Egyptian Journal of Chemistry

http://ejchem.journals.ekb.eg/

Impact of sugarcane press mud application on the productivity of some legumes under salt water irrigation

Reda E. Essa [a]; Soad M. El-Ashry [b]; Mirvat E. Gobarah [a] and Marwa M. Reda [c]

[a] *Field Crop Research Department, National Research Centre, Dokki, Giza, Egypt.*

[b] *Soils and Water Use Department, National Research Centre, Dokki, Giza, Egypt*

[c] *Central Laboratory for Environmental Quality Monitoring, National Water Research Center, Egypt*

Abstract

Increasing the production and quality of the faba bean crop is the main objective of the farmers and breeders. The application of sugarcane press mud is one of the new agricultural strategies of faba bean crop production. The field experiments were conducted to study the effect of sugarcane press mud on the growth and productivity of faba bean (Giza-716 and Nubaria-3) varieties under saline irrigation water in sandy soil. The results showed that the addition of sugarcane press mud significantly increased growth parameters, yield and chemical constituents of Giza-716 and Nubaria-3 varieties compared to control under saline irrigation water in sandy soil conditions. The results could be summarized that there were significant differences between the two varieties on all growth parameters concerning yield and chemical composition per dry grains of faba bean in both seasons. Nubaria-3 variety significantly surpasses Giza-716 variety on growth characteristics, grain and straw yield and percentage of nutritional values of faba bean dry grain i.e. NPK, crude protein, total carbohydrates and total soluble sugars. Finally, for improving yield and quality of faba bean plants under saline irrigation water the best treatment with 150 kg/fed sugarcane press_ mud and it was effective in knowing some new technologies to improve the productivity of faba bean in sandy soil conditions.

Keywords: Giza-716, Nubaria-3, sugarcane press mud, saline irrigation water, fertigation, biological fertilizers.

1. Introduction

Legumes play an important role in sustainable agriculture and have economic and environmental benefits due to their important ability to stabilize atmospheric nitrogen in root nodules. Faba bean (*Vicia faba* L.) is one of the most important crops of legumes winter for human use in Egypt as a source of protein, where the grains contain high levels of protein (28-36%). Therefore, increasing crop productivity is one of the main goals of the agricultural strategy and can be achieved by increasing the area under cultivation, using high-yield varieties, providing appropriate and balanced levels of necessary plant nutrients and weed control [1].

Scientists have been competing over the past various decades to overcome the salinity problem by employing a variety of strategies. The most important strategies at present were the use of various types of organic and biological fertilizers that help in inhibiting salinity [2].

Sugarcane press mud is the solid part produced after filtration of sugarcane juice. The purification process separates the juice into a clear juice that rises upwards and goes for sugar making, and mud that accumulates at the bottom [3]. The mud is then filtered to divide the suspended material, which includes insoluble salts and fine bagasse [4]. The global production of fresh filter press mud can be estimated at 30 million tons [5].

Press mud is a solid waste product from sugar and rich in phosphorus, organic carbon, NPK and other micronutrients [6]. Some studies have been conducted on press mud for its ability to be used in crop production and energy production. Sugarcane press mud is considered a valuable resource of plant nutrients and could therefore affect the physical, chemical and biological soil [7,8] reported that continuous application of cane sugar filter cake on the cultures for 5-6 years should improve soil health by adding sulphur and organic matter to the soil.

Sugarcane press mud can help as organic material superior source [9].This organic material is highly soluble and easily accessible to microbial activity and thus the ground [10].The presence of these chemicals in large quantities in the sugar affects press mud not only the growth of plants but also improves the soil properties when used for the amendment [11]. Press

*Corresponding author email: mashrera@yahoo.com,

Receive Date: 29 September 2021, Revise Date: 12 December 2021, Accept Date: 26 December 2021

DOI: 10.21608/EJCHEM.2021.98778.4595

mud is rich in fibre, crude protein, sugar, crude waxes, fats and ashes comprising oxides of Si, Ca, P, and K [12].
In several reports, the media properties of sugar and agronomic characteristics of various plants grown were determined [13]. But some studies have been conducted on some agronomic steps with parameters limited in various cultures but there are few reports of comprehensive agronomic studies in different agronomic stages of these plants [14].
Therefore, the current study was conducted to determine the effects of sugarcane press mud on the agronomic traits of the bean varieties under new soils. Thus, the purpose of this study is to determine the effect of various levels of sugarcane press mud on the yield and yield components of certain varieties of beans under saline irrigation water in sandy soil for the two following seasons.

2. Materials and methods

2.1. Experimental Site

Field trials were approved in the area of Wadi El-Natroun, El-Behaira Governorate, during two following winter seasons of 2018/2019 and 2019/2020, to study the effect of sugarcane press mud on yield components and quality of faba bean varieties (Giza-716 and Nubaria-3) under fertigation in newly soil conditions.

2.2. Soil Sample and Analysis

A representative soil sample (0-30 cm) was taken from the experimental field before sowing for each season to determine the physical and chemical characteristics. Soil chemical properties were determined by standard procedures using soil extract solutions. Electrical conductivity (EC) was measured using a conductivity meter [15]. Chemical analysis of soil and irrigation water used are shown in Tables (1 and 2) using the method described by [16].
The sugarcane press mud was analyzed for pH using a pH meter and electrical conductivity (EC) using a conductivity meter. The properties of sugarcane press mud are shown in Table 3.

2.3. Experimental design

Field experiments in both seasons were conducted under a drip irrigation system with a distance of 30 cm between drippers (2 L/hour) and 60 cm between rows. The size of the plot was 15 m2 (1/280 fed). Each plot consisted of five ridges (5 m long and 0.6 m wide). The irrigation system was irrigated at intervals of 4-6 days. A split-plot design in a randomized complete block arrangement was used with three replications. The main plots were allocated to the faba bean varieties, while sugarcane press mud four rates (0.0, 50.0, 100.0 and 150.0 kg/fed) were distributed at random in the sub-plots.

Table 1: Physico-chemical properties of the experimental sites during the two seasons

Growing Season	**Particle size distribution (%)**				**OM (%)**	**$CaCO_3$ (%)**	**pH**	**EC** ($dS.m^{-1}$)
	Sand	Silt	Clay	Texture				
2018/2019	85.15	9.07	5.78	Sandy	0.23	1.39	8.84	1.35
2019/2020	83.76	10.02	6.22	Sandy	0.35	1.33	7.78	1.20

Growing Season	Cation (1:2) (meq/l)				Anion (1:2) (meq/l)				NPK available (mg/kg)		
	Ca^{++}	**Mg^{++}**	**Na^{+}**	**K^{+}**	**$CO_3^{=}$**	**HCO_3**	**Cl^{-}**	**$SO_4^{=}$**	**N**	**P**	**K**
2018/2019	2.12	1.55	5.60	1.57	0.00	2.15	7.35	1.34	33.22	72.34	115.42
2019/2020	2.15	1.64	5.63	1.60	0.00	2.30	7.42	1.30	23.28	79.34	98.22

Table 2: Chemical analysis of irrigation water used

pH (1:5)	**EC dS.m^{-1}**	K^{+}	Na^{+}	Mg^{2+}	Ca^{2+}	CO_3^{2-}	HCO_3^{-}	Cl^{-}	SO_4^{2-}
		Soluble cation (mg/l)				**Soluble anion (mg/l)**			
8.38	1.25	0.28	7.32	1.20	2.32	0.00	1.57	5.77	2.78

Table 3: Physico-chemical characteristics of sugarcane press_mud used

pH (1:5)	**EC** $dS.m^{-1}$	**N**	**P**	**K**	**Mg**	**Ca**	**Fe**	**Zn**	**Mn**
		mg/kg							
7.18	1.14	36.35	15.20	65.54	40.20	160.06	5.25	2.14	1.32

2.4. Cultural practices

The preceding crop was a maize in both seasons. Faba bean was sown on October 20th in the 1st and 2nd seasons. Faba bean (Giza-716 and Nubaria-3) grains were inoculated before sowing with the bacteria of Streptococcus. Faba bean in the rate of 30 kg/fed (fed=4200 m2) was sown two sides of the ridge in the hills 30 cm apart and one plant/hill was left at thinning (Giza-716 and Nubaria-3) varieties were obtained from Faba bean Research Department, Field Crops Research Institute, Agricultural Research Centre, Egypt.
Nitrogen fertilizer was added at the rate of 60 kg N/fed as ammonium nitrate (33.5% N) in three equal doses starting from after thinning and fifteen days intervals. Phosphorus and potassium were added at the rate of 60

kg P_2O_5 and 50 kg K_2O (fed), respectively. Phosphorus was applied as calcium superphosphate (15.5 % P_2O_5) pre-sowing. Potassium was applied as potassium sulfate (48 % K_2O) in two equal doses at 45 and 60 days after sowing.

The weed control was carried out during the growing season by hoeing twice at 30 and 60 days after sowing and the pest control, if necessary, was done according to practices used at the experimental station. The other cultural practices were applied as recommended by the Ministry of Agriculture, Egypt.

2.5. Yield and its components

Samples of ten (10) guarded plants were taken at random from each plot to the three replications to measure growth parameters at 120 days after sowing including plant height (cm); several branches (plant); grain weight/plant (g); 100-grains weight (g); grains and straw-yield (ton/fed). All plants of each plot were harvested then grain and straw yields (ton/fed) were determined by multiplying grain and straw yields/plot*280.

2.6. Chemical analysis

Wet digestion of plant sample (0.5 g) by acid mixture (perchloric-nitric, v: v) was performed. The digest was quantitatively transferred, diluted (50 ml distilled water) and filtered on an ash-free filter paper. The filtrate was used for K, Na, Ca, Fe, Zn, Mn and Cu directly by Atomic Absorption, while phosphorous was spectrophotometrically measured through the vanadate method [17]. Total nitrogen content in grains was determined by the Micro-Kjeldahl method, while crude protein % was calculated as N% x 6.25 according. Total Carbohydrates content were determined according to [18].

Total soluble sugars were extracted from dried grains (0.2 g) using ethanol (96%). After centrifugation, the supernatant was stored at 40o C. Determination was conducted by reacting 0.1 ml of the ethanolic extract with 3 ml of freshly prepared anthrone reagent (150 mg anthrone + 100 ml of 72% (v/v) sulfuric acid) in a boiling water bath for 10 min. After cooling, the mixture was read at 625 nm [19].

2.7. Statistical analyses

The obtained data were statistically analyzed by analysis of variance (ANOVA), mean comparison using Costat Edition 6.3 software and differences among means were determined by least significant differences (LSD) at 5 % level according to [20].

3. Results and Discussion

3.1. Effect of press mud on plant growth parameters of faba bean varieties

The results reported in Table 4 expressed the significant effects of sugarcane press mud on plant height, the number of branches per plant and grain weight per plant using sugarcane press mud compared with control (without adding) in both seasons. Increasing the rate of sugarcane press mud from 50-150 kg/fed caused a significant increase in all growth characters studied.

Data in Table (4) showed that significant differences were found between the two varieties Giza-716 and Nubaria-3 in growth characters in both seasons. In addition, the Nubaria-3 variety significantly surpassed the significant Giza-716 variety in plant height, number of branches per plant and grain weight per plant in both seasons.

It is observed from Table (4) that the interaction between varieties and sugarcane press mud rates seemed to have a significant effect on plant height and grain weight per plant. In general, the greatest mean values from plant height and weight of grain per plant were collected from Nubaria-3 variety under rate 150 kg/fed sugarcane press mud, meanwhile, Giza-716 variety gave the lowest values when under without application of sugarcane press mud.

Therefore, we may infer that the elongation of the plant height, number of branches per plant, and grain weight per plant when treated with sugarcane press mud can produce osmotic change activity in plants that can develop growth. This may include increasing plant height, the number of branches per plant, and grain weight per plant due to the uptake of nitrogen, phosphorus, and potassium by bean plants. Improving vegetative growth can be approved for the role of potassium in the translocation of nutrients and sugar in plant cells. It is also involved in cellular enhancement and the triggering of young or growth tissues [21].

On the other hand, the noticeable decrease in plant height, number of branches per plant, and grain weight per plant due to without adding sugarcane press mud or changes in enzymatic activity (which subsequently affects protein synthesis), as well as reduced levels of carbohydrates and growth hormones, both of which can lead to growth decrease [22]

3.2. Effect of sugarcane press mud on yield of faba bean varieties

For faba bean varieties response to sugarcane press mud application, the data in Table 5 show that there are significant differences in 100-grain weight in both seasons due to the different treatments. Tables 5 show that the 100-grain weight increased due to the application of sugarcane press mud. In addition, data also show that the highest values were obtained due to sugarcane press mud addition for the Giza-716 and Nubaria-3 varieties compared with control in both growing seasons.

Data in Table 5 and Figures (1 and 2) revealed that the application of sugarcane press mud significantly increased grain and straw yield in both seasons. It is cleared that the Nubaria-3 variety significantly surpassed the Giza-716 variety in both seasons. The highest values of grain and straw yield were obtained where (150) > (100) > (50) > no fertilizer (control) for grain and straw yield, respectively in both seasons. Data also, showed that the highest rate (150 kg/fed) gave the highest weight of grain and straw yield with

Nubaria-3 variety, followed by the same rate of Giza-716 variety compared with control in both seasons, respectively.

The data presented in Table 5 show that for the interaction effect between sugarcane press mud rates and faba bean varieties on the yield of the faba bean and its components, the interaction gave significant values, except for straw yield in both seasons, where the highest values were recorded by the Nubaria-3 variety at the highest rate (150 kg/fed) in both seasons.

The effect of sugarcane press mud application may be due to an increase in plant growth, which would increase the amount of light energy intercepted by leaves and increase photosynthetic pigments and photosynthesis, and in turn, increase synthesized metabolites and consequently leaves and grains. These results are consistent with those obtained by previous studies [23].

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Table (4): Effect of sugarcane press mud rates application on plant height, number of branches/plant and number of pods/plant of faba bean varieties

Varieties	Plant height (cm)				Mean	No. of Branches/plant				Mean	Number of Pods/plant				Mean
	0.0	50	100	150		0.0	50	100	150		0.0	50	100	150	
2018/2109															
Giza-716	85.00	90.67	97.67	101.00	**93.59**	3.58	5.63	6.3	7.33	**5.71**	37.33	42.00	45.00	47.33	**42.92**
Nubaria-3	88.00	106.33	111.67	119.67	**106.42**	3.75	6.22	6.97	8.48	**6.36**	41.00	46.33	48.67	60.33	**49.08**
Mean	**86.50**	**98.50**	**104.67**	**110.34**	**100.00**	**3.67**	**5.93**	**6.64**	**7.91**	**6.03**	**39.17**	**44.17**	**46.84**	**53.83**	**46.00**
LSD 0.05	**Var.**	2.22				0.57					1.29				
	Rates	4.98				0.47					2.92				
	V*R	4.45				ns					2.58				
2019/2021															
Giza-716	90.33	97.00	103.33	106.67	**99.33**	5.33	7.00	7.67	8.00	**7.00**	38.33	49.00	51.33	52.67	**47.83**
Nubaria-3	94.67	112.33	119.67	131.00	**114.42**	6.67	9.00	9.67	10.33	**8.92**	42.67	51.67	58.00	68.67	**55.25**
Mean	**92.50**	**104.67**	**111.50**	**118.84**	**106.88**	**6.00**	**8.00**	**8.67**	**9.17**	**7.96**	**40.50**	**50.34**	**54.67**	**60.67**	**51.54**
LSD 0.05	**Var.**	3.56				0.84					1.82				
	Rates	9.63				1.14					5.82				
	V*R	7.12				ns					3.64				

V*R =Varieties * Rate

Table (5): Effect of sugarcane press_mud rates application on grain and straw yield of faba bean varieties

Varieties	100-grains weight (g)				Mean	Grain yield (ton/fed)				Mean	Straw yield (ton/fed)				Mean
	0.0	50	100	150		0.0	50	100	150		0.0	50	100	150	
2018/2109															
Giza-716	93.33	103.33	110.33	114.67	**105.42**	0.88	0.99	1.06	1.19	**1.03**	1.00	1.21	1.32	1.35	**1.22**
Nubaria-3	96.33	124.67	130.00	134.00	**121.25**	0.90	1.13	1.2	1.31	**1.14**	1.05	1.28	1.35	1.47	**1.29**
Mean	**94.83**	**114.00**	**120.17**	**124.34**	**113.33**	**0.89**	**1.06**	**1.13**	**1.25**	**1.08**	**1.03**	**1.25**	**1.34**	**1.41**	**1.25**
$LSD_{0.05}$	**Var.**	1.15				0.03					0.03				
	Rates	4.14				0.05					0.09				
	V * R	2.31				0.07					ns				
2019/2020															
Giza-716	99.00	109.00	117.33	123.67	**112.25**	0.90	1.12	1.20	1.30	**1.13**	1.03	1.25	1.33	1.4	**1.25**
Nubaria-3	101.00	133.67	143.00	147.00	**131.17**	0.94	1.18	1.30	1.37	**1.20**	1.10	1.33	1.48	1.55	**1.37**
Mean	**100.00**	**121.34**	**130.17**	**135.34**	**121.71**	**0.92**	**1.15**	**1.25**	**1.34**	**1.16**	**1.07**	**1.29**	**1.41**	**1.48**	**1.31**
$LSD_{0.05}$	**Var.**	1.79				0.01					0.03				
	Rates	3.66				0.03					0.04				
	V * R	3.58				0.03					ns				

V*R =Varieties * Rate

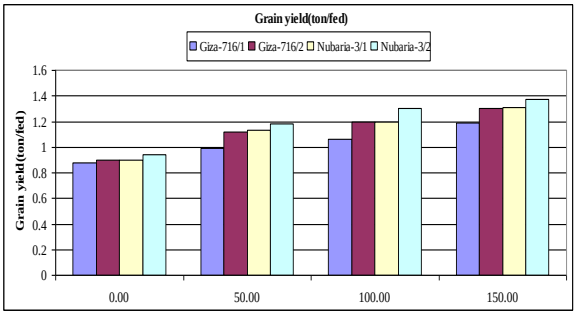

Fig.1: Effect of sugarcane press_mud rates application on grain yield of faba bean varieties in the two seasons (2018/2019 and 2019/2020)

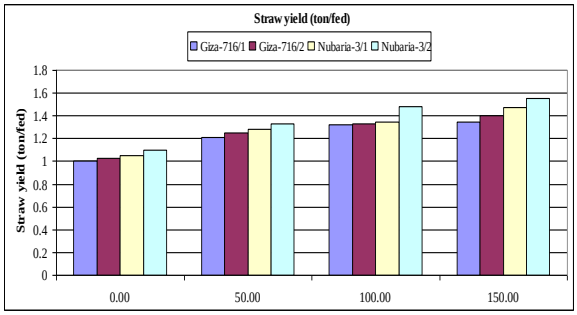

Fig.2: Effect of sugarcane press_mud rates application on straw yield of faba bean varieties in the two seasons (2018/2019 and 2019/2020)

3.3. Effect of sugarcane press mud on macronutrients in grains of faba bean varieties

The data in Table 6 indicated that nitrogen, potassium and phosphorus contents in grains increased due to the application of sugarcane press mud. The key role of sugarcane press mud in increasing the nutrient content of plants was due to the effects different such as improving certain chemical properties of the soil. This is probably due to the optimal absorption of these elements by cultivated plants.

It is observed from Table (6) that the interaction between varieties and sugarcane press mud rates to have a non-significant effect on N, P and K contents. In general, the greatest mean values from N, P and K contents were collected from Nubaria-3 variety under rate 150 kg/fed sugarcane press mud, meanwhile, Giza-716 variety gave the lowest values when under without application of sugarcane press mud.

The application of sugarcane press mud increased the rate of uptake of elemental nutrients N, P and K (Table 6) and, consequently, increases in proteins and sugars that can serve as an indicator of the decreasing effect of saline irrigation water [24].

3.4. Effect of sugarcane press mud on grains quality of faba bean varieties

The data present in Table 7 and figures 3 and 4 show the effect of sugarcane press mud addition on crude protein, total carbohydrate and total soluble sugar contents on the faba bean varieties. The results indicated that sugarcane press mud treatments significantly affected the chemical components contained in the faba bean verities.

The application of sugarcane press mud at a rate of 50-150 kg/fed showed significant differences in protein, total carbohydrate and total soluble sugars concentrations compared to the control treatment. In the present study, the maximum crude protein, total carbohydrate and total soluble sugar contents of Nubaria-3 variety were recorded with 150 Kg/fed treatment of sugarcane press mud during the cultivated seasons.

The data in Table 7 show that for the interaction effect between sugarcane press mud rates and varieties on faba bean quality, the interaction gave significant values except for proteins and carbohydrates in both seasons.

The increase in protein, total carbohydrate and total soluble sugar concentrations in the faba bean through the application of sugarcane press mud can be attributed to the crucial role of sugarcane press mud in mitigating the negative effects of saline irrigation water. In addition, previous studies [23]. observed that sugarcane press mud was beneficial to newly recovered saline soils to mitigate the adverse effects of salt stress and improve sustainable crop productivity.

Table (6): Effect of sugarcane press_mud rates application on some elements to faba bean varieties.

Varieties	Nitrogen (%)					Phosphorus (%)					Potassium (%)				
	0.0	50	100	150	Mean	0.0	50	100	150	Mean	0.0	50	100	150	Mean
2018/2109															
Giza-716	2.79	3.08	3.26	3.34	**3.12**	0.088	0.093	0.095	0.096	**0.093**	2.23	2.51	2.54	2.60	**2.47**
Nubaria-3	2.88	3.28	3.36	3.61	**3.28**	0.090	0.095	0.096	0.097	**0.095**	2.25	2.62	2.70	2.78	**2.59**
Mean	**2.84**	**3.18**	**3.31**	**3.48**	**3.20**	**0.089**	**0.094**	**0.096**	**0.097**	**0.094**	**2.24**	**2.57**	**2.62**	**2.69**	**2.53**
$LSD_{0.05}$	**Var.**	0.13				0.001					0.03				
	Rate	0.20				0.002					0.04				
	V * R	ns				ns					0.06				
2019/2020															
Giza-716	2.97	3.32	3.52	3.73	**3.39**	0.095	0.101	0.103	0.104	**0.101**	2.24	2.58	2.64	2.73	**2.55**
Nubaria-3	3.03	3.55	3.63	3.89	**3.53**	0.097	0.102	0.104	0.106	**0.102**	2.28	2.71	2.78	2.82	**2.65**
Mean	**3.00**	**3.44**	**3.58**	**3.81**	**3.46**	**0.096**	**0.102**	**0.104**	**0.105**	**0.102**	2.26	2.65	2.71	2.78	**2.60**
$LSD_{0.05}$	**Var.**	0.08				0.002					0.05				
	Rate	0.14				0.002					0.09				
	V * R	ns				ns					0.11				

Table (7): Effect of sugarcane press_mud rates application on quality of faba bean varieties.

Varieties	Protein (%)				Mean	Carbohydrates (%)				Mean	Total Soluble sugar (mg/g)				Mean
	0.0	50	100	150		0.0	50	100	150		0.0	50	100	150	
2018/2109															
Giza-716	17.44	19.25	20.38	20.88	**19.49**	33.00	33.50	35.92	38.96	**35.35**	2.89	2.94	2.95	2.96	**2.94**
Nubaria-3	18.00	20.50	21.00	22.56	**20.52**	34.00	38.33	42.00	44.00	**39.58**	2.93	3.21	3.30	3.45	**3.22**
Mean	**17.72**	**19.88**	**20.69**	**21.72**	**20.00**	**33.50**	**35.92**	**38.96**	**41.48**	**37.46**	**2.91**	**3.08**	**3.13**	**3.21**	**3.08**
$LSD_{0.05}$	**Var.**	0.78				1.32					0.03				
	Rates	1.22				1.39					0.03				
	V * R	ns				ns					0.05				
2019/2020															
Giza-716	18.56	20.75	22.00	23.31	**21.16**	36.00	37.30	41.50	44.00	**39.70**	2.94	3.13	3.10	3.29	**3.12**
Nubaria-3	18.94	22.19	22.69	24.31	**22.03**	37.60	38.40	42.00	45.00	**40.75**	2.95	3.25	3.33	3.47	**3.25**
Mean	**18.75**	**21.47**	**22.35**	**23.81**	**21.59**	**36.80**	**37.85**	**41.75**	**44.50**	**40.23**	**2.95**	**3.19**	**3.22**	**3.38**	**3.18**
$LSD_{0.05}$	**Var.**	0.51				1.35					0.02				
	Rates	0.93				1.80					0.03				
	V * R	ns				ns					0.05				

V*R =Varieties * Rate

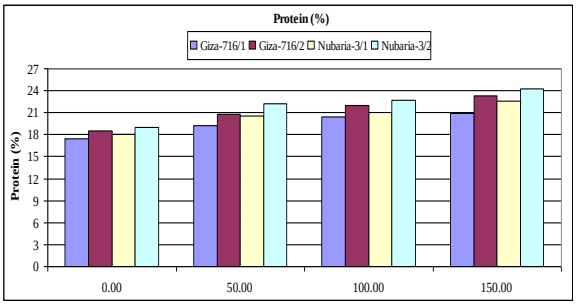

Fig.3: Effect of sugarcane press_mud rates application on protein % of faba bean varieties in the two seasons (2018/2019 and 2019/2020)

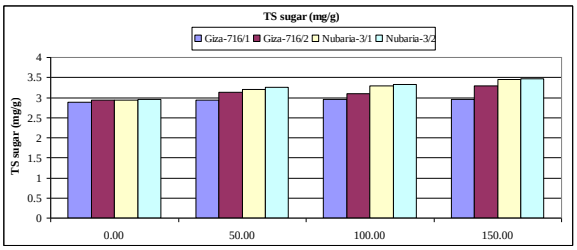

Fig.4: Effect of sugarcane press_mud rates on total soluble sugar (mg/g) of faba bean varieties in the two seasons (2018/2019 and 2019/2020)

3.5. Economic feasibility

The economic analysis presented here shows a high probability of profitability for sugarcane press mud and faba bean varieties co-production in the research region. In the best case, the cultivation of the bean (Nubaria-3 variety) can produce up to 11852.50 L.E/fed., which is mainly due to the high yield potential demonstrated during two years of faba bean crop trials, where the control condition produced close to 7993.88 L.E/fed. While, for Giza-716 variety was 11035.00 L.E/fed, respectively (Table 8). According to the research, the bean would be beneficial compared to many other agronomic enterprises. Sugarcane press mud is can be used in agriculture and industry. As a result, sugarcane press mud production can improve soil properties while providing new income prospects. Grain yield of faba bean = 8 L.E/kg Straw yield of faba bean = 0.75 L.E/kg sugarcane pressmud =5 L.E/kg

The productivity of faba bean cultivation continues to be quite low in sandy soils. As a result, the yield of bean verities can be increased by adding sugarcane press mud to farmer's fields. Cultivars varied significantly in yield components over both seasons. Nubaria-3 showed the highest values for plant height, number of branches/plants, and grain/plant weight, over both seasons, while Giza-716 gave the lowest value for the same characters over both seasons. For the weight of 100 grains, Nubaria-3 gave the highest values, while Giza-716 presented the lowest values in both seasons [22].

Concerning grain yield/fed, Nubaria-3 gave the highest value (1.31 ton/fed) while Giza-716 gave the lowest value (1.19 ton/fed) in the first season. The same trend was obtained in the second season. Note the significant variation in grain yield and yield components between the two seasons. Similar variations between yield and yield components of faba bean cultivars were reported by[7]., who concluded that these variations can be attributed to applied sugarcane press mud.

The interaction of the two factors revealed that varieties differed in performance, under the influence of add sugarcane press mud levels, for yield and yield components. The sugarcane press mud with 150 kg/fed gave the maximum grain yield indicating the importance of both macronutrients in achieving the high grain yield of the faba bean over the two seasons [25].

Improved faba bean growth and yield can be attributed to one or more of the following factors: 1) availability of more elements due to N2 fixation; 2) production of growth-promoting substances by microorganisms; and 3) successful competition of bacteria [26]. Normally, it can be concluded from this study that the highest values of yield and its components and the content of elements N, K and P could be obtained from Nubaria -3 variety by adding sugarcane press mud to the newly reclaimed soils of Egypt.

4. Conclusions

In this investigative research, plant growth was better at high rates (150 kg/fed). It was found that this rate is suitable for the sandy environment; however, the soils differ in the rate of the addition of sugarcane press mud for optimal plant growth. So that it could set up other tests in different types of soils. In this research, it was illustrated a conclusion that further research on sugarcane press mud rates compared to other aspects in the soil by considering 150 kg/fed as the final level of sugarcane press mud use. Therefore, it is recommended to use sugarcane press mud as a proportion of bio-fertilizer (up to 150 kg/fed) to improve the yield of this crop and reduce environmental pollution under saline irrigation water in sandy soil conditions.

Table 8: Economic feasibility of sugarcane press_mud amendment on yield of faba bean varieties (Average of two years)

Varieties	Fertilizers (Pressmud)	Price (L.E.)	Grain yield (ton/fed)	Price (L.E.)	Straw yield (ton/fed)	Price (L.E.)	Total yield income
Control	Non pressmud	0.00	0.91	7240.00	1.01	753.88	7993.88
Giza-716	150 kg/fed	750.00	1.25	10000.00	1.38	1035.00	11035.00
Nubaria-3	150 kg/fed	750.00	1.34	10720.00	1.51	1132.50	11852.50

5. Acknowledgements

The author(s) are thankful to the Director of a private farm in Wadi El-Natroun, El-Behaira Governorate, Egypt for providing all the necessary facilities to complete the research work.

6. Conflict of interest

The authors announce that they have no irreconcilable circumstances

7. References

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