acid etc.) which play an important role in osmotic adjustment in plant (Agbemafle *et al.,* 2014). Similar trend reported that total soluble solids and crude fibers contents in green bean pods were increased by reducing water volumes from 100 to 60% of ETc (Marzouk *et al.,* 2016 and Saleh *et al.,* 2018).

From another point of view, the highest significant values of pods total yield in weight and number of pod per plant came from using the level at 100 % of ETc and this could be explained as a result of increasing vegetative growth characteristics (Fig. 1), and physical parameters of pods (Fig.3). Thus, it is obvious from data that the medium values of yield were achieved by irrigating green bean plants at 80% of ETc whereas, irrigation at 60% of ETc showed the lowest significant values in yield. Previous study agreed with the current studies which shows that there was an increase in weight of pod and number of pods per plant with increasing the levels of irrigation water up to 100 % of field capacity for Giza cultivar (Singer *et al.,* 2003).

With respect of the water relative content, the data showed that the highest value of water relative content was recorded from the irrigation level at 100% of ETc and this may be due to relative water content which is an important marker to measure plant water status. Hence, the adequate supply of water may increase water availability in the root zone resulting in improving plant water status which led to the enhancement of relative water content and the reduced of water saturation deficit in the plant cells (Farooq *et al.,* 2009).

In the contrary, the lowest values in the previous parameters resulting from using the irrigation level at 60% from ETc can be attributed to reduce plant ability on water absorbance from the soil with high moisture tension around the root zone. Consequently, the soil water and nutrients were inadequate for well vegetative growth. Which means, reduction in yield and its quality (Karaye and Yakubu, 2007). Besides, low soil moisture adversely affected the changes happened in the various physiological and biochemical processes and growth promoters (Farooq *et al.,* 2008).

CONCLUSION

Under the conditions of this experiment, it can be concluded that the application of 100% of ETc was befitted Joya cultivar with increasing most plant growth characteristics and pod yield, although the highest total soluble solids, ascorbic acid, total sugars and crude fiber contents in pods were achieved by 60% of ETc.

REFERENCES

A.O.A.C. 1980. Association of Official Methods of Analytical Chemists, Official Methods of Analysis 13th ed., Washington, D.C., U.S.A.

Abou Hadid, A.F., El-Beltagy, A.S. 1992. Water balance under plastic house condition in Egypt. Acta Horticulturae, 303: 60-72.

Agbemafle, R., Joshua, O.S., Ato, B.B., Johan, O. 2014. Effect of deficit irrigation and storage on the physicochemical quality of tomato (*Lycopersicon esculentum Mill. Var. Pechtomech*). Food Sci. and Quality Manag. 34:113-120.

Allen, R.G., Pereira L.S., Raes, D., Smith, M. 1998. Crop evapotranspiration: Guide-lines for computing crop water requirements. FAO Irrigation and Drainage Paper 56. FAO, Rome, Italy.

Ayas, S. 2015. The effects of different regimes on tomato (*Lycopesicon lycopesicum L*. var. Hazal) yield and quality characteristics under unheated greenhouse conditions. Bulgarian Journal of Agricultural Science, 21(6): 1235-1241.

Bates, L.S., Waldern, R.P., Teare, D. 1973. Rapid determination of free proline for water stress studies. Plant and Soil, 39: 205-207.

Cottenie, A., Verloo, M., Kiekens, L., Velghe, G., Camerlynck, R. 1982. Chemical analysis of plants and soils. Lab. Agroch. State Univ. Ghent, Belgium.

El-Nemr, A.M. 2006. Effect of mulch types on soil environmental conditions and their effect on the growth and yield of cucumber plants. J. Applied Sci. Res., (2): 67–73.

El-Noemani, A.A., Aboellil, A.A.A., Dewedar O.M. 2015. Influence of irrigation systems and water treatments on growth, yield, quality and water use efficiency of bean (*Phaseolus vulgaris L.*) plants. International Journal of ChemTech Research., 8(12): pp 248-258.

Fabbri, A.D.T., Crosby, G.A. 2016. A review of the impact of preparation and cooking on the nutritional quality of vegetables and legumes. International Journal of Gastronomy and Food Science, 3:2-11.

Farooq, M., Wahid, A., Kobayashi, N., Fujita, D., Basra, S.M.A. 2009. Plant drought stress: effects, mechanisms and management. Agron. Sustain. Dev., 29:185–212.

Farooq, M., Basra, S.M.A., Wahid, A., Cheema, Z.A., Cheema, M.A., Khaliq, A. 2008. Physiological role of exogenously applied Glycinebetaine in improving drought tolerance of fine grain aromatic rice (*Oryza sativa* L.). Agron. Crop Sci., 194: 325-333.

Karaye, A.K., Yakubu, A.I. 2007. Checklist of Weeds in Irrigated Garlic (*Allium sativum* L.) and Onion (*Allium cepa* L.) in Sokoto River Valley. Journal of Weed Science, 20 : 53-60.

Lichtenther, H.K. 1987. Cholorophylls and carotenoids: pigments of photosynthetic biomembranes. Met. Enzy., 148: 350-382.

Mahabal, R. 1986. High yielding varieties of crops. All Indian co-ordinated Barley Improvement Project, IARI Regional station Karnal, Pp.641.

Mahmoud, H.A. 2000. Effect of irrigation on growth and yield of pea (*Pisum sativum* L.) M.Sc., Thesis. Fac. Agric. Minufia Univ. Egypt.

Marzouk, N.M., Abdelraouf, R.E., Salman, S.R., Abd El Baky, M.M.H., 2016. Effect of water stress on yield and quality traits of different snap bean varieties grown in an arid environment. Middle East Journal of Agriculture, 5(4): 629-635.

Mohamed, E.A., Hassan, H.B.A., Abdel Fatah, H.Y., Mohamed, K.A. 2018. An analytical economic study of production and export of Green beans in Egypt. Middle East Journal of Agriculture, 7(4): 1208-1216.

Moustafa, M.M.I. 2017. Effect of some agriculture treatments on water requirements of garlic (*Allium sativum L.*). M.Sc. Thesis, Fac. Agric. Al-Azhar Univ., Cairo, Egypt.

Ramezani, E., Sepanlou, M.G., Badi, H.A.N. 2011. The effect of salinity on the growth, morphology and physiology of Echium amoenum Fisch. and Mey. Afric. J. Biotech., 10: 8765-8773.

Rao, B., Deshpande, V. 2006. Experimental biochemistry. Tunbridge Wells, Kent: Anshan.

Sadasivam, S., Manickam, A. 1991. Biochemical methods for agricultural sciences. Wiley Eastern Limited, New Dellhi and Tamil Nadu Agricultural University, Coimbatore, pp. 20-21.

Saleh, S., Liu, G., Liu, M., Ji, Y., He, H., Gruda, N.E. 2018. Effect of irrigation on growth, yield, and chemical composition of two green bean cultivars. Horticulturae., 4: 1-10.

Sepehri, A., Golparvar, A.R. 2011. The effect of drought stress on water relations, chlorophyll content and leaf area in canola cultivars (*Brassica napus* L.). Electronic J. Biol., 7: 49-53.

Sezen, S.M., Yazar, A., Akyildiz, A., Dasgan, H.Y., Gencel, B. 2008, Yield and quality response of drip irrigated green beans under full and deficit irrigation. Scientia Horticulturae, 117: 95-102.

Singer, S.M., Helmy, Y.I., Karas, A.N., Abou-Hadid, A.F. 2003. Influences of different water-Stress treatments on growth, development and production of snap bean (Phaseolus vulgaris. L.). Acta Hort 614(605-611).

Smith, F.M.A., Hamilton, G.D.K., Geeds, P.A. 1956. Colorimetric method for determination of sugar and related substances. Anal. Chem., 28: 550.

Snedecor, G.W., Corchran, W.G. 1980. Statistical meathods.7th ed. Iowa State Univ. Press Amer. Iowa, U.S.A.

Zadehbagheri, M. 2014. The evaluation of various agronomic traits of Red & Chitti bean varieties under well-watered and drought stress conditions. International Journal of Farming and Allied Sciences, 3(4): 389-398.

Table 1. Chemical analyses of the irrigation water.

Cations (mmolc L^{-1}):				Anions (mmolc L^{-1})			
Ca^{++}	Mg^{++}	Na^{+}	K^{+}	Cl^{-}	HCO_3	SO_4^{--}	CO^{--}
2.60	1.00	3.44	0.16	3.00	3.80	0.40	0.00

Trace element (ppm):				S.A.R	E.C. (dSm-1)	pH
Fe	Zn	Mn	Cu			
0.02	0.01	0.02	0.01	2.60	0.77	7.27

Table 2. Physical and chemical properties of experimental soil.

Physical properties													
Clay %	Silt %	Coarse sand %			Fine sand %			Soil texture		FC (%)		PWP (%)	
18.23	23.37	18.00			40.40			Sandy loam		15		6	
Chemical properties													
E.C (dSm^{-1})	pH	N (ppm)	P (ppm)	K (ppm)	Cation (meq/L)				Anion (meq/L)				
					Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^{-}	Cl^{-}	SO_4^{--}		
3.41	8.2	39.45	17.63	304	8.03	6.85	15.8	1.1	8.87	14.3	14.6		

Table 3. Meteorological data of the experimental location during the two seasons of 2017/2018 and 2018/2019.

Month	Air temperature (ºc)		Relative Humidity (%)		Wind speed (m/s)		ETo (mm/day)	
Season	2017/ 2018	2018/ 2019	2017/ 2018	2018/ 2019	2017/ 2018	2018/ 2019	2017/ 2018	2018/ 2019
November	17.6	18.8	76.6	82.7	1.4	1.9	2.3	2.1
December	15.6	15	85	79.3	1.45	2.25	1.9	1.7
January	13.5	12.2	78.5	61.3	2.2	2.45	2.0	1.9
February	16.8	13.5	75.8	71.7	1.55	2.15	2.6	2.6
March	18.8	15.6	64.5	72.4	1.95	1.85	3.9	3.8

Table 4. Total applied of irrigation water quantities (mm/season) in the different levels under the greenhouse conditions during the two growing seasons of 2017/2018 and 2018/2019.

Seasons	Irrigation levels (% ETc)		
	60 %	80 %	100 %
2017/2018	179.8	239.8	299.7
2018/2019	175.4	233.8	292.3

Table 5. Effect of irrigation levels on total yield, number of pods per plant and relative water content during both seasons 2017/2018 and 2018/2019.

Irrigation levels (% ETc)	Total yield of pods (g / plant)		Number of pods per plant		Relative water content (%)	
	2017/2018	2018/2019	2017/2018	2018/2019	2017/2018	2018/2019
60	291.17	353.77	59.67	78.33	71.96	60.56
80	495.03	448.50	78.33	94.00	75.76	66.20
100	614.17	567.10	99.33	116.67	76.89	68.97
L.S.D at 5%	93.10	46.62	14.59	12.40	0.54	4.49

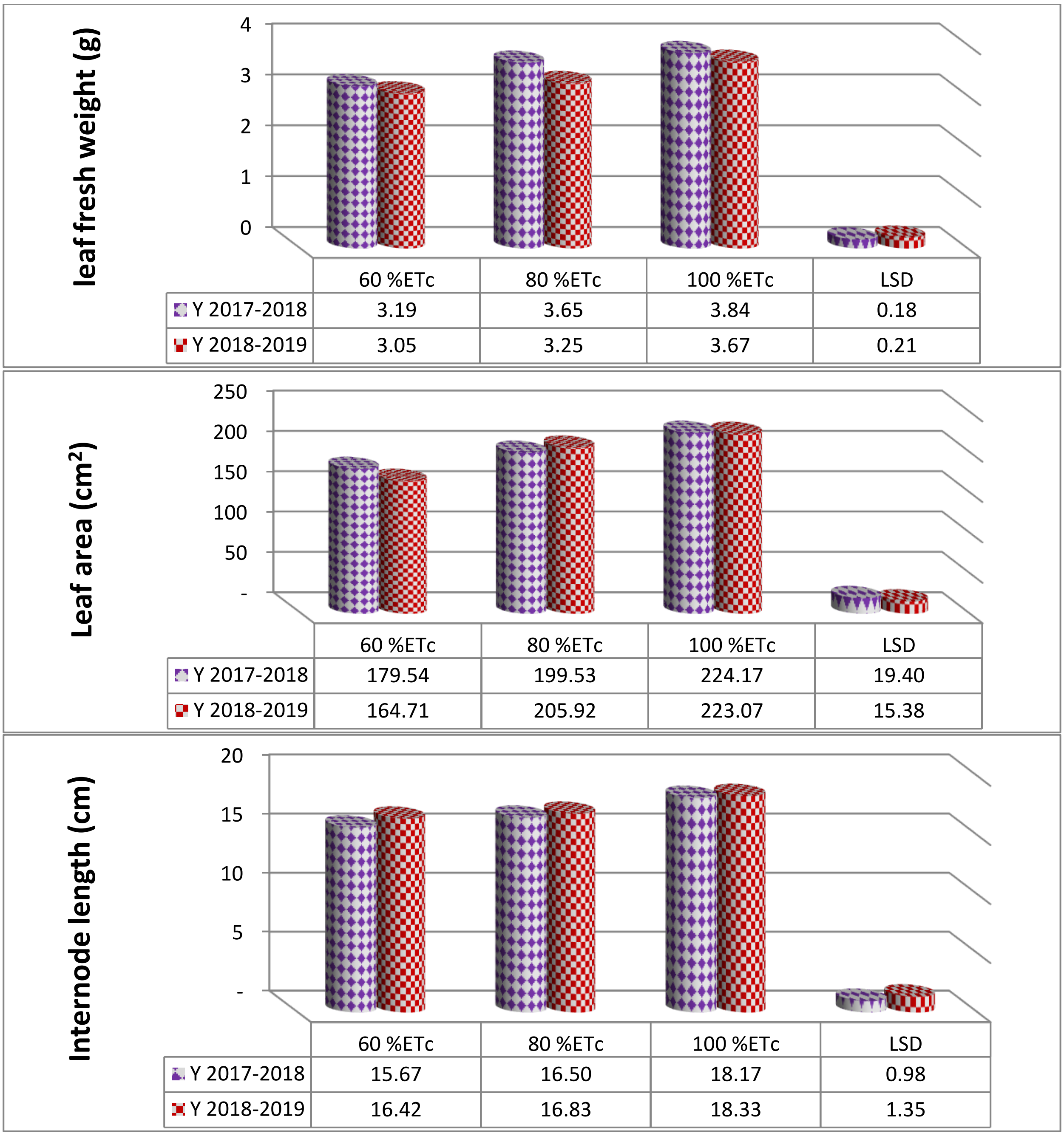


Figure 1. Effect of different irrigation levels on leaf fresh weight and area and stem internode length of green beans in the two seasons of 2017/2018 and 2018/2019.

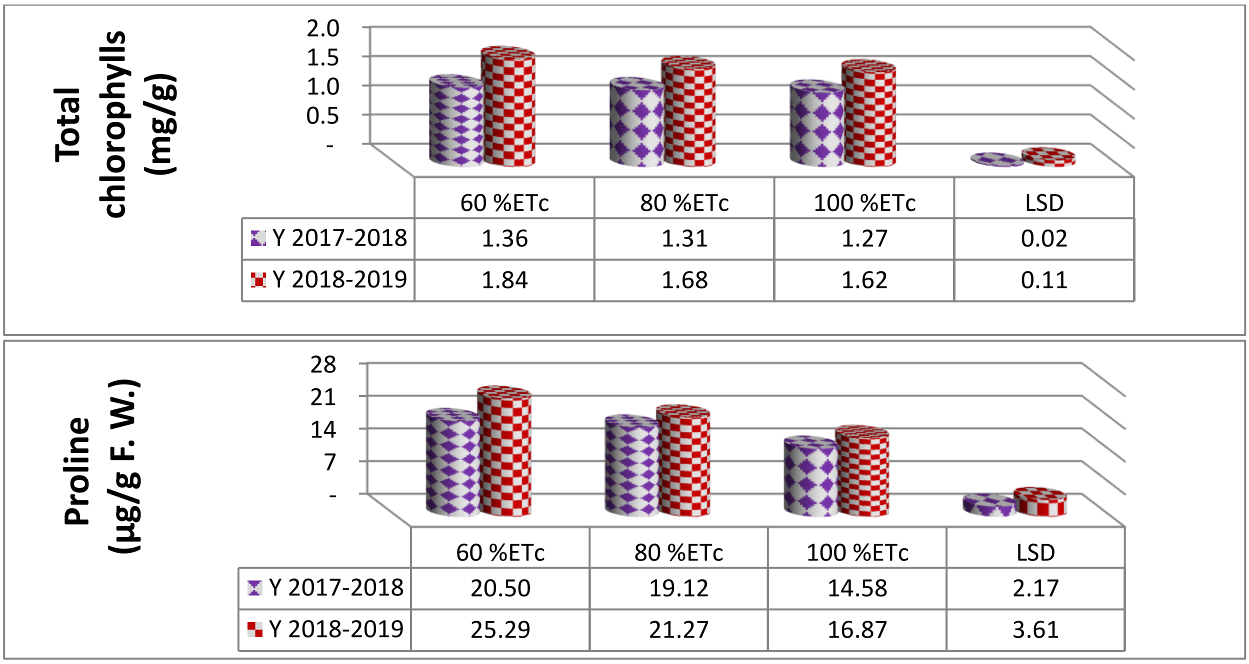


Figure. 2. Effect of different irrigation levels on the contents of total chlorophylls and proline of green beans in the two seasons of 2017/2018 and 2018/2019.

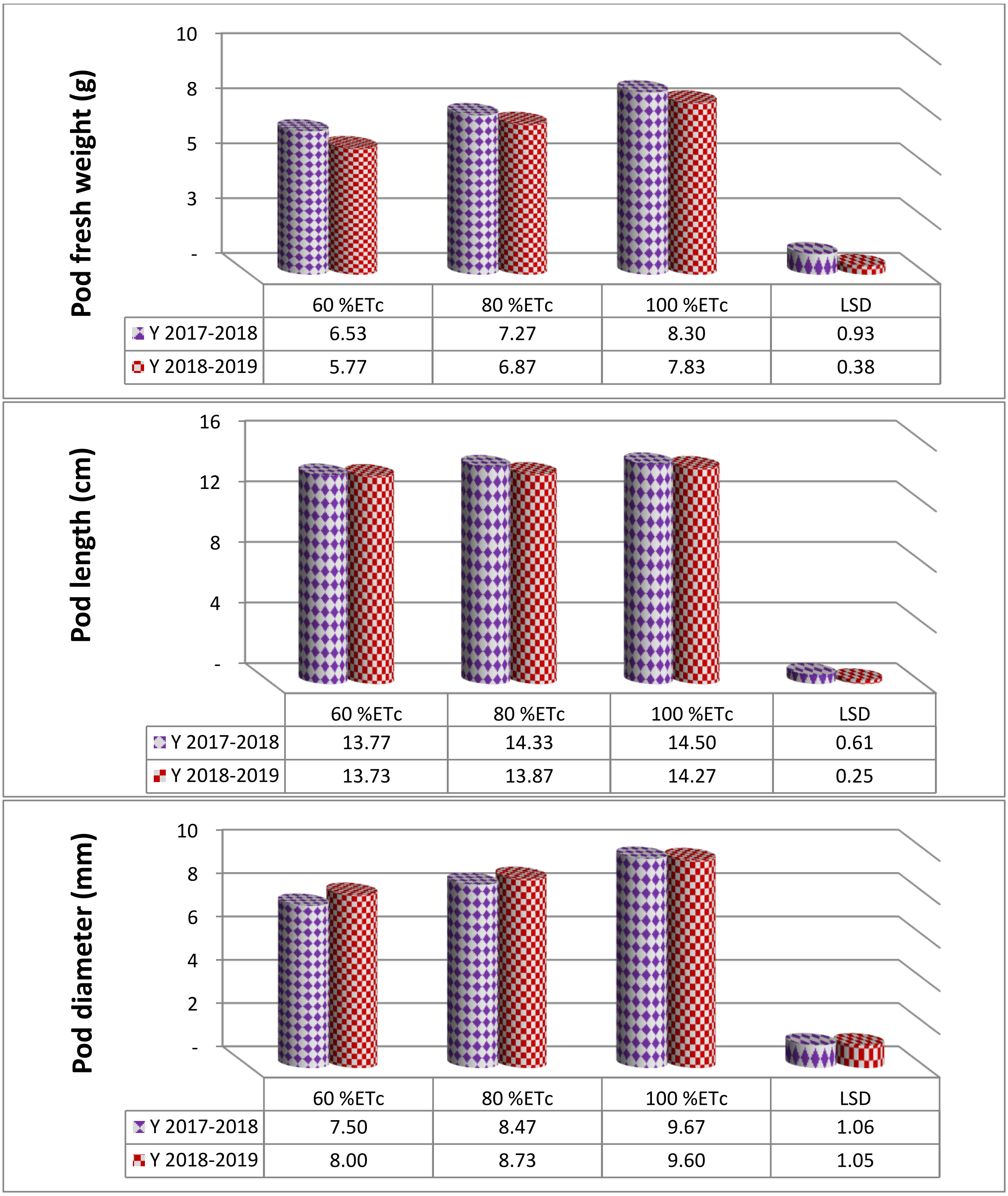
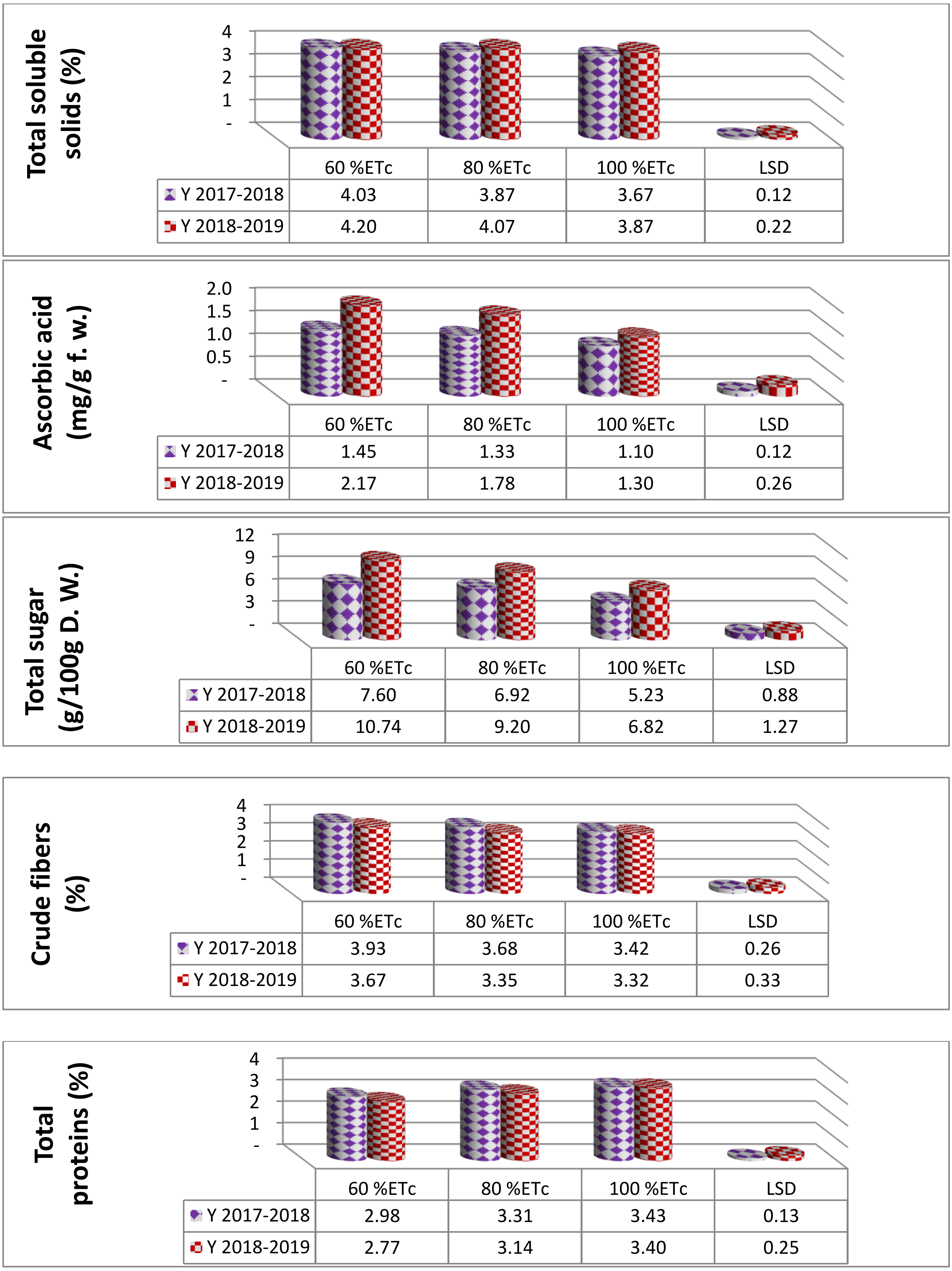


Figure. 3. Effect of different irrigation levels on pod physical parameters of green beans in the two seasons of 2017/2018 and 2018/2019.



Total soluble solids (%)

	60 %ETc	80 %ETc	100 %ETc	LSD
Y 2017-2018	4.03	3.87	3.67	0.12
Y 2018-2019	4.20	4.07	3.87	0.22

Ascorbic acid (mg/g f. w.)

	60 %ETc	80 %ETc	100 %ETc	LSD
Y 2017-2018	1.45	1.33	1.10	0.12
Y 2018-2019	2.17	1.78	1.30	0.26

Total sugar (g/100g D. W.)

	60 %ETc	80 %ETc	100 %ETc	LSD
Y 2017-2018	7.60	6.92	5.23	0.88
Y 2018-2019	10.74	9.20	6.82	1.27

Crude fibers (%)

	60 %ETc	80 %ETc	100 %ETc	LSD
Y 2017-2018	3.93	3.68	3.42	0.26
Y 2018-2019	3.67	3.35	3.32	0.33

Total proteins (%)

	60 %ETc	80 %ETc	100 %ETc	LSD
Y 2017-2018	2.98	3.31	3.43	0.13
Y 2018-2019	2.77	3.14	3.40	0.25

Figure. 4. Effect of different irrigation levels on pod chemical parameters of green beans in the two seasons of 2017/2018 and 2018/2019.

تأثير مستويات الرى المختلفة على نمو ومحصول وجودة قرون الفاصوليا الخضراء تحت ظروف الصوبة.

محمود مصطفى إبراهيم مصطفى*, ماهر أمين والي, عرفة عبد القوى عبده, أحمد حمدى محمد عبد الواحد

قسم البساتين - كلية الزراعة - جامعة الأزهر - القاهرة.

* البريد الالكتروني للباحث الرئيسي:Mahmoud.mostafa21@azhar.edu.eg

الملخص العربي

أجريت هذه الدراسة في مزرعة التجارب بالسادات بمحافظة المنوفية- التابعة لكلية الزراعة - جامعة الأزهر خلال موسمى الزراعة 2017- 2018 و2018- 2019 م لتقييم تأثير مستويات ماء الرى المختلفة وهي 60 – 80 – 100 % من البخر- نتح المحصولى على نمو ومحصول وجودة قرون الفاصوليا الخضراء صنف جويا تحت ظروف الصوبة البلاستيكية. أوضحت النتائج وجود إختلافات معنوية بين مستويات الرى الثلاثة 60 – 80 – 100 % بمعظم الصفات المختبرة، حيث أظهرت النتائج أن الرى عند مستوى 100 % قد حقق زيادة معنوية في وزن وطول وقطر القرن بالإضافه الى طول السلاميات على الساق و محتوى الماء النسبى بالورقة و كذلك الوزن الطازج للورقة ومساحتها . أيضا أدى الرى بهذا المستوى الى زياده معنوية بالمحصول الكلى وزناً وعدداً للقرون مع تحسين جودة القرون من محتوى البروتين الكلى. وعلى الرغم من هذا، نجد أن الرى بمستوى 60% أدى الى تحسين بعض صفات الجودة مثل المحتوى من الكلورفيل الكلى و البرولين بالأوراق، بجانب المواد الصلبة الكلية وحامض الأسكوربيك والسكريات الكلية والألياف بالقرون.

الكلمات الاسترشادية: الفاصوليا الخضراء و الصوبة و الرى و البخر- نتح