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Effect of organic manure on growth and productivity of Barley (*Hordeum vulgare* L.), Berseem (*Trifolium alexandrinum,* L.) and their mixture under New Valley conditions - Egypt.

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ABSTRACT

Two field experiments were conducted at El-Kharga Experimental Farm of Desert Research Center New Valley Governorate in sandy clay loam soil, during 2011-2012 and 2012-2013 seasons to study the effect of organic manure on productivity and quality of three cuts of sole barley (*Hordeum vulgare,* L.*)* cv., Giza 123**,** berseem (*Trifolium alexandrinum,* L.) cv., Giza 6, and their mixture plants with certain rate to increase forage yield and quality. Three treatments were used which were % of recommended grain rate of sole barely, also recommended seed of sole berseem and mixed by rate 25 % barley + 75 % berseem. All characters were determined in forage at three cuts at 50, 85 and 115 day from sowing with three organic manure with rates 10, 15, and 20m^3/ fad.,. Obtained results was should that increasing organic manure from 10 up to 20 m^3/fad, caused significant increase in the investigated characters such as plant height (cm), No., of tillers- branches/plant, forage yield (fresh and dry weights kg/m^2,), grain, seed yield (kg/fad,), straw yield (kg/fad,), biological yield (kg/fad,), and % protein except % total carbohydrate was significant at 10 m^3 /fad., in both seasons. Results indicated that 1st cut surpassed 2nd and 3rd cuts for grain yield in the two growing seasons. Mixture of forage plants produced the best values in all characters under studied in both seasons expect carbohydrates% and grain yield (kg/fad.,) at sole barley. Sole barley gave the highest grain yield (kg/fad.,), biological yield (kg/fad.,) and total carbohydrates (%) in the 1st cut. Moreover, mixture (25% barley+75%berseem) produced the highest value of straw, biological yields kg/fad., in both seasons. The highest value for parameters were observed under mixture forage plants in the third cut with organic manure at rate 20m^3/fad,. On the other hands, seed yield (kg/fad), biological yield (kg/fad,) and total carbohydrates % were superior in the first cut of sole barley. It could be concluded that, the mixture of forage crops (25% barley+75%berseem) and organic manure at 20 m^3/fad, with three cuts are recommended annually for high forage fresh, dry weights, straw yield and protein% under semi-arid conditions at the New Valley, Egypt.

Key words: Forage crops, cuts, organic manure, mixture, yield and chemical composition.

Introduction

A major limiting factor for livestock production in Egypt is the shortage of quality feed. In order to solve this problem, productivity from both forage crops and livestock should be enhanced; this could be achieved through efficient use of all the available resources. Using organic manure considered one of many ways to reduce the applied quantities of mineral nitrogen fertilizers. In literatures several workers showed the importance of organic manure on increasing cereal grain yield. Application of either chemical nitrogen or organic manure significantly increased grain yield compared with the control (Bassal and Zahran, 2002). Also, 50 m^3 organic manure/h significantly increased plant height, grain and straw yield (Bassal and Zahran, 2002).

Berseem or (Egyptian clover) *(Trifolium alexandrinum* L.) is the most important forage legume crop in Egypt, particularly those having long winter season with cold-moderate temperature. It is grown either in monoculture or together with different grasses such as barley (Al-Khateeb *et al.,* 2001). Despite that the yield and protein content of berseem clover are high; it is characterized by low dry matter content especially in the 1st cut. Thus, mixture berseem clover with forage grasses is a low input technology that has many useful effects on the forage's productivity and nutritive value (El-Karamany *et al.,* 2014).

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Choosing favorable mixtures scores several advantages, *i.e.* yields of mixtures tend to be greater compared with legume or grass alone. Also, legumes supply nitrogen to legume-grass mixtures so it may produce more forage yield than grasses grown alone. The yield of barley in such mixtures may be greater than its yield when grown in pure stands. Barley in legume mixtures also contains a higher percentage of protein. Mixtures of barley and legumes provide a useful model for a better quality diet for animals. The successful mixture needs to be selected from these forage crops that possess compatible maturity and harvesting schemes, complement each other in growth distribution and ecological niche, and do not, severely, compete with each other for growth and life requirements (Al-Khateeb *et al.,* 2001). Thus, berseem clover and barley may have a potential as annual mixtures under the Egyptian conditions. However, in order to have a balanced nutritional diet for animal, optimum mixing rate should be used, (El-Karamany *et al.,* 2009; Ross *et al.,* 2004a), clear that increasing clover stand in mixture of (legume-cereal) clover and barley or oat increased forage yield and quality. (Blaser *et al*., 2007), concluded that addition of a red clover (*Trifolium pretense* L.) intercrop to winter cereal grains can supply forage and provide N to subsequent crops. (El karamany *et al*., 2009), reported superiority of first cut at 60 DAS in forage yield, superiority of clover in forage yield and protein% followed by mixture of 75% clover+25% triticale but sole barley recorded the best DM% and carbohydrates% followed by 25% clover + 75% barley. Mixture forage legumes with cold – season grasses are a very common practice. In Mediterranean countries such as Egypt, mixture of cereals especially barley, with Egyptian clover has been a common cropping system in the winter season due to increased productivity and sustainability. In addition, this agronomic practice has increased the dry matter content and decreased the moisture content of the plants in the first cut (Bassal and Zahran, 2002).

The objective of this study was to investigate the effect of organic manure on productivity of three cuts of sole barely, sole berseem and their mixture under New Valley conditions to produce high yielding fresh forage that high in dry matter, highly nutritious, and palatable for animals and the mixture produces an excellent fresh and balanced diet for animal.

Materials and Methods

Two field experiments were carried out in the Agricultural Experimental Farm of Desert Research Center (DRC), at EL-Kharga Oasis, New Valley Governorate Experimental sites geographical coordinate is between longitudes 28º 48 and 29 º 21 and 25 º 44 N) and about 1000 meters above sea level. The research lied was located in a semiarid region where the summer is hot and dry while the winter is cool, during two successive winter growing seasons of 2011/ 2012 and 2012/ 2013 to study the effect of organic manure on productivity of three cuts of sole barely, sole berseem and their mixture under New Valley conditions. Soil samples collected before cultivation and analyzed for physical and chemical properties analysis whereas, Soil pH of experimental site was found to be vary from 9.14 to 9.05 while EC 636 to 627 ppm, Organic Matter 0.50 to 0.57 %, Available Nitrogen 61 to 64 ppm, Available Phosphorus 0.52 to 0.55 ppm, Available Potassium 33 to 36 ppm and Available Sulphur 2.27 to 3.11 in the first and second seasons respectively. Soil samples analyzed was found to be of sandy clay loam texture.

The experimental design was spilt-spilt plot design with six replicates: the main plot were allocated to forage crops with sole barley (*Hordeum vulgare,* L.*)* cv., Giza 123, at rate 50 kg/ fad, berseem (*Trifolium alexandrinum,* L.) cv., Giza 6, at rate 25kg/ fed, and mixture plants (75% berseem +25 barley) with rate 18.75kg berseem + 12.5 kg barley/ fad, the seeds of barley and berseem were mixed at the previous rate and planted by broadcasting on the surface, seed were used which obtained from the Agriculture Research Center ,Ministry of Agriculture ,Giza, Egypt, While three cuts were distributed in sub-plot which were taken in each season after 50, 85 and 115 day from sowing and three levels of organic manure (as a farm manure) by rate 10 ,15 and 20 m^3 /fad, occupied in sub-sub plot as ground application during the preparing of sowing. Analysis of used farm manure was as followed: pH was 7.23, 7.39 , C/N ratio was 9.7 and 9.5, total elements were, N % was 1.99 and 1.76, Ca % 0.82 and 0.89, Mg was 0.53 and 0.49, Fe was 953 and 931 ppm, Zn was 147 and 159 ppm, Cu was 41 and 35 ppm and Mn 233 and 239 ppm, P_2O_5 % was 1.92 and 1.63, K_2O % was 1.38 and 1.42, in 2011/ 2012 and 2012/ 2013 growing seasons respectively. The plot area was 10.5 m^2 (3.5 m length

×3 m width). Sowing dates were planted at the first week of November in the two growing seasons. The irrigation system used was developed surface irrigation. All recommended common agricultural practices i.e. irrigation, fertilization were adopted throughout the two experimental seasons till harvest for the whole experiment. The preceding summer crop was sunflower in both seasons. First irrigation was applied at 13 days after sowing and then plants were irrigated every 8 days till the cutting then irrigation and mineralization shall be carried out immediately after cutting.

All plots were hand–harvested at a cutting height of approximately 10 cm. i.e., 50 days (1st cut), 85 days (2nd cut) and 115 days (3rd cut) from sowing, the growth periods of sole barley plants were 155 and 160, sole berseem plants were 165,160 and mixture were 170, 165 days after sowing in 2011/2012 and 2012/2013 growing seasons, respectively. The remaining time of the crop after the third cut to produce the yield were (40 and 45), (50 and 55), (55 and 60) for barley, berseem and mixture in both seasons respectively. Six replicates which three of them were used for growth determinations and the other three were used for yield and its component, as well as chemical composition at growth for mixture plants and seed-grains after harvest. All growth parameters it was estimated from middle area of (1×1) m^2/kg to determine the following characters: (growth characters): plant height (cm), fresh forage weight (kg)/m^2, dry weight (kg)/m^2, after 50, 85 and 115 days after sowing. While dry forage yield /fad: It was calculated by multiplying the fresh forage weight by dry matter percentage. After harvest determined grain-seed yield (kg/fad,) straw, biological yields (kg/fad)/ m^2, protein percentage and total carbohydrates (%). Plant samples (300 g) were taken from each cut and then oven dried at 60 ºc until constant weight, followed by fine grinding to estimate the Protein percentage, which determined using Macro-Kjeldahl technique for estimating nitrogen content and the crude protein was calculated by multiplying the factor 6.25 by the nitrogen content for barley while the berseem was calculated by multiply by 5.75 as described by (Peach and Tracey, 1956). The recommended collected practices such as for tillage for growing crops plots were applied. Total available carbohydrates were extracted according to (Smith *et al.,* 1964) and estimated calorimetrically by phenol-sulphuric acid method as described by (Montogomery, 1961). Analysis of variance for data was determined according to (Gomez and Gomez, 1984). Mean comparison was done using LSD at 5%.

Results and Discussion

1- Growth, yield and chemical composition

1.1. Effect of forage crops:-

Available results in Tables (1, 2 and 3) explained that the main effect of each forage crops, cut number and organic manure had marked impact on growth, yield characters and chemical composition. Planting forage crops as a mixture led to significantly increased all growth characters studied i.e. plant height (cm), No., of tillers- branches/plant, forage yield (fresh and dry weights kg/m^2,), seed yield (kg/fad,), straw yield (kg/fad,), biological yield (kg/fad,), and % protein compared to sole planting (Table 1) in both seasons except grain yield and % total carbohydrate were significantly effective on sole barely in the two growing seasons. Similar results were reported by (Ghaffarzadeh, 1997; Holland and Brummer, 1999; Juskiw *et al.*, 2000a,b and Ross *et al,.* 2004a), they reported the benefits of mixture berseem clover with cereal crops, increased total dry matter yields, improved forage quality. Moreover, in the same concern Morris and (Chaichi *et al.*, 2007; Helmy, *et al.,* 2011 and Abdel Magid *et al.*, 1991), concluded that mixing crops system is an important role in profitability and sustainability in crop production Such effect might be due to the more efficient use of the surround environmental condition such as more occupation of deeper layers of the soil by the different root systems of berseem as well as the foundation of more canopy cover in the space as a result of the different vegetation types of both alfalfa and clover. This in turn will result in more efficient absorption of nutrients from the soil, more interception of light energy at different layers and finally more photosynthetic rate, better translocation of photosynthesis from source to sink. This is causally the favorably influenced the higher dry matter accumulation, the cultivation of pure berseem gave the lowest quantities compared to mixture. (Degirmenci, and Avcioglu, 2011; Deveci

et al., 2009; Karadag, 2004 and El-karamany *et al*., 2009), pointed that barley is potentially promising crop component in the some legume-cereal mixtures for forage and hay production during winter period under rain fed condition. while sole berseem produced the highest value of protein percentage (18.45 and 5.80) as increasing percentage compared with mixture in both seasons respectively, similar results were obtained by (Younis *et al.,* 1986), studied the performance of mixing barley with berseem, found that The protein percentage of the pure stand legumes was much higher than the mixtures. Similar results were obtained by (Kandill, *et al*., 2005; Kandil *et al*., 2004; Silbir *et al.,* 2000; Kuusela *et al.*, 2004; Yolcu et al., 2011 and Blaser *et al.*, 2007).

1.2. Effect of cuts:-

Data in (Table 2), illustrated that all Cuts of forage crops characters i.e., plant height (cm), No., of tillers- branches/plant, forage yield (fresh and dry weights kg/m^2,), seed yield (kg/fad,), straw yield (kg/fad,), biological yield (kg/fad,), % protein compared and carbohydrates % increased significantly in the 2nd cut in the first season and 3rd cut in second season. On the other hand, the first cut gave the lowest value of all growth parameter in both seasons except fresh forage weight obtained by first cut in the second season while no significantly differences in fresh forage weight parameter between second and third cuts in the second season. The lowest value of all characters studied parameters were in the 1st cut. Support me in that, (Shoaib *et al.,* 2013), studied that berseem + grass mixtures and mixtures tested were berseem + barley, Mixtures significantly out yielded pure berseem in the first cut. In second and third cut, solo berseem out yielded all mixtures in both years, may be due to, the slow rate of leaf area development before the first cut. However, total seasonal DM production from Choice of cereal-clover mixture exceeds both cereal and legume monocultures due to cereal contribution in Cut-1 and subsequent multiple cutting of clover (Andrzejewska *et al*., 2014), reported that cereals dominate early season DM while clover provides the production stability in mixture. Similar results were obtained by (Ross *et al.,* 2004a). There is a negative relationship between 1st cut of cereal herbage DM yield and re-growth clover herbage DM yield. (Ross et al., 2004a,b and Kandil et al., 2005), showed that, Maximum combined protein yield (kg/ha), crude fibre (kg/ha) ash (kg/ha), and ether expect (kg/ha) for blades and stems were 502.23 (2nd cut), 712.52 (3rd cut), 560.5 (2nd cut) and 71-176 (4th cut) respectively. (Kandil et al., 2004), investigated that seed rates and cutting schedules on cv. Meskawi. Cutting schedules were 30, 40, and 50 cm height, cutting intervals were fixed at 25, 35, 45 and55 days. In both years the first cut was 60 days from sowing. 50 cm height cut provided maximum fresh forage yield of 27.08 t/ha in first year while in second year maximum yield of 25.53 t/ha was achieved in 3rd cut under 50 days cutting. Fresh forage yield of 28.35 t/ha was obtained under 45 days interval in first year while in second year it was 26.43. (Ross *et al.,* 2004b), clears that increasing clover stand in mixture of (legume-cereal) clover and triticale or barley or oat increased forage yield and quality. (El karamany *et al.,* 2009 and El karamany *et al.,* 2014), reported superiority of first cut at 60 DAS in forage yield, superiority of clover in forage yield and protein percentage followed by mixture of 75% clover + 25% triticale but sole barley recorded the best DM% and total carbohydrates % followed by 25% clover + 75% barley, also, pointed that seeding rate mixture of 80% Egyptian clover + 20% triticale produced mixture identify 79% forage yield, 99% protein,73% DM and 65% total carbohydrates (%) from best treatment in each character so, they recommended it to be promise mixture.

1.3. Effect of organic manure:

Data in Table (3) showed that increasing organic manure from 10 up to 20 m^3 / fad., increased significantly all studied parameters i.e., plant height (cm), No., of tillers- branches/plant, forage yield (fresh weights kg/m^2,), seed yield (kg/fad,), straw yield (kg/fad,), biological yield (kg/fad,), and % protein except total carbohydrates % was increase significantly under 10 m^3 in both seasons. This may be due to organic manure has been a rather common conventional practice it is well documented that the incorporation of organic manure into soils increases soil fertility and improves crop yield and quality Muir, (2002). Similar results were obtained by (Malhi *et al.,* 2002; Newton *et al*., 2003; Van *et al.,* 2005; El-Karamany *et al.,* 2014; Lynch and Warman, 2004 and Al-Khateeb, 2004).

Table 1: Effect of forage crops on growth, yield characters and chemical composition in the first and second seasons.

Characters / Forage crops	Plant height (cm)	No. of Tillers-branches / plants	Forage yield (Kg/fad.,)		Grain, seed yields (kg/fad.)	Straw yield (kg/fad.)	Biological yield (kg/fad.)	Protein (%)	Total carbohydrate (%)
			Fresh weight	Dry weight					
2011/2012 season									
Sole barley	47.96	5.70	1245.18	201.92	319.44	455.14	774.58	7.45	22.35
Sole berseem	51.48	5.01	1677.77	338.59	312.23	463.63	775.86	15.53	15.57
Mixture	61.03	8.61	2102.22	407.11	266.15	646.74	912.89	13.11	20.80
LSD at 5%	5.41	0.35	63.15	22.03	31.4	29.20	32.61	0.92	0.81
2012/2013 season									
Sole barley	41.96	4.92	1139.59	271.85	306.24	410.51	716.75	7.46	22.19
Sole	53.77	5.25	1641.70	336.65	301.53	488.18	789.71	15.50	16.40
Mixture	58.81	8.66	1919.59	518.14	250.30	706.44	956.74	14.65	20.15
LSD at 5%	4.02	0.24	58.61	19.33	29.35	28.37	33.55	0.88	0.69

Table 2: Effect of cut number on growth, yield characters and chemical composition in the two growing seasons.

Characters / Cuts	Plant height (cm)	No. of Tillers-branches / plants	Forage yield (Kg/fad.,)		Grain, seed yields (kg/fad.)	Straw yield (kg/fad.)	Biological yield (kg/fad.)	Protein (%)	Total carbohydrate (%)
			Fresh weight	Dry weight					
2011/ 2012 season									
1st cut	51.03	3.85	1594.81	276.59	306.66	475.74	782.40	11.54	19.93
2nd cut	54.25	8.81	1823.40	325.63	291.44	554.53	845.97	11.64	20.13
3rd cut	55.18	6.70	1606.96	345.40	299.66	535.18	834.84	12.94	18.66
LSD at 5%	1.95	0.53	42.43	17.23	21.92	21.55	35.62	0.41	0.22
2012/2013 season									
1st cut	49.37	3.32	1635.25	346.29	294.35	542.96	837.31	12.03	19.43
2nd cut	51.37	7.71	1519.01	389.81	281.38	498.11	779.49	12.51	19.73
3rd cut	53.81	7.74	1546.63	390.55	283.67	564.07	847.74	13.07	19.58
LSD at 5%	1.22	0.51	41.53	19.32	22.92	19.33	36.16	0.39	0.27

Table 3: Effect of organic manure on growth, yield characters and chemical composition in 2011/2012 and 2012/2013 under New Valley conditions

Characters / Organic manure	Plant height (cm)	No. of Tillers-branches / plants	Forage yield (Kg/fad.,)		Grain, seed yields (kg/fad.)	Straw yield (kg/fad.)	Biological yield (kg/fad.)	Protein (%)	Total carbohydrate (%)
			Fresh weight	Dry weight					
2011/ 2012 season									
10 m^3	48.62	5.14	1623.14	298.55	271.33	498.33	769.66	11.61	19.83
15 m^3	54.44	6.66	1652.11	317.96	296.41	522.92	819.33	11.68	19.81
20 m^3	57.40	7.55	1749.92	331.11	330.12	544.25	874.37	12.83	19.08
LSD at 5%	1.33	0.62	33.20	15.74	17.22	21.33	32.53	0.22	0.12
2012/2013 season									
10 m^3	46.48	5.29	1556.44	362.03	260.92	488.77	749.69	12.40	19.59
15 m^3	52.25	6.27	1538.07	390.55	284.61	538.07	822.68	12.55	19.53
20 m^3	55.81	7.25	1606.37	374.07	313.68	568.18	881.86	12.66	19.51
LSD at 5%	1.21	0.54	29.18	13.92	16.55	21.06	29.73	0.34	0.21

2. Effect of interactions:-

First order interactions, i.e. forage crops and cuts; forage crops and organic manure, cuts and organic manure are presented in Tables 4, 5 and 6 as well as the second order interaction, i.e. forage crops, cuts and organic manure in Table (7a and 7b).

2.1- Interaction between forage crops and cuts:

Data demonetized in (Table 4), shows the effect of the interaction between forage crops and cuts under New Valley conditions on some growth, yield characters and chemical composition during 2011/ 2012 and 2012/ 2013 seasons had a significant effect on plant height (cm), No., of tillers-branches/plant, forage yield (fresh and dry weights kg/m^2,), seed yield (kg/fad,), straw yield (kg/fad,), biological yield (kg/fad,) and % protein in both seasons except total carbohydrates % was superior in first cut with sole barely. The maximum increments for all parameters were obtained by mixture of forage crops with third cut in both seasons except No. branches-tillers/plant and fresh forage weight in the first seasons. Cereals yield more than clover monocultures and cereal-clover binary mixtures prior to first cut (Contreras -Govea and Albrecht, 2005; Ross *et al.,* 2004a; Shoaib *et al.,* 2013 and Andrzejewska *et al.,* 2014). Yet some researchers found that mixtures yields equal or greater DM yield than component sole corps (Vasilakoglou and Dhima, 2008 and Salama, 2015).

Table 4: Effect of the interaction between forage crops and cuts on growth, yield characters and chemical composition in (2011/2012 and 2012/2013) seasons.

Characters / Forage crops		Plant height (cm)	No. of Tillers-branches / plants	Forage yield (Kg/fad.,)		Grain, seed yields (kg/fad.)	Straw yield (kg/fad.)	Biological yield (kg/fad.)	Protein (%)	Total carbohydrate (%)
				Fresh weight	Dry weight					
2011/2012 season										
Sole barley	1st cut	54.22	3.66	1434.55	232.22	636.33	743.11	1379.44	6.37	23.10
	2nd cut	51.66	8.01	1382.22	194.44	241.01	427.11	668.12	6.45	23.24
	3rd cut	38.00	5.44	918.77	179.11	44.02	195.22	239.24	9.51	20.70
Sole berseem	1st cut	40.88	1.81	1354.44	240.88	155.18	280.05	435.23	15.49	15.38
	2nd cut	50.61	6.55	1776.66	353.81	333.12	487.22	820.34	15.48	15.56
	3rd cut	62.82	6.65	1902.22	421.01	448.09	623.66	1071.75	15.74	15.76
mixture	1st cut	58.10	6.01	1995.41	356.61	91.66	404.11	495.77	12.75	21.30
	2nd cut	60.41	11.81	2311.31	428.55	300.31	749.43	1049.74	13.00	21.58
	3rd cut	64.61	8.11	1999.88	436.11	406.31	786.62	1192.93	13.57	19.52
LSD at (5%)		0.41	0.32	12.37	10.08	6.44	9.72	12.34	0.20	0.18
2012/2013 season										
Sole barley	1st cut	48.33	3.11	1413.44	318.88	619.38	705.44	1324.82	7.20	22.35
	2nd cut	43.33	7.01	1271.41	281.11	247.65	341.66	589.31	7.48	22.14
	3rd cut	34.22	4.66	733.88	215.55	53.86	184.44	238.30	7.70	22.08
Sole berseem	1st cut	44.22	1.88	1610.11	250.01	161.52	400.03	561.55	15.38	16.15
	2nd cut	53.22	6.77	1606.77	358.33	314.49	447.33	761.82	15.50	16.38
	3rd cut	63.88	7.11	1708.22	401.66	428.57	617.22	1045.79	15.62	16.68
mixture	1st cut	55.51	5.01	1882.22	470.05	100.54	523.44	623.98	13.51	20.09
	2nd cut	57.55	9.51	1678.77	530.05	281.68	705.33	987.01	14.56	20.68
	3rd cut	63.31	11.41	2197.77	554.43	369.43	890.56	1359.99	.15.89	19.68
LSD at 5%		0.33	0.22	13.22	11.33	7.42	10.35	13.24	0.21	0.20

2.2. Interactions between forage crops and organic manure:

It was clear from data in (Table 5), reported that the effect of the interaction between forage crops and organic manure had a significant effect on growth and yield characters i.e. plant height (cm), No., of tillers- branches/plant, forage yield (fresh and dry weights kg/m^2,), seed yield (kg/fad,), straw yield (kg/fad,), and biological yield (kg/fad,) increased significantly by the mixture crops with 20 m^3 /fad., in both seasons except chemical composition % protein and total carbohydrates % increased with sole plant. This may be due to organic manure significantly increase to plant height, no. of branches-tillers/ plant, fresh, dry forage weights in both seasons. Grain–seed yield and total carbohydrates (%) were increased significantly by pure barley with 20 m^3 in both seasons.

2.3. Interactions between cuts and organic manure:

Data manifested in (Table 6), showed that 3rd cut with 20 m^3 of organic manure resulted was superior on plant height (cm), No., of tillers- branches/plant, forage yield (fresh and dry weights

kg/m^2), straw yield (kg/fad,), biological yield (kg/fad,) and % protein in both seasons except total carbohydrates % and seed yield (kg/fad), were in 1st cut in both seasons compared with other treatments in both seasons.

Table 5: Effect of the interaction between forage crops and organic manure on growth, yield characters and chemical composition in the two growing seasons.

Characters / Forage crops		Plant height (cm)	No. of Tillers-branches / plants	Forage yield (Kg/fad.,)		Grain, seed yields (kg/fad.)	Straw yield (kg/fad.)	Biological yield (kg/fad.)	Protein (%)	Total carbohydrate (%)
				Fresh weight	Dry weight					
2011 /2012 season										
Sole barley	10 m^3	43.55	4.66	1152.22	187.44	300.66	431.11	731.77	6.41	20.60
	15 m^3	48.01	6.01	1242.33	200.55	315.01	457.66	772.67	6.47	23.02
	20 m^3	52.31	6.44	1341.00	217.77	342.23	476.66	818.89	9.46	23.32
Sole berseem	10 m^3	46.10	3.71	1667.77	324.88	278.15	447.22	725.37	15.50	15.55
	15 m^3	52.01	5.21	1652.22	337.77	309.33	465.01	774.34	15.58	15.52
	20 m^3	56.31	6.01	1713.33	353.11	349.01	478.66	827.67	15.63	15.63
mixture	10 m^3	56.21	7.01	2049.41	383.33	235.33	616.66	851.99	12.92	20.71
	15 m^3	63.31	8.71	2061.77	415.55	265.01	646.11	911.12	13.01	20.68
	20 m^3	63.51	1021	2195.44	422.44	298.31	677.44	975.75	13.40	21.03
LSD at 5%		0.31	0.42	11.12	10.32	6.34	9.53	11.81	0.41	0.30
2012/2013 season										
Sole barley	10 m^3	37.44	4.11	1051.22	276.11	285.65	375.55	661.2	7.40	22.15
	15 m^3	41.66	5.12	1135.88	320.05	298.15	411.10	709.25	7.48	22.19
	20 m^3	46.77	5.55	1231.66	219.44	336.35	444.81	781.16	7.50	22.23
Sole berseem	10 m^3	48.66	4.02	1622.55	316.56	272.53	462.45	734.98	15.46	16.32
	15 m^3	54.66	5.54	1609.55	328.33	299.35	506.55	805.9	15.43	16.40
	20 m^3	58.02	6.22	1693.05	365.09	331.26	495.55	826.81	15.56	16.49
mixture	10 m^3	53.33	7.77	1995.55	493.32	224.32	658.61	882.93	14.35	20.25
	15 m^3	60.41	8.22	1868.77	523.33	253.53	696.56	950.09	14.70	20.17
	20 m^3	62.61	10.05	2194.44	537.77	273.92	761.11	1035.03	14.91	20.04
LSD at 5%		0.28	0.41	9.23	8.55	5.91	7.13	8.31	0.21	0.13

Table 6: Effect of the interaction between cuts and organic manure on growth , yield characters and chemical composition during 2011 /2012 and 2012 /2013 under New Valley conditions.

Characters / Cuts / organic		Plant height (cm)	No. of Tillers-branches / plants	Forage yield (Kg/fad.,)		Grain, seed yields (kg/fad.)	Straw yield (kg/fad.)	Biological yield (kg/fad.)	Protein (%)	Total carbohydrate (%)
				Fresh weight	Dry weight					
2011 /2012 season										
1st cut	10 m^3	45.51	2.88	1558.33	254.44	275.01	463.88	738.89	11.51	19.81
	15 m^3	52.21	4.01	1581.77	281.66	302.51	477.66	780.17	11.52	19.84
	20 m^3	55.32	4.65	1644.33	293.66	342.24	485.66	827.90	11.58	20.90
2nd cut	10 m^3	48.71	7.33	1686.55	308.33	271.81	522.77	794.58	11.57	20.11
	15 m^3	55.51	8.81	1850.88	325.55	288.51	553.33	841.84	11.66	20.12
	20 m^3	58.41	10.22	1932.77	343.01	314.51	587.66	902.17	11.70	20.15
3rd cut	10 m^3	51.52	5.21	1624.55	323.88	267.82	508.33	776.15	11.73	19.52
	15 m^3	55.51	7.11	1523.66	346.66	298.51	537.75	836.26	11.87	19.47
	20 m^3	58.42	7.77	1672.66	356.66	333.53	559.41	892.94	11.89	17.05
LSD at 5%		0.17	0.78	7.11	7.39	6.91	6.13	6.49	0.21	0.13
2012 /2013 season										
1st cut	10 m^3	43.55	2.77	1521.88	328.33	264.51	520.11	784.62	11.87	19.38
	15 m^3	51.11	3.33	1645.77	363.33	291.35	540.08	831.43	12.07	19.41
	20 m^3	53.44	3.88	1738.11	347.22	325.53	568.77	894.30	12.15	19.47
2nd cut	10 m^3	46.11	6.61	1622.21	363.33	260.42	457.11	717.53	12.32	19.76
	15 m^3	52.33	7.71	1432.05	396.52	283.32	508.66	791.98	12.50	19.70
	20 m^3	55.66	8.82	1502.77	400.24	309.32	528.55	837.87	12.72	19.73
3rd cut	10 m^3	49.77	6.44	1525.22	364.44	258.36	519.42	777.78	13.02	19.58
	15 m^3	53.31	7.71	1536.44	398.88	276.14	565.55	841.69	13.09	19.61
	20 m^3	58.31	9.05	1578.22	408.33	306.26	607.22	913.48	13.10	19.55
LSD at 5%		0.15	0.52	6.15	8.25	7.42	8.17	5.91	0.24	0.17

2.4. Interactions among forage crops, cuts and organic manure:

Data in Table (7a and 7b), show the effect of the interaction among forage crops, organic manure on three cuts of forage yield was highest growth, yield characters and chemical composition in 2011/2012 and 2012/2013. It is obvious in the second season, that mixture plants in the third cut with 20m^3/fad, organic in all parameters studied i.e. plant height (cm), No., of tillers-branches/plant, forage yield (fresh and dry weights kg/m^2), straw yield (kg/fad,), and % protein in both seasons except seed yield (kg/fad), biological yield (kg/fad,) and total carbohydrates % were superior in the first cut of sole barley, whereas, in the first season, sole barley in first cut recorded the highest values of grain-seed, straw and biological yields with fertilized under 20 m^3. On the other hand, the highest total carbohydrates % was obtained by third cut with the same plant and organic manure, in both seasons.

Table 7 a: Effect of the interaction among forage crops, cuts and organic manure on growth , yield characters and chemical composition in 2011 -2012 season under New Valley conditions.

Forage crops / Characters / Cuts, organic			Plant height (cm)	No. of Tillers-branches / plants	Forage yield (Kg/fad.,)		Grain, seed yields (kg/fad.)	Straw yield (kg/fad.)	Biological yield (kg/fad.)	Protein (%)	Total carbohydrate (%)
					Fresh weight	Dry weight					
Sole barley	1st cut	10 m^3	47.01	3.00	1360.01	261.66	631.65	733.32	1364.97	6.34	23.09
		15 m^3	56.01	4.01	1420.33	230.02	665.53	743.01	1408.54	6.38	23.07
		20 m^3	59.61	4.01	1523.33	250.03	724.85	753.01	1477.86	6.41	23.14
	2nd cut	10 m^3	49.01	6.61	1246.66	186.66	234.82	380.09	614.91	6.42	23.19
		15 m^3	50.61	8.31	1373.33	185.03	237.24	425.02	662.26	6.46	23.21
		20 m^3	55.32	9.01	1526.66	211.66	252.38	476.33	728.71	6.47	23.32
	3rd cut	10 m^3	34.62	4.33	850.00	159.04	37.53	180.19	217.72	6.46	23.33
		15 m^3	37.31	5.66	933.31	186.66	43.61	205.03	248.64	6.56	23.32
		20 m^3	42.01	6.33	973.01	191.66	52.64	200.66	253.3	6.61	23.39
Sole berseem	1st cut	10 m^3	36.02	1.31	1333.33	226.66	114.43	271.66	386.09	15.51	15.39
		15 m^3	40.31	1.67	1343.33	238.33	152.82	281.63	434.45	15.50	15.37
		20 m^3	46.35	2.67	1386.66	257.66	119.67	286.66	406.33	15.48	15.38
	2nd cut	10 m^3	43.36	5.33	1773.33	328.33	319.27	466.66	785.93	15.50	15.56
		15 m^3	54.01	6.66	1733.33	360.01	325.67	488.31	813.98	15.35	15.55
		20 m^3	54.69	7.66	1823.33	373.33	355.67	506.66	862.33	15.59	15.57
	3rd cut	10 m^3	59.03	4.63	1896.66	419.66	401.82	603.33	1005.15	15.54	15.70
		15 m^3	61.66	7.33	1880.01	415.00	451.67	625.01	1076.68	15.65	15.64
		20 m^3	68.03	7.66	1930.00	428.33	494.83	642.66	1137.49	15.72	15.95
mixture	1st cut	10 m^3	53.62	4.33	1981.61	320.01	82.51	386.66	469.17	15.84	21.06
		15 m^3	60.35	6.33	1981.66	376.66	90.14	408.33	498.47	12.71	21.08
		20 m^3	60.01	7.33	2023.00	373.33	103.92	417.33	521.25	12.70	21.75
	2nd cut	10 m^3	54.05	10.01	2039.66	410.06	260.57	721.63	982.20	12.85	21.59
		15 m^3	62.04	11.66	2446.00	431.66	304.26	746.65	1050.91	12.95	21.58
		20 m^3	65.31	14.01	2448.33	444.12	337.82	780.06	1117.88	12.98	21.57
	3rd cut	10 m^3	61.01	6.66	2127.00	420.01	364.26	741.66	1105.92	13.09	19.48
		15 m^3	67.62	8.33	1757.66	438.33	401.67	783.36	1185.03	13.33	19.38
		20 m^3	65.31	9.33	2115.01	450.00	454.61	835.05	1289.66	14.30	19.70
L.S.D at 5%			0.05	0.26	2.37	2.46	2.29	2.01	2.15	0.08	0.05

Table 7 b: Effect of the interaction among forage crops, cuts and organic manure on growth , yield characters and chemical composition in 2012 -2013 season under New Valley conditions.

Forage crops / characters	Cuts , organic		Plant height (cm)	No. of Tillers-branches / plants	Forage yield (Kg/fad.,)		Grain, seed yields (kg/fad.)	Straw yield (kg/fad.)	Biological yield (kg/fad.)	Protein (%)	Total carbohydrate (%)
					Fresh weight	Dry weight					
Sole barley	1st cut	10 m^3	41.66	2.66	1240.08	325.08	573.25	680.07	1253.32	7.15	22.03
		15 m^3	51.01	3.35	1450.05	380.05	619.34	700.05	1319.39	7.19	22.07
		20 m^3	52.31	3.31	1550.33	251.66	667.53	736.31	1403.84	7.27	22.07
	2nd cut	10 m^3	40.66	6.01	1140.01	320.01	238.12	300.05	538.17	7.41	22.11
		15 m^3	41.62	7.02	1251.05	353.33	227.61	350.05	577.66	7.48	22.13
		20 m^3	47.63	8.04	1423.33	170.05	277.23	375.23	652.46	7.55	22.18
	3rd cut	10 m^3	30.01	3.66	773.66	183.33	46.32	140.62	186.94	7.64	22.33
		15 m^3	32.31	5.03	706.66	226.66	50.12	183.35	233.47	7.78	22.38
		20 m^3	40.31	5.33	721.33	236.66	64.42	223.32	287.74	7.69	22.44
Sole berseem	1st cut	10 m^3	38.66	1.33	1539.07	210.05	126.42	380.05	506.47	15.35	16.06
		15 m^3	44.31	2.05	1577.33	240.06	156.51	400.23	556.74	15.34	16.18
		20 m^3	49.62	2.33	1714.07	300.02	202.12	420.34	622.46	15.45	16.22
	2nd cut	10 m^3	46.01	5.66	1677.31	350.05	300.42	425.38	725.80	15.48	16.29
		15 m^3	56.01	7.05	1545.33	345.05	316.24	489.66	805.90	15.52	16.36
		20 m^3	57.61	7.67	1601.66	380.10	326.43	426.62	753.05	15.51	16.48
	3rd cut	10 m^3	61.31	5.02	1655.33	390.13	392.72	581.62	974.34	15.55	16.62
		15 m^3	63.66	7.66	1706.08	400.05	426.95	630.05	1057.01	15.61	16.66
		20 m^3	66.36	8.61	1763.33	415.02	466.28	640.06	1106.34	15.71	16.76
mixture	1st cut	10 m^3	50.31	4.33	1786.66	450.02	94.52	500.31	594.83	13.12	20.06
		15 m^3	58.01	4.66	1910.04	470.31	100.15	520.31	620.46	13.68	20.09
		20 m^3	58.33	6.03	1950.04	490.31	107.24	550.16	657.40	13.74	20.14
	2nd cut	10 m^3	51.66	8.33	2053.33	510.21	242.14	645.66	887.80	14.06	20.88
		15 m^3	59.31	9.33	1499.66	530.31	286.42	686.61	973.03	14.52	20.62
		20 m^3	61.62	11.01	1993.33	550.31	316.33	784.05	1100.38	15.09	20.55
	3rd cut	10 m^3	58.03	10.66	2146.66	520.16	336.24	830.04	1166.28	15.86	19.81
		15 m^3	64.01	10.69	2196.65	570.35	375.46	883.34	1258.80	15.89	19.80
		20 m^3	68.08	13.03	2250.07	573.21	398.24	958.35	1386.59	15.92	19.45
L.S.D at 5%			0.051	0.17	2.15	2.75	2.47	2.72	1.97	0.08	0.05

Conclusion

In general, it can be concluded that in barley (*Hordeum vulgare,* L.) c.v. Giza 123 with berseem (*Trifolium alexandrinum,* L.) c.v. Giza 6, as a mixture of fodder crops by fertilized at rate 20 m^3 organic manure /fad, with three cuts of mixture crops to produce high yielding fresh forage that high in dry matter, highly nutritious, and palatable for animals and the mixture produces an excellent fresh and balanced diet for animal under New valley conditions.

References

Abdel Magid, H. M., M.F. Ghoneim, R.K. Rabie and R.E. Sabrah, 1991. Productivity of Wheat and Alfalfa under intercropping. Experimental Agriculture*, 27: 391-395.*

Al-Khateeb, S. A., 2004. Impact of nitrogen fertilizer and water deficit on forage yield of Egyptian clover-ryegrass mixture. *Egyptian Journal of Applied Sciences 19 (7B):540 - 554.*

Al-khateeb, S.A., A.A.Leilah, S.S.Al-Thabat and K.M. Al-Barak, 2001. Study on Mixid sowing of Egyptian clover (*Trifolium alexandrinum,* L.) with raygrass (*Lolium multiflorum* Lam) , Barley (*Hordeum vulgare,* L.*)* and oat (*Avene fatua* L.) on fodder yield and vality Egyptian J. of Applied Sci.,16,159-171.

Andrzejewska J., K.A., Albrecht and G. Harasimowicz-Hermann, 2014. Intercropping winter cereals with and intercropping systems. Asian J. Plant Sci., 6(5): 833-838.

Bassal, S.A.A. and F. A.Zahran, 2002. Effect FYM manure , bio and mineral nitrogen fertilizer and hillepaces on rice crop productivity. J. Agric. Sci. Mansoura Univ., 27: 1975-1988.

Blaser, B.C., J.W Singer and L.R. Gibson, 2007. Winter cereal, seeding rate and intercrop seeding rate effect on red clover yield and quality. Agronomy Journal, 99, 723-729.

Chaichi, M.R., F. Daryaei and M. Aqaalikhani, 2007. Forage production of sorghum and alfalfa in sole and intercropping systems. Asian J. Plant Sci., 6(5): 833-838.

Contreras-Govea F.E. and K.A. Albrecht, 2005. Mixtures of kura clover with small grains or Italian ryegrass to extend the forage production season in the Northern *USA*. Agron. J., 97:131-136

Degirmenci, R. and R. Avcioglu, 2011. Effect of some legumes and cereal mixtures on yield and yield characters. Proceedings of IX. Turkish Field Crops Congress, 12-15 September 2011, Bursa, Vol 3: 1621-1626 (In Turkish with English abstract).

Deveci, M., Y. Silbir, N. Yilmaz and O. Dede, 2009. Determination of Seed Yield and Fodder Yield of Some Berseem Clover (*Trifolium alexandrinum* L.)Varieties in Ordu Ecological Conditions. Proceedings of VIII. Turkish Field Crops Congress, 19-22 October 2009, Hatay, Vol 2: 882 - 885 (In Turkish with English abstract).

El-Karamany, M. F, B. A. Bakry, and T. F. Elewa, 2014. Integrated action of mixture rates and Nitrogen levels on quantity and quality of forage mixture from Egyptian clover and Barley in sandy soil. *Agricultural Sciences, 5, 1539-1546.*

El-karamany, M.F., A. Amany and M. M. Tawfic, 2009. Forage mixture potential of Berseem clover (*Trifolium alexandrinum*) with triticale (*X triticosecale wittmack*) or barley (*Hordeum vulgare* L.). Bull. NRC, 34(2): 175-185.

Ghaffarzadeh, M., 1997. Economic and biological benefits of intercropping Berseem clover with oat in corn-soybean-oat rotation. J. Prod. Agric., 10: 314-219.

Gomez K. A. and A. A. Gomez, 1984. Statistical procedures in agricultural research. New York, Chichester, Wiley 1984, 2nd edition, paperback. pp 680.

Helmy,A., A. Amal, M. Wafaa, I. Sharawy, I. Hoda and M. Ibrahim, 2011. Evaluation of fodder yield and its quality of Barley and Rye grass sown alone or intercropped with Berseem clover. J Plant Prod. Mansoura Univ. 2(7):851- 863.

Holland, J. B. and E. C. Brummer, 1999. Cultivar effect on oat-berseem clover intercrops. Agron. J., 91: 321-329.

Juskiw, P. E., J. H. Helm and D. F. Salmon, 2000a. Forage yields a quality for monocarps and mixtures of small grain cereals. Crop Sci., 40: 138-147.

Juskiw, P. E., J. H. Helm and D. F. Salmon, 2000b. Competitive ability in mixtures of small grain cereals. Crop Sci., 40: 159-164.

Kandil, A. A., A. A. Salama, S. A. El-Moursy and W. A. Abido, 2004. Productivity of Egyptian clover as affected by seeding rates and cutting schedules. I. Forage yield and its attributes. Proc. 4th Sci. Conf. Agric. Sci. Assiut.

Kandill, A. A., A. M. Salama, S. A. El-Moursy and W. A. Abido, 2005. Productivity of Egyptian clover as affected by seeding rates and cutting schedules. II. Chemical dry matter yields. Pakistan J Biol. Sci. 8 (12):1766-1770.

Karadag, Y., 2004. Forage yields, Seed yields and botanical compositions of some legume-Barley mixtures under Rainfed condition in semi-arid regions of Turkey. Asian Journal of Plant Sciences, 3, 295-299.

Kuusela, E., H. Khalili, and P. Nykanen-Kurki, 2004. Fertilization, Seed Mixtures and supplementary feeding for annual legume-grass-cereal pastures in organic milk production systems. Livestock Production Science, 85, 113-117

Lynch, D. H., R. P. Voroney and P.R. Warman, 2004. Nitrogen availability from composts for humid region perennial grass and legume-grass forage production. Journal of Environmental Quality, 33, 1509-1520.

Malhi, S. S., R. P. Zentner and K. Heier, 2002. Effectiveness of Alfalfa in reducing fertilizer N input for optimum forage yield, protein concentration, returns and energy performance of Bromegrass-Alfalfa mixtures. Nutrient Cycling in Agroecosystems, 62, 219-227. http://dx.doi.org/10.1023/A:1021229824357

Montogomery R., 1961. Further studies of the phenol sulphoric acid reagent for carbohydrate. Biochem. Biophus. Acta, 48:59.

Muir, J. P., 2002. Effect of dairy compost application and plant maturity on forage kenaf cultivar fibre concentration and in Sacco Disappearance. Crop Science, 42, 248-254. http://dx.doi.org/10.2135/cropsci2002.0248

Newton, G. L., J. K. Bernard, R. K. Hubbard, J. R Allison, R.R. Lowrance, G.J. Gascho, R.N. Gates, and G. Vellidis, 2003. Managing manure nutrients through multi-crop forage production. Journal of Dairy Science, 86, 2243-2252.

Peach K. and M. V. Tracey, 1956. Modern methods of plant analysis. Vol. 1. Springer Verlag. Berlin, 4, 643.

Ross, S. M., King, J. R., Donovan, J. T. and D. Spaner, 2004a. Forage potential of intercropping berseem clover with Barley, oat or triticale. Agronomy Journal, 96, 1013-1020.

Ross, S. M., King, J. R., Donovan, J. T. and D. Spaner, 2004b. Intercropping berseem clover with barley and oat cultivares for forage. Agronomy Journal, 96, 1719-1729.

Salama, H.S.A., 2015. Interactive effect of forage mixing rates and organic fertilizers on the yield and nutritive value of berseem clover (*Trifolium alexandrinum* L.) and annual ryegrass (*Lolium multiflorum* Lam.). Agricultural Sciences, 6:415-425.

Shoaib, M., M. Ayub, M.S.I. Zamir and M.J. Akhtar, 2013. Dry matter yield of oat- Egyptian clover mixture under varying proportions and different growth stages of oat. Int. J. Agric. Biol., 15: 673-679

Silbir, Y., I. Baysal, and T. Polat, 2000. A research on the mixture of some grasses, berseem clover and field pea to be grown as winter crop at Harran plain conditions. Turkey Agricultural Research Project Symposium, 20-21 September 2000, Sanliurfa (In Turkish with English abstract).

Smith, D. G. M. Poulsen and C.A. Raguse, 1964. Extraction of total available carbohydrates from grass and legume tissues. Plant physiol., 39: 960.

Van Wieringen, L.M., J.H. Harrison, T. Nennich, D.L. Davidson, L. Morgan, S. Chen, S. Bueler, and M. F. Hoisington, 2005. Manure management effects on grass production, nutritive content, and soil nitrogen for a grass silage-based dairy farm. Journal of Environmental Quality, 34, 164-173.

Vasilakoglou I. and K. Dhima, 2008. Forage yield and competition indices of berseem clover intercropped with barley. Agron. J., 100: 1749-1756

Yolcu H., H. Seker, G. Mkerim, A. Lithourgidis and A. Gunes, 2011. Application of cattle manure, Zeolite andLeonardite Improves hay yield and quality of annual ryegrass (*Lolium multiflorum* Lam.) under semiarid conditions. Australian Journal of Crop Science, 5, 926-931.

Younis A.A., M. A. Harfoush and K. M. Ghobrial, 1986. Effect of inter-seeding some winter leguminous foragecrops with Barley on forage yield and quality. Proc. 2nd Conf. Agron. Alex, Egypt: 763-771.