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Effect of Relaying Intercropping Onion Transplanting Dates on Faba Bean under Different Plant Densities

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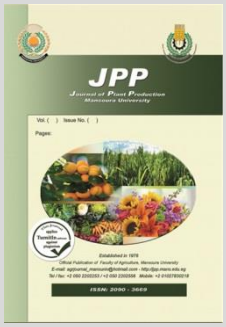

ABSTRACT

This investigation was carried out at El-Gemmeiza Agricultural Research Station during two winter seasons of 2019/2020 and 2020/2021,to study the response of different onion transplanting dates (Giza 20; T1,15th of December;T2, 30th of December;T3,15th of January)for intercropping with different densities of faba bean (Giza716;D1,100%onion+25.0%faba bean; D2, 100% onion+33.5% faba bean;D3,100% onion+42.0 % faba bean of the recommended density) and its impact on yield and yield components of both crops.The competitive relationships and yield advantages was also studied.A split plot design with three replicates was employed.The results showed that early transplanting (e.g.,T2) had a good impact on onion growth, yield and its components,yet this was accompanied with a negative response on quality traits of yielded bulbs.The highest quality traits were achieved with late transplanting (T3).Obviously,the mean value of onion growth, yield and its components was increased with increasing sowing density of faba bean,except for plant height and weight of culls yield.T1 plus D1 was the best treatment for enhancing vegetative growth and yield components except for plant height and weight of culls yield,All faba bean studied characters possessed the highest mean value at middle density of faba bean was the best one as compared to D1 and D3 densities.The interaction released that T3 at D2 achieved the highest mean values for number of seeds, seed yield and seed yield.It has been concluded that, early transplanting of onion(15th of December)in association with light density of faba bean(25%)possessed the highest value in both seasons of LER, RCC, ATER, MAI and Income return.

Keywords: Onion yield components, faba bean yield components, land equivalent ratio, Relative crowding coefficient, net return.

INTRODUCTION

The onion (*Allium cepa* L.) is one of the most important vegetable crops; it`s average cultivated area was 172801 fed., with an average yield of 14.610 t/fed. (Egypt's Ministry of Agriculture's Annual Report on Statistics and Agricultural Economics, 2020). It is produced for home consumption and as income sources for many small-scale farmers and commercial growers in Egypt.

Onion seedlings are transplanted at different times depending on the effect of edaphic variables and other environmental circumstances on growth, bulb yield, and bulb quality, which vary greatly from area to region. Many studies from around the world have looked into the impact of transplanting dates on onion seed output and quality (Teshome *et al*., 2014; Ali *et al*., 2016; Abou Khadrah *et al*., 2017; Minackhi *et al*., 2018; Tesfaye *et al*., 2018; Ojha *et al*., 2019; Khan *et al*., 2020 and Salari *et al*., 2021)

The faba bean (*Vicia faba* L.) is a high protein food crop. It also provides ecosystem services such as renewable nitrogen (N) inputs into crops and soil via biological N_2 fixation, as well as crop diversity. At present, cultivated faba bean area in Egypt at average of (120000) faddan with total annual production is (180,000 tons), which is not enough for increasing population (Agricultural Statistics, 2021). This reduction in cultivated faba bean area is due to the increasing in cultivation of other strategic crops such as wheat, berseem, sugar beet,….etc. The crop's production is currently restricted, and it is expected to face rising local demand. Cropping systems, cultivar selection, disease and weed management are only a few of the elements that must be addressed to boost productivity and close the gap between local production and human consumption.

Intercropping is described as the cultivation of two or more crops in the same area at the same time. It is respect, as technology has been passed down for hundreds of years, and farmers have earned it from one another. Many types of intercropping have been utilized in the past, including seasonal intercropping (planting summer crops before the first harvest's end, and the other way around), and intercropping on a local scale as planting winter crops on the same area (John and Stephen, 2009). All environmental resources are used in the cropping system to maximize crop yield per unit of area and time. So that, cropping styles have a number of advantages such as, increase land use efficiency, flexibility, risk minimization against total crop failure or disease, profit maximization, soil conservation, weed control, improvement of soil fertility by the use of legumes, increasing light and water capture and usage (Dhima *et al.*, 2007 and Hamd Alla *et al.*, 2014).

Since yield of the intercrops will depend on both interspecific and intraspecific competition, it is necessary to test a wide range of densities for each component in a wide range of combinations. The interpretation for the effect of the component density on the performance of binary

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intercrops has been complicated in many studies due to the use of replacement series experimental designs, which confound intraspecific with interspecific competition (Snaydon and Satorre, 1989 and Snaydon, 1991). Willey and Osiru (1972) found that the optimum density of intercrops was greater than that of sole crops.

In Egypt, intercropping faba bean with other winter crops (wheat, onion, garlic, fennel, sugar beet, sugar cane and tomato) is common to increasing the cultivated faba bean area and minimizing the gap between production and consumption. Abou-Keriasha *et al.* (2013) reported that yield and it`s attributes of the three crops (faba bean, onion and wheat). The highest values of land equivalent ratio (1.59) and the values of competitive ratio of faba bean were greater when intercropping with onion.

Although intercropping onion with faba bean decreased yield of the both crops, all intercropping treatments gave better financial returns than either crop grown alone (El-Hawary *et al*., 1991). Ghobashi and El-Aweel (1996) found that, in intercropping onion with faba bean, the land equivalent ratio was more than one as compared to solitary cultures.

Many factors influence faba bean yield, including genotypes, plant distribution, and plant density (Khalil *et al*., 2010 and Abd El-Rahman, 2014). While, plant density is a critical component in onion production (Mlik ,1994). So that more information is needed for determining the optimal spatial arrangement of intercropping onion with faba bean through the manipulation of both hill distance and ridge width.

This investigation aimed to study the response of different onion transplanting date for intercropping with different densities of faba bean and its effect on yield and yield components of both faba bean and onion, as well as competitive relationships and yield advantages.

MATERIALS AND METHODS

The experiment was conducted at the research farm of EL- Gemmeiza Agriculture Research Station, Agriculture Research Center, Egypt, during winter seasons 2019/2020 and of 2020/2021 to study the response of different onion transplanting date for intercropping with different densities of faba bean and its effect on yield and yield components. As well as competitive relationships, yield advantages and net economic return of both crops. A split plot design with three replicates was used where the plot area was 28.8 m^2 as each plot consisted of 6 raised beds (4.0 m long and 1.2 m wide).

The main- plots were used for the three transplanting dates of onion T_1 (15th December), T_2 (30th December) and T_3 (15th January) under three different intercropping patters (sub-plot) as follow:-

D_1 - (100% onion + 25.0 % faba bean from the recommended) by sowing 8.8 K g/fed of faba bean (26.250 plants/fed.) on the other side of onion to give 25.0 % of solid cultures density recommended (105000 plants/fed).

D_2 - (100% onion + 33.5 % faba bean from the recommended) by sowing 11.7 K g/fed of faba bean (35.175 plants/fed.) on the other side of onion to give 33.5 % of solid cultures density recommended (105000 plants/fed).

D_3 - (100% onion + 42.0 % faba bean from the recommended) by sowing 14.7 K g/fed of faba bean (44.100 plants/fed.) on the other side of onion to give 42 % of solid cultures density recommended (105000 plants/fed).

The solid agriculture was not included in the analysis, but planted in purpose of estimating the competitive relationship and economic relations. The onion cultivar (Giza 20) and faba bean cultivar (Giza 716) were used. The preceding summer crop was maize in both seasons.

The solid faba bean seeds were sown on the two sides and the top of the ridge which was 60 cm apart and 20 cm between hills, one seeds/hill to give plant density (105000 plant/fed). The solid faba bean and the different densities were sown at 15th November in the two successive seasons.

The soil was clay with a pH of 7.3, 1.2% organic matter and having 21.8, 9.5 and 520 ppm available N, P and K, respectively and EC 0.8 dsm /cm^3. The meteorological data during the two seasons were presented in Table (1). These data were from the World Climate Research Programme (WCRP) Global Energy and Water Cycle Experiment's (GEWEX) Surface Radiation Budget (NASA/GEWEX SRB).

Table 1. Wind speed, relative humidity percent, monthly maximum and minimum air temperatures at El-Gemmeiza Agric. Res. Stat. in 2019/2020 and 2020/2021 seasons.

Day	2019/2020					2020/2021				
	Wind speed	Relative humidity precents	Temperature ºC			Wind speed	Relative humidity precents	Temperature Cº		
			Max.	Min.	Mean			Max	Min	Mean
1st:15th November	2.52	63.44	31.29	17.63	24.46	2.32	61.35	27.35	16.86	22.11
16th: 30th November	2.39	55.81	27.01	14.55	20.78	2.08	68.52	23.74	14.18	18.96
1st:15th December	2.62	63.17	22.54	12.69	17.62	2.08	58.11	23.80	11.17	17.48
16th: 31th December	3.06	68.76	21.08	9.65	15.36	2.02	71.50	23.15	12.23	17.69
1st:15th January	3.06	71.45	18.20	8.74	13.47	2.07	70.96	24.40	12.04	18.22
16th: 31th January	2.60	72.18	18.48	8.86	13.67	2.91	63.42	19.85	8.00	13.92
1st:15th February	2.46	69.38	20.31	8.55	14.43	1.77	64.70	24.96	10.60	17.78
16th: 29th February	2.26	71.03	21.13	8.99	15.06	2.67	72.25	19.11	8.74	13.92
1st:15th March	2.61	69.65	24.44	10.47	17.45	2.59	66.34	23.70	9.82	16.76
16th: 31th March	3.07	62.10	24.19	10.09	17.14	2.73	64.99	23.04	10.75	16.89
1st:15th April	2.47	61.27	26.22	11.76	18.99	2.78	59.80	25.98	9.94	17.96
16th: 30th April	2.76	64.60	27.89	13.38	20.63	3.01	52.64	33.70	14.23	23.97
1st:15th May	2.55	62.96	30.89	14.14	22.52	2.48	44.60	37.89	17.90	27.89
16th: 31th May	3.16	55.04	34.45	17.17	25.81	3.13	48.03	36.45	17.84	27.14

Onion seeds were sown in nursery at 15th October, 30th October and 15th November, the transplanting date took place at15th December (T_1), 30th December (T_2) and 15th January (T_3). Transplants were laid at 10.0 cm and transplanting on six rows on top of the raised beds to give plant density (210000 plant/fed).

The recommended cultural practices for onion and faba bean production were adopted at the proper time. Insects were chemically controlled as needed. Also, the recommended cultural practices for onion production were adopted at the proper time. Calcium superphosphate fertilizer was applied (15.5 % P_2O_5) at the rate of 300 Kg P_2O_5/ fed were added before ridging. Nitrogen in the form of ammonium nitrate (33.5 % N, 200 Kg/fed) was added in two equals portions at 30 and 60 days after transplanting.

Data recorded:-

1- **Onion plants:-**

At the vegetative growth, a representative sample consists of 10 plants was taken from each plot at 120 days after transplanting where the following measurements were recorded:

a) Plant height (cm)
b) No. of leaves/plant
c) Bulbing ratio (bulb/neck diameter)
d) Fresh weight/plant (g)
e) Dry weight/plant (g)

After harvest (50% tops down), all onion plants in the field were left to cure for about two weeks, then tops and roots were removed. The following yield and yield components traits were estimated:-

a) Weight of culls yield contained small bulbs < 3.5 cm in diameter and double bulbs (ton/fed).
b) Marketable bulbs yield (ton/fed).
c) Total yield (ton/fed).
d) Average bulb weight (g)

A representative sample of each plot, both total soluble solid % (T.S.S) by refractometer and dry matter were determined in fresh bulbs at harvest time.

For storability marketable bulbs of each plot were weighted, and placed in common burlap bags and then kept in room temperature. The total weight loss % was recorded at fifth month after harvesting.

The difference between the initial weight and successive weights gave the rate of total weight losses as described by Abubaker et al. (2019).

$$\text{Weight loss \%} = \frac{W_0 - W_1}{W_0} X\ 100$$

Where,

W_0 – initial weight, W_1– weight after fifth month

2-Faba bean plants:-

At harvest ten plants were randomly taken from each plot to determine yield and yield components as follow:

Plant height (cm), number of branches / plant, number of pods / plant, number of seeds / plant, seed yield / plant (g) and 100-seed weight (g). Also, seed yields and straw were recorded from the all of plot and converted to get seed yield (ardab/fed) and straw weight (ton/fed).

Competitive relationships and yield advantages:-

The following competitive relationships and yield advantages were calculated:

(1) Land equivalent ratio (LER): It was calculated according to Willey and Rao (1980):

$$LER = \frac{Yab}{Yaa} + \frac{Yba}{Ybb}$$

Where,

Yaa and Ybb were pure stand of crop, a (onion) and b (faba bean), respectively. Yab is mixture yield of a crop and Yba is mixture yield b crop.

(2) Land equivalent coefficient (LEC): It is measuring the interaction concerned with the strength of relationship; it was calculated according to Adetiloye *et al.* (1983) as following:

$$LEC = La \times Lb$$

Where,

La = LER of crop a (onion) and Lb = LER of crop b (faba bean).

(3) Area time equivalent ratio (ATER): The ratio of number of hectare-days required in monoculture to the number of hectare-days used in the intercrop to get identical quantities of each component was determined according to Hiebsch and Mc-Collum (1987) as follows:

$$ATER = \left(\frac{Yab}{Yaa} \times ta\right) + \left(\frac{Yba}{Ybb} \times tb\right) / T$$

Where,

RY = Relative yield of crop a (onion) or crop b (faba bean). *i.e.*, yield of intercrop/yield of main crop, t = duration (days) for species a or b and T = duration (days) of the intercropping system.

(4) Relative crowding coefficient (RCC) or K: It was calculated based on the equation described by De-Wit (1960) as follows:

$$K = Kab \times Kba$$

$$Kab = \frac{Yab \times Zba}{(Yaa - Yab)\ Zab} \quad ; \quad Kba = \frac{Yba \times Zab}{(Ybb - Yba)\ Zba}$$

Where,

a (onion) and b (faba bean) respectively. B is percentage of the area occupied by onion and Zba is percentage of the area occupied by faba bean.

(5) Aggressivity (Ag): It was determined according to Mc-Gillchrist (1965) according to the following formula:

$$Aga = \frac{Yab}{Yaa \times Zab} - \frac{Yba}{Ybb \times Zba};$$

$$Agb = \frac{Yab}{Yaa \times Zab} - \frac{Yba}{Ybb \times Zba}$$

Where,

Aga = Aggressivity value for the component a (onion); Agb = Aggressivity value for the component b (faba bean); Yab is intercrop yield of onion, Zab is percentage of the area occupied by onion and Zba is percentage of the area occupied by faba bean.

(6) Monetary advantage index (MAI) fad^{-1}: The economic assessment should be in terms of the value of land saved, this could probably be most assessed on the basis of the rentable value of this land. It was determined according to the formula, suggested by Willey (1979).

$$MAI = \frac{\text{Value of combined intercrop} \times (LER - 1)}{LER}$$

(7) Economic evaluations: It was estimated by comparing the net return of intercropping culture to the solid planting of onion and faba bean as suggested.

Gross income of intercropping cultures = price of onion yield + price of faba bean seed yield + price of faba bean straw yield in Egyptian pound. The average of onion and faba bean prices from the Bulletin of Statistical Cost Production and Net Return (2019) were used to compute gross income. The onion yield prices were LE 2039/ Ton; meanwhile faba bean prices were LE 1878 /ardab of seed and LE 154 / Ton of straw.

- Net return / fed = Gross income – Production costs.
- Production costs were LE 10441/ fed for the solid culture of faba bean and LE 12463 /fed for the solid culture of onion.

Each treatment's cost of cultivation was determined in Egyptian pounds (L.E.). Input costs, rental costs, land preparation, seedling planting, irrigation, fertilizers, weeding, harvesting, and other costs are all included in this data.

Statistical analysis

Data were analyzed using analysis of variance (ANOVA) with the Statistical Analysis System MSTAT–C Statistical Packing (Freed 1991). Significant results were defined as those with a probability of less than or equal to 0.05. LSD test was performed according to (Steel and Torrie 1980). The homogeneity test was done according to (Bartlett, 1937). The test was not significant for most of traits under study, so, the two season's data were combined.

RESULTS AND DISCUSSION

I- Onion plants:-

The combined analysis for onion plants showed that all the vegetative growth, yield, yield components and quality criteria were significantly affected with difference in transplanting date. These findings corroborated previous findings by Minackhi *et al.*(2018) ; Tesfaye *et al.* (2018) ; Ojha *et al.* (2019) and Salari, *et al.* (2021). The difference between faba bean densities and the interaction between both factors also were significant except the interaction of No. of leaves/plant character as shown in Tables (2, 3 and 4).

1-Growth and phenological criteria:-

Table (2) shows the impact of onion transplanting dates and faba bean densities on onion plant growth. The highest mean value for plant height, No. of leaves/plant, bulbing ratio, fresh weight and dry weight/plant (80.00 cm, 9.38, 3.89, 168.25 g and 11.77 g, respectively) were increased by transplanting onion on 15th Dec., The mean values of these characters were decreased with delaying of transplanting onion plants.

These results were in harmony with those obtained by Tesfaye *et al.* (2018), Ojha *et al.* (2019) and Khan *et al.* (2020) who revealed that the increase in plant height could mainly be due to early transplanting which might have provided plants with relatively cooler period compared to the latter transplanting, the increase in the vegetative growth because the taller plant height provides more photosynthetic capacity to the plant than shorter height with more number of leaves. Minackhi *et al.* (2018), suggested that plant height is one of the important growth contributing characters for onion, plant height was gradually decreased due to drying of leaf tip.

The effect of different faba bean densities on these characters took the same pattern, as the faba bean density increase the mean value of these characters decrease gradually except plant height (cm) was vice verse. The interaction between both factors confirmed that T1 with D1 was the best treatment in this study at vegetative growth except plant height character, the T1 with D3 was the best one.

Onion solid plants had higher mean value than all treatments under study for all of plant growth characters except plant height. These results parallel to those found by Talukder *et al.* (2015).

Table 2. Effect of transplanting dates of onion and density of faba bean on plant height, No. of leaves/plant, bulbing ratio, fresh weight/plant and dry weight/plant (g) of onion in both seasons 2019/2020 and 2020/2021 and combined between them.

Treatment		Plant height (cm)			No. of leaves / plant			Bulbing ratio			Fresh weight/plant (g)			Dry weight/plant (g)		
		1st	2nd	com	1st	2nd	com	1st	2nd	com	1st	2nd	com	1st	2nd	com
Planting date (A)	15th of Dec.	79.22	80.78	80.00	9.38	9.39	9.38	3.93	3.85	3.89	167.20	169.30	168.25	11.84	11.69	11.77
	30th of Dec.	`68.33	67.89	68.11	8.47	8.91	8.69	3.52	3.53	3.53	154.53	152.53	153.53	9.55	10.10	9.83
	15th of Jan.	60.11	60.56	60.33	7.06	6.99	7.02	2.48	2.48	2.48	111.73	111.46	111.59	6.39	6.81	6.60
L.S.D.		8.81	2.59	4.95	0.74	1.44	0.81	0.27	0.18	0.16	7.72	6.77	5.13	0.89	1.03	0.68
Density (B)	25.0 %	61.22	60.44	60.83	8.83	8.82	8.83	3.71	3.70	3.71	154.04	157.59	155.81	9.70	10.17	9.93
	33.5 %	70.22	71.56	70.89	8.10	8.29	8.19	3.27	3.27	3.27	145.29	142.31	143.80	9.16	9.30	9.23
	42.0 %	76.22	77.22	76.72	7.97	8.18	8.07	2.96	2.88	2.92	134.13	133.38	133.76	8.92	9.14	9.03
L.S.D.		3.40	4.08	2.66	0.71	0.65	0.48	0.24	0.13	0.14	5.39	5.10	3.71	N.S	0.52	0.52
Planting date x Density																
15th of December	25.0 %	67.33	69.67	68.50	9.90	9.50	9.70	4.43	4.44	4.44	179.11	184.38	181.74	12.59	12.30	12.44
	33.5 %	83.00	83.33	83.17	9.03	9.00	9.02	3.84	3.87	3.86	167.51	166.59	167.05	11.69	11.45	11.57
	42.0 %	87.33	89.33	88.33	9.20	9.67	9.43	3.50	3.24	3.37	154.99	156.92	155.95	11.25	11.33	11.29
30th of December	25.0 %	61.00	60.00	60.50	9.00	9.20	9.10	3.85	3.82	3.84	162.59	163.64	163.12	10.10	11.17	10.64
	33.5 %	67.33	68.67	68.00	8.17	9.00	8.58	3.60	3.63	3.62	157.98	152.32	155.15	9.07	9.41	9.24
	42.0 %	76.67	75.00	75.83	8.23	8.53	8.38	3.12	3.13	3.12	143.01	141.64	142.32	9.47	9.74	9.61
15th of January	25.0 %	55.33	51.67	58.50	7.60	7.77	7.68	2.85	2.85	2.85	120.41	124.75	122.58	6.41	7.04	6.73
	33.5 %	60.33	62.67	61.50	7.10	6.87	6.98	2.35	2.31	2.33	110.38	108.04	109.21	6.71	7.04	6.87
	42.0 %	64.67	67.33	66.00	6.47	6.33	6.40	2.25	2.27	2.26	104.39	101.60	102.99	6.04	6.36	6.20
L.S.D.		3.80	N.S	2.97	N.S	N.S	N.S	N.S	0.15	0.16	N.S	N.S	4.15	N.S	0.58	0.58
C.V.		3.43	4.08	3.77	5.93	5.39	5.66	5.15	2.82	4.16	2.60	2.46	2.53	6.79	3.81	5.46
Solid		77.33	84.67	81.00	9.80	9.90	9.85	4.59	4.79	4.69	202.91	206.59	204.75	13.74	14.08	13.91

2-Yield and yield components traits:-

The effect of different transplanting dates of onion and different densities of faba bean on onion yield and its components criteria is presented in (Table 3). T1 (15th December), had the highest mean value for weight of culls yield (ton/fed), marketable bulbs yield (ton/fed), total yield (ton/fed) and average bulb weight (1.833, 17.382, 19.214 T/fed and 97.89 g, respectively). The mean values of these characters were decreased with delaying transplanting of onion plants. These results are in agreement with those found by El-Helaly and Karma (2012), Abou khadrah *et al.* (2017) and Tesfaye *et al.*(2018) who reported that the enhanced of seed production in early transplanting may be due the longest growth period. The reduce in seed yield as a result of late transplanting may be due to flower abortion and poor seed yield per plant.

Therefore, early transplanting times in December are suitable for higher onion bulb yield and plant growth these results found also by Mohamedali and Nouri (1988) and Ibrahim *et al.* (1996) reported that under the conditions of the

Ismailia Governorate, early planting on the first of December is preferred for onion bulb production over planting on the first of October or the middle of January. For greatest yield, it was suggested that onion seedlings be transplanted between 15 and 30 December Khan *et al.* (2020).

Table 3. Effect of transplanting dates of onion and densities of faba bean on Weight of culls yield (ton/fed), Marketable bulbs yield (ton/fed), Total yield (ton/fed) and Average bulb weight (g) of onion in both seasons 2019/2020 and 2020/2021 and combined between them.

Treatment		Weight of culls yield (Ton/Fed)			Marketable bulbs yield (Ton/Fed)			Total yield (Ton/Fed)			Average bulb weight (g)		
		1st	2nd	com	1st	2nd	com	1st	2nd	com	1st	2nd	com
Planting date (A)	15th of Dec.	1.853	1.812	1.833	17.503	17.260	17.382	19.356	19.072	19.215	96.56	99.22	97.89
	30th of Dec.	1.638	1.601	1.619	16.757	16.152	16.455	18.395	17.753	18.077	87.92	90.85	89.38
	15th of Jan.	0.685	0.661	0.673	15.232	15.146	15.189	15.917	15.807	15.862	73.84	74.21	74.02
L.S.D.		0.13	0.19	0.12	0.48	0.30	0.28	0.54	0.33	0.32	2.47	2.34	1.70
Density (B)	25.0 %	1.045	1.032	1.038	17.262	17.140	17.201	18.307	18.172	18.239	92.14	93.90	93.02
	33.5 %	1.433	1.408	1.421	16.388	16.000	16.194	17.821	17.408	17.615	87.26	89.24	88.25
	42.0 %	1.698	1.634	1.666	15.843	15.418	15.630	17.541	17.052	17.296	78.92	81.13	80.02
L.S.D. Planting date x Density		0.22	0.19	0.14	0.46	0.39	0.30	0.54	0.34	0.32	3.50	4.10	2.70
15th of December	25.0 %	1.527	1.490	1.508	18.607	18.490	18.548	20.134	19.980	20.056	105.42	108.75	107.08
	33.5 %	1.773	1.772	1.773	17.193	17.015	17.104	18.966	18.787	18.877	97.17	98.58	97.88
	42.0 %	2.260	2.174	2.217	16.710	16.275	16.492	18.970	18.422	18.709	87.09	90.32	88.70
30th of December	25.0 %	1.057	1.080	1.068	17.633	16.966	17.300	18.690	18.046	18.368	92.50	93.97	93.23
	33.5 %	1.833	1.800	1.817	16.680	15.910	16.295	18.513	17.710	18.112	90.42	94.50	92.46
	42.0 %	2.023	1.923	1.973	15.958	15.580	15.769	17.981	17.503	17.742	80.83	84.08	82.46
15th of January	25.0 %	0.551	0.527	0.539	15.547	15.964	15.755	16.098	16.491	16.294	78.49	78.98	78.74
	33.5 %	0.694	0.653	0.674	15.290	15.073	15.182	15.984	15.706	15.856	74.18	74.65	74.42
	42.0 %	0.812	0.803	0.807	14.860	14.400	14.630	15.672	15.203	15.437	68.83	68.98	68.91
L.S.D.		0.25	0.21	0.16	0.51	N.S	0.34	N.S	0.38	0.36	3.91	4.58	3.01
C.V.		11.14	9.55	10.40	1.93	1.69	1.82	2.10	1.35	1.77	2.84	3.25	3.05
Solid		1.337	1.400	1.369	19.180	19.087	19.134	20.517	20.487	20.503	114.25	113.90	114.08

The effect of different faba bean densities on these characters also revealed that the mean value of these characters decreases gradually as the faba bean density increase except weight of culls yield (T/fed) was vice versa. The interaction between both factors confirmed that T1 with D1 was the best treatment for marketable bulbs yield (T/fed), total yield (T/fed) and average bulb weight (g) (18.548,20.056 and 107.08, respectively) , while weight of culls yield (T/fed), T1 with D3 was the highest one (2.217) as shown in (Table 2).

Onion solid plants had higher mean value than all treatments under study for all of Yield and it`s components traits except weight of culls yield (T/fed), these findings matched those of the previous study. found by Talukder *et al.* (2015).

3- Quality traits:-

The impact of varying onion transplanting dates and faba bean densities. on onion quality showed that T3 (15th January), had the highest mean value for total soluble solid % (T.S.S) and dry matter (13.75 and 14.87, respectively) and this value decrease in the early transplanting dates gradually, while T1 (15th December), had the highest mean value for total lose % at fifth month (11.82) and decreased as the transplanting date of onion delayed as shown in (Table 4). This result was also reported by Mostafa 1998).

Table 4. Effect of transplanting dates of onion and densities of faba bean on total soluble solid % , dry matter and total loss at fifth month % of onion in both seasons 2019/2020 and 2020/2021 and combined between them.

Treatment		T.S.S. %			Dry matter			Total loss at fifth month%		
		1st	2nd	com	1st	2nd	com	1st	2nd	com
Planting date (A)	15th of Dec.	13.77	13.73	13.75	14.89	14.84	14.87	12.32	11.32	11.82
	30th of Dec.	14.18	14.07	14.12	15.07	14.91	14.99	10.86	10.98	10.92
	15th of Jan.	15.27	14.29	14.78	15.89	15.42	15.66	9.11	8.92	9.01
L.S.D.		0.87	N.S	0.70	0.60	1.03	0.60	0.65	0.40	0.38
Density (B)	25.0 %	14.19	13.60	13.89	15.04	14.67	14.86	9.75	9.23	9.49
	33.5 %	13.89	13.69	13.79	14.93	14.76	14.84	10.72	10.71	10.72
	42.0 %	15.13	14.80	14.97	15.87	15.76	15.81	11.81	11.27	11.54
L.S.D. Planting date x Density		0.75	0.84	0.56	0.70	0.80	0.53	0.37	0.64	0.37
15th of December	25.0 %	13.90	13.67	13.78	15.00	14.67	14.83	11.37	10.17	10.78
	33.5 %	13.47	12.93	13.20	14.67	14.27	14.47	12.01	11.33	11.67
	42.0 %	13.93	14.60	14.27	15.00	15.60	15.30	13.57	12.44	13.01
30th of December	25.0 %	12.93	13.07	13.00	13.73	14.07	13.90	9.44	9.67	9.56
	33.5 %	14.20	14.40	14.30	15.33	15.20	15.27	11.07	11.30	11.19
	42.0 %	15.40	14.73	15.07	16.13	15.47	15.80	12.07	11.96	12.02
15th of January	25.0 %	15.73	14.07	14.90	16.40	15.27	15.83	8.44	7.85	8.15
	33.5 %	14.00	13.73	13.87	14.80	14.80	14.80	9.07	9.50	9.29
	42.0 %	16.07	15.07	15.57	16.47	16.20	16.33	9.80	9.41	9.61
L.S.D.		0.84	N.S	0.63	0.78	N.S	0.59	0.42	N.S	0.42
C.V.		3.63	4.17	3.90	3.20	3.68	3.45	2.42	4.29	3.46
Solid		14.27	13.67	13.97	15.20	14.67	14.94	13.04	12.39	12.72

This means that early transplanting of onion plants had a negative effect on quality traits of onion, but it had positive effect on growth, yield and yield components characters, so we can recommend transplanting onion in

middle of December if we want high seed yield, but if we want high quality and storage for long time we must transplanting in the middle of January. D_3 (42.0%) recorded the highest mean value for (T.S.S), dry matter characters and total lose at fifth month % (14.97, 15.81 and 11.54, respectively). T_3 with D_3 had the highest mean value for (T.S.S) and dry matter (15.57 and 16.33, respectively) , while total lose at fifth month % recorded the highest mean value in T_1 with D_3 (13.01). T_3 with D_1 was the best treatment to obtain high quality of onion with high (T.S.S), dry matter (14.90, 15.83) and low total loss at fifth month % (8.15) as shown in (Table 4).

For all quality criteria, onion solid plants had a lower mean value than all other treatments studied; these findings were consistent with those obtained by Talukder *et al.* (2015).

II) Faba bean plants:-

Effect of T_1 (15th December), T_2 (30th December) and T_3 (15th January) transplanting dates of onion and D_1 (25 %), D_2 (33.5 %) and D_3 (42.0%) plant densities of faba bean on yield and its components criteria are shown in Tables 5 and 6. All yield and yield components traits were significant for factors A, B and interaction between them except straw weight (T/fed) trait was significant for factor B only. Also, the interaction for both No. of branches/plant and 100-seed weight (g) traits was non-significant, but the two factors A and B were significant.

All faba bean studied characters except 100-seed weight (g) and straw weight (ton/fed) possessed the highest mean value at T_3 onion transplanting date; while T_1 had the lowest mean value, this mean that delaying transplanting onion give good chance for faba bean plants to grow and increase yield and yield components criteria.

In general, 33.5 % density (D_2) of faba bean possessed higher mean value than 25.0 % density (D_1) for all characters under study. These findings are consistent with those obtained by Gezahegn (2019), who reported that seed yield is restricted by the number of plants at low densities, but it drops at greater densities due to the increase in the number of aborted pods and barren stalks. At the same time, D_2 had the highest mean value for number of branches, pods, seeds, seed yield and seed yield ardab/fed (4.32, 18.22, 56.700, 45.809 g and 2.959 ardab/fed, respectively). D_3 (42.0% density) recorded the lowest mean value (3.48, 15.89, 49.011, 41.082 g, 102.72 g and 2.651 ardab/fed, respectively), because high plant population adversely affects plant growth and development, while suboptimal plant population results in high yield per plant but lower yield per unit area (Singh, *et al.* 1992). This might be due to high plant density led to competitive shading within the leaf canopy architecture (Hiyane, *et al.* 2010) thereby limiting interception of radiation by the middle and lower stem leaves particularly during poding time (Christopher, *et al.* 2009 and Li and Wang 2010) accelerating leaf senescence (Antietta, *et al.* 2014) reducing photosynthesis and net assimilation of individual plants. Increasing plant density enhances intra-plant competition, decreases the growth of single- plant crops (Yan, *et al.* 2010). D_3 possessed the highest mean value for plant height, 100-seed weight and straw weight (ton/fed) (106.09 cm, 84.274 and 2.711, respectively), These findings matched those published by Dahmardeh *et al.* (2010). From the previous data we can concluded that 33.5 % density (D_2) of faba bean was the best one as compared to D_1 and D_3 densities, this is in a accordance with Wendimu (2019), who reported that grain yield increased for all tested faba bean varieties with increasing plant densities up to 250000 plants/ha and then declined for further increase in plant density above it with the highest grain yield. Increasing rivalry between plants for incident light, soil nutrition, and soil water with high plant density causes crop yield components to be reduced after a certain point (Singh and Singh, 2002).

Table 5. Effect of transplanting dates of onion and densities of faba bean on plant height, number of branches/plant, number of pods/plant, number of seeds/plant and seed yield/ plant of faba bean in both seasons 2019/2020 and 2020/2021 and combined between them.

Treatment		Plant height (cm)			Number of branches/plant			Number of pods/plant			Number of seeds/ plant			Seed yield/ plant (g)		
		1st	2nd	com	1st	2nd	com	1st	2nd	com	1st	2nd	com	1st	2nd	com
Planting date (A)	15th of Dec.	99.09	103.20	101.14	3.40	3.22	3.31	15.78	12.00	13.89	47.333	36.000	41.667	37.608	30.209	33.908
	30th of Dec.	101.31	101.33	101.32	4.29	3.93	4.11	16.56	16.00	16.28	51.478	49.711	50.594	44.360	41.570	42.965
	15th of Jan.	106.76	106.53	106.64	4.31	4.61	4.46	22.00	21.89	21.94	68.044	66.711	67.378	54.196	55.784	54.990
L.S.D.		6.20	4.12	3.72	0.72	0.75	0.52	3.22	1.96	1.89	9.76	4.06	5.29	6.63	5.56	4.33
Density (B)	25.0 %	94.90	101.91	98.41	3.98	4.18	4.08	19.89	16.11	18.00	60.167	47.689	53.928	46.352	40.672	43.512
	33.5 %	105.19	104.04	104.62	4.42	4.22	4.32	18.89	17.56	18.22	58.778	54.622	56.700	48.366	45.809	47.087
	42.0 %	107.07	105.11	106.09	3.60	3.37	3.48	15.56	16.22	15.89	47.911	50.111	49.011	41.446	41.082	41.264
L.S.D. Planting date x Density		5.87	N.S	3.99	0.78	0.83	0.57	3.45	N.S	2.21	10.57	7.46	6.47	N.S	N.S	5.62
15th of December	25.0 %	86.83	100.53	93.68	3.53	3.00	3.27	21.33	11.67	16.50	64.000	35.000	49.500	49.973	29.437	39.705
	33.5 %	106.17	98.00	102.08	3.60	4.00	3.80	13.00	12.67	12.83	39.000	38.000	38.500	30.123	31.753	30.938
	42.0 %	104.27	111.07	107.67	3.07	2.67	2.87	13.00	11.67	12.33	39.000	35.000	37.000	32.727	29.437	31.082
30th of December	25.0 %	93.47	102.47	97.97	4.13	4.07	4.10	15.00	14.00	14.50	46.500	43.400	44.950	38.850	36.480	37.665
	33.5 %	105.00	107.20	106.10	4.80	4.20	4.50	19.67	18.67	19.17	62.933	59.733	61.333	52.853	49.850	51.352
	42.0 %	105.47	94.33	99.90	3.93	3.53	3.73	15.00	15.33	15.17	45.000	46.000	45.500	41.377	38.380	39.878
15th of January	25.0 %	104.40	102.73	103.57	4.27	5.47	4.87	23.33	22.67	23.00	70.000	64.667	67.333	50.233	56.100	53.167
	33.5 %	104.40	106.93	105.67	4.87	4.47	4.67	24.00	21.33	22.67	74.400	66.133	70.267	62.120	55.823	58.972
	42.0 %	111.47	109.93	110.70	3.80	3.90	3.85	18.67	21.67	20.17	59.733	69.333	64.533	50.233	55.430	52.832
L.S.D.		6.56	6.04	4.46	N.S	N.S	N.S	3.86	N.S	2.47	11.81	N.S	7.23	9.15	N.S	6.28
C.V.		4.00	3.64	3.82	13.61	14.71	14.16	13.29	11.57	12.55	13.25	10.24	11.99	12.58	12.63	12.61
Solid		96.50	92.77	94.64	5.57	5.73	5.65	25.32	25.85	25.59	76.11	77.65	76.88	67.00	68.53	67.77

The interaction between transplanting dates of onion and densities of faba bean released that 15th January transplanting date of onion (T_3) at 25% density of faba bean (D_1) had the highest mean values for both number of

branches and number of seeds/plant (4.87 and 23.00, respectively). While D_2 at the same transplanting date possessed the highest mean value for number of seeds, seed yield and seed yield (ardab/fed) (70.267, 58.927 g and 3.948). D_3 also had highest mean value for straw weight (ton/fed) (2.859). The greatest mean value for 100-seed weight (g) was recorded in transplanting date of onion (T_2) at D_3 (87.792).

All mean values for interaction between transplanting dates of onion and densities of faba bean were less than solid faba bean except plant height (cm) which ranged from 93.68 cm to 110.70, while solid was 94.64 cm. These results are in harmony to those obtained by Abou-Keriasha *et al.* (2013) and Mahmoud, *et al.* (2018).

Table 6. Effect of transplanting dates of onion and densities of faba bean on 100-seed weight, biological weight/plant, straw weight/ plant and seed yield of faba bean in both seasons 2019/2020 and 2020/2021 and combined between them.

Treatment		100-seed weight (g)			Straw weight (T/Fed)			Seed yield (ardab / fed)		
		1st	2nd	com	1st	2nd	com	1st	2nd	com
Planting date (A)	15th of Dec.	79.738	83.079	81.408	1.914	2.129	2.022	2.321	2.207	2.264
	30th of Dec.	86.541	83.777	85.159	2.129	2.425	2.277	2.527	2.664	2.596
	15th of Jan.	79.983	83.672	81.828	2.114	2.404	2.259	3.663	3.639	3.651
L.S.D.		3.27	N.S	N.S	N.S	N.S	N.S	0.53	0.68	0.43
Density (B)	25.0 %	77.816	84.868	81.342	1.386	1.667	1.526	2.876	2.924	2.900
	33.5 %	81.690	83.868	82.779	2.262	2.380	2.321	3.031	2.888	2.959
	42.0 %	86.757	81.792	84.274	2.509	2.912	2.711	2.604	2.698	2.651
L.S.D.		3.48	N.S	3.33	0.35	0.47	0.29	0.46	N.S	0.28
Planting date x Density										
15th of December	25.0 %	78.083	83.583	80.833	1.660	1.327	1.494	2.947	2.900	2.923
	33.5 %	77.227	83.587	80.407	1.600	2.508	2.054	2.193	1.660	1.927
	42.0 %	83.903	82.067	82.985	2.482	2.553	2.517	1.823	2.060	1.942
30th of December	25.0 %	83.530	84.387	83.958	1.413	1.825	1.619	2.333	2.240	2.287
	33.5 %	83.910	83.543	83.727	2.681	2.233	2.457	2.837	3.170	3.003
	42.0 %	92.183	83.400	87.792	2.293	3.217	2.755	3.410	2.583	2.497
15th of January	25.0 %	71.833	86.633	79.233	1.084	1.848	1.466	3.347	3.633	3.490
	33.5 %	83.933	84.473	84.203	2.505	2.398	2.452	4.063	3.833	3.948
	42.0 %	84.183	79.910	82.047	2.754	2.965	2.859	3.580	3.450	3.515
L.S.D.		3.89	N.S	N.S	0.39	N.S	N.S	0.51	0.36	0.31
C.V.		2.96	4.73	3.96	11.91	14.15	13.24	11.27	7.84	9.71
Solid		88.030	88.255	88.150	8.850	9.126	8.988	10.233	9.830	10.032

III- Competitive Relationships and Yield Advantages:-

(1)Land equivalent ratio (LER):

Data in (Table 7) showed that land equivalent ratio values were greater than one. Here, it could be concluded that actual productivity was higher than the expected productivity. The highest value of LER (1.27) was observed when onion transplanting date15th December intercrop with faba bean density 25.0 % in both seasons. The lowest value 1.10 was observed in transplanting date 15th December intercrop with faba bean density 42.0 % in the first season and 1.09 for both transplanting date 15th December intercrop with faba bean density 33.5 % and onion transplanting date 15th January intercrop faba bean density 42.0 %.

These results could be due to that, intercropping pattern of 100% onion + 25.0% faba bean furnished better environmental conditions for onion plants to grow well during the early growth and development stages compared to the others. In the other words, the lowest plant density of faba bean might be reduced due to inter-specific competition for basic development resources between plants of the intercrops, which reflected favorably on the intercropped onion's economical output. These findings follow the same pattern as the previous researchers Abou-Keriasha *et al.* (2013), Sheha (2016) and Shehata Manal (2017).

(2)Land equivalent coefficient (LEC):

When the values of LEC were increased than 25%, the treatments were positive; this means that all treatments had LEC values above 0.25 suggesting yield advantages and showed efficient utilization of land resource and vice versa. Data in (Table 7) revealed that the best yield advantage as the interaction between factors under study in the first season was shown with onion transplanting date 15th December intercrop with faba bean density 25.0 % (0.28), 30th December intercrop with faba bean density 42.0 % (0.29), 15th January intercrop with faba bean density 25.0, 33.5 and 42.0 % (0.26, 0.31 and 0.27, respectively). In the second season was shown with onion transplanting date 15th December intercrop with faba bean density 25.0 % (0.29), 30th December intercrop with faba bean density 33.5 % (0.28), 15th January intercrop with faba bean density 25.0, 33.5 and 42.0 % (0.30, 0.30 and 0.26, respectively).

(3)Area time equivalent ratio (ATER):

High area time equivalent ratio was obtained when onion transplanting date 15thDecember intercrop with faba bean density 25.0 % (1.11) for both seasons, in the first season was 30th December intercrop with faba bean density 33.5 % and 42.0% (1.03 and 1.06, respectively) and 15th January intercrop with faba bean density 33.5% (1.05). While in the second season was (1.04) for both 30th December intercrop with faba bean density 33.5 % and 15th January intercrop with faba bean density 25.0 % , also with faba bean density 33.5 % in the same transplanting date (1.03). These results suggested that the intercropping strategy was more efficient than solitary cropping of both crops in terms of utilizing growth resources (Table 7).

(4) Relative crowding coefficient (RCC or K):

Data in Table (7) showed that, intercropping pattern of 100% onion + 25.0 % faba bean at onion transplanting date 15th December had the highest RCC, it was only exceeded 8.00 in both seasons, it was (21.27 and 16.49, respectively) compared to the other intercropping patterns. These findings could be explained by the fact that the lowest plant density of faba bean reduced inter or intra-specific

competition for basic growth resources between plants of two species or plants of the same species, respectively, which reflected positively on the economical yield of onion under intercropping system. These results are in similar trends to those obtained by Abou-Keriasha *et al.* (2013) and Shehata Manal , (2017). While, the lowest values (1.74 - 1.56) was observed in transplanting date 15th January intercrop with faba bean density 42.0 % in the both season.

They attributed this result to the increased above and below ground competition in the intercropping system, where late transplanting times in onion on 15th January and the dense faba bean sowing would lead to severe competition among plants for water, light and nutrients, resulting in the production of less vigorous plants. These findings were consistent with those obtained by Singh and Singh (2002), Aboukhadra *et al.* (2013), Abou-Keriasha *et al.* (2013) and Mahmoud, *et al.* (2018).

(5) Aggressivity (Ag):

Aggressivity determines the difference in competitive ability of the component crops in intercropping association. The positive sign indicates the dominant component, and the negative sign indicates the dominated component. Higher numerical values of aggressiveness denote greater difference in competitive ability, as well as bigger difference between actual and expected yield in both crops. For all treatments, the value of Agb of faba bean was positive, meanwhile the values of Aga were negative for intercropped onion (Table 7). Results showed that faba bean was the dominant crop and onion was the dominated.

(6) Monetary advantage index (MAI) fad^{-1}:

The economic assessment should be in terms of the value of land saved; this could probably be most assessed on the basis of the rentable value of this land. It is used as an indicator of the economic feasibility of intercropping systems, results presented in Table (7) indicated that the highest MAI values were obtained from onion transplanting date 15thDecember intercrop with faba bean density 25.0 % in both seasons (10104.32 and 10000.56, respect.). These MAI results were positive since the LER was the highest.

These findings are in line with previous researchers Abou-Keriasha *et al.* (2012); Hamd Alla *et al.* (2014), Sheha (2016), Shehata Manal (2017) and Mahmoud *et al.* (2018), who claimed that the economic benefit of intercropping was reflected in the increased MAI values.

Table 7. Competitive relationships of intercropping onion in different transplanting times with different densities of faba bean in both seasons.

Treatment		LER		LEC		ATER		RCC		Ag				MAI	
										Aga		Agb			
		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
15th of December	25.0 %	1.27	1.27	0.28	0.29	1.11	1.11	21.27	16.49	-1.29	-1.35	1.29	1.35	10104.32	10000.56
	33.5 %	1.14	1.09	0.20	0.15	0.98	0.93	3.34	2.25	-0.74	-0.37	0.74	0.37	5333.01	3399.80
	42.0 %	1.10	1.11	0.16	0.19	0.95	0.96	2.66	2.37	-0.43	-0.72	0.43	0.72	4067.28	4218.57
30th of December	25.0 %	1.14	1.11	0.21	0.20	0.99	0.96	3.02	2.18	-0.87	-0.90	0.87	0.90	5291.81	4131.07
	33.5 %	1.18	1.18	0.25	0.28	1.03	1.04	3.55	3.04	-1.29	-1.72	1.29	1.72	6811.43	6841.38
	42.0 %	1.21	1.12	0.29	0.22	1.06	0.97	3.55	2.09	-1.78	-1.22	1.78	1.22	7711.35	4457.75
15th of January	25.0 %	1.11	1.17	0.26	0.30	0.98	1.04	1.77	2.42	-1.83	-2.17	1.83	2.17	3986.34	6199.24
	33.5 %	1.18	1.16	0.31	0.30	1.05	1.03	2.32	2.10	-2.42	-2.38	2.42	2.38	6257.33	5509.50
	42.0 %	1.11	1.09	0.27	0.26	0.99	0.97	1.74	1.56	-2.05	-2.08	2.05	2.08	4125.34	3345.85

Note, LER: Land equivalent ratio; LEC: Land equivalent coefficient; RCC: Relative crowding coefficient; ATER: Area time equivalent ratio; MAI: Monetary advantage index fad^{-1}; AI: Aggressivity index; Aga: Aggressivity value for onion and Agb : Aggressivity value for faba bean.

(7) Economic evaluations:

The onion price was 2039 LE/ T, meanwhile faba bean prices were 1878 LE/ardab of seeds and 154 LE/ 250 kg of straw. Total income and net return (LE) of all intercropping treatments were found to be superior to solid cultures of onion and Faba bean as shown in (Table 8). The highest net return value was recorded with 15thDecember intercrop with faba bean density 25.0 % +100% onion (34443.65), it also was higher than both onion and faba bean solid plants (29340.58 and 13757.31, respectively). Whereas, the lowest values of total return and net return was in onion transplanting date 15thJanuary intercrop with faba bean density 42.0 % treatment (26017.71).

Table 8. Economic performance of onion-faba bean intercropping system.

Treatment		Onion total yield (Ton/Fed)	Faba bean total yield		Actual yield (L.E)		Total income (L.E)/Fed	Total cost	Net return L.E/Fed
			Seed yield (ardab/fed)	Straw weight (T/Fed)	Onion	Faba bean			
15th of December	25.0 %	20.056	2.923	1.494	40894.18	6409.47	47303.65	12860	34443.65
	33.5 %	18.877	1.927	2.054	38490.20	4884.31	43374.51	12970	30404.51
	42.0 %	18.709	1.942	2.518	38147.65	5197.96	43345.61	13110	30235.61
30th of December	25.0 %	18.368	2.287	1.619	37452.35	5292.19	42744.54	12860	29884.54
	33.5 %	18.112	3.003	2.457	36930.37	7153.13	44083.50	12970	31113.50
	42.0 %	17.742	2.497	2.755	36175.94	6386.40	42562.34	13110	29452.34
15th of January	25.0 %	16.294	3.49	1.466	33223.47	7456.99	40680.46	12860	27820.46
	33.5 %	15.856	3.948	2.452	32330.38	8924.59	41254.97	12970	28284.97
	42.0 %	15.437	3.515	2.859	31476.04	8362.59	39838.63	13110	26728.63
Solid onion		20.503	-	-	41805.62		-	12463	29342.62
Solid faba bean		-	10.03	8.705	24198.31		-	10441	13757.31

The onion yield prices were 2039 LE/ T, meanwhile faba bean prices were 1878 LE/ardab of seeds and 154 LE/ 250 k.g of straw.

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تأثير التحميل المناوب لمواعيد شتل البصل على الفول البلدى تحت كثافات مختلفة

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الملخص

تم اجراء هذا البحث فى محطة البحوث الزراعية بالجميزة خلال الموسمين الشتويين ٢٠١٩/٢٠٢٠ و٢٠٢٠/٢٠٢١ لدراسة استجابة مواعيد شتل البصل المختلفة صنف جيزة ٢٠ (١٥ ديسمبر، ٣٠ ديسمبر، ١٥ يناير) للتحميل المناوب مع كثافات مختلفة من الفول البلدي صنف جيزة ٧١٦ (١٠٠% بصل + ٢٥,٠% فول بلدي، ١٠٠% بصل + ٣٣,٥ % فول بلدي، ١٠٠% بصل + ٤٢,٠ % فول بلدي من الكثافات الموصى بها) وتأثير ذلك على صفات المحصول ومكوناته لكلا المحصولين، وكذلك العلاقات التنافسية ومزايا المحصولين. تم استخدام تجربة القطع المنشقة مرة واحدة في تصميم القطاعات كاملة العشوائية في ثلاث مكررات. أظهرت النتائج أن الشتل المبكر (على سبيل المثال في ٣٠ ديسمبر) له تأثير جيد على النمو الخضري والمحصول ومكوناته للبصل وبينما كان له تأثير سلبى على صفات الجودة لمحصول الأبصال. في حين أن صفات الجودة العالية تم الحصول عليها من الشتل المتأخر (منتصف يناير). من الواضح أن متوسط قيم صفات النمو الخضرى والمحصول ومكوناته للبصل تقل بزيادة كثافة الفول البلدي، ماعدا طول النبات ومحصول النقضة للأبصال. حققت جميع الصفات المدروسة للفول البلدي أعلى قيم للمتوسطات عند الكثافة المتوسطة للفول البلدي (١٠٠% بصل + ٣٣,٥ % فول بلدي) مقارنة بالكثافات (١٠٠% بصل + ٢٥,٠% فول بلدي، ١٠٠% بصل + ٤٢,٠ % فول بلدي) . أوضح التفاعل أن الشتل المتأخر للبصل (١٥ يناير) عند الكثافة المتوسطة للفول البلدي (١٠٠% بصل + ٣٣,٥ % فول بلدي) أعطت أعلى قيم للمتوسطات لصفات عدد البذور , وزن البذور , محصول البذور (أردب/ الفدان) للفول البلدي .نستنتج من ذلك أن الشتل المبكر للبصل (١٥ ديسمبر) في حالة الكثافة المنخفضة من الفول البلدي (٢٥ %) حققت أعلى قيمة خلال الموسمين لكلا من LER و RCC و ATER و MAIوصافى العائد الاقتصادي .