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EFFECT OF SOWING DATE AND SEEDING RATE ON FORAGE AND SEED PRODUCTIVITY OF FAHL BERSEEM (*Trifolium alexandrinum* L.)

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ABSTRACT

Two field experiments were carried out at the experiment farm of Shandaweel, Agriculture Research Station, Agric. Res. Center, Sohag Governorate through 2020/2021 and 2021/2022 seasons. The study aim to investigate five sowing dates (1st October, 15th October, 1st November, 15th November and 1st December) under various seeding rates (20, 25 and 30 kg/fad.) for green forage productivity and seed yields of fahl berseem. The experiments were distributed a randomized complete block in a spilt plot array with three replicates. Results showed that sowing dates had significantly affected on fresh, dry forage yields, plant height, No. of branches/plant, fresh and dry leaf/ stem ratio, protein and fiber percentage during the two seasons and over two seasons. Maximum values for these traits had recorded for sowing date on 1st October meanwhile, the minimum values were obtained with sowing date 1st December except fiber (%) which was the highest value but it was the lowest at sowing date 1st October. The highest values prior traits were at seeding rate 30 kg fad^{-1} except fiber (%), which it had the best value with seeding rate 20 kg fad^{-1} in both seasons and over two seasons. The interaction effect between sowing dates and seeding rates had highly significant different for dry forage yield and insignificant for the rest of the other traits. Sowing dates and seeding rates recorded highly significant effect for seed yield and its components in fahl berseem in both seasons and over the two seasons. The highest No. of branches/plant, No. of heads/plant, No. of flowers/head, No. of seeds/head, seed setting, 1000 seed weight, seed yield and straw weight were the results of the interaction between sowing date 15th November and seeding rate 12 kg fad.$^{-1}$ except seed yield had the highest at the seeding rate 15 kg fad.$^{-1}$ and straw at the seeding rate 18 kg fad.$^{-1}$ for both seasons and over the two seasons. The interaction effect among sowing dates and seeding rates had insignificant for seed yield and it's components. The best treatments for fresh forage yield of fahl were sowing date 1st October and seeding rate 30 kg fad.$^{-1}$ and for seed yield was sowing date 15th November and seeding rate 15 kg fad^{-1} at Sohag Governorate.

INTRODUCTION

Forage crop moves a vital role in the sustainability of agriculture production. It is an outstanding plant for quell prevailing and controlling weeds and is environment friendly crop because minimum or no pesticides are used. Berseem is a main seed export crop (more than 12000 ton) and taken about one third of the cultivated area in Egypt (between two to three millions faddans as full season and short season crops), as well as the area faithful seed production during winter **El-Nahrawy (2005).** Its presence in rotation with other non-leguminous crops helps to secure reasonable amount of high-quality forage for animal husbandry, improves soil fertility

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and thus maximizes the gain from the agricultural practice.

It has high nutrional value and is very palatable in addition to being highly productive; part of single-cut area is devoted to seed production, a product that is as valuable as product forage **Bakheit *et al*.** (**2007)**. Fahl occupies the soil for a maximum of ninety days, its cultivation early in the season (September) would fill a gap in the crop rotation, like no other crop can do **Duke (2012).**

Fahl berseem (*Trifolium alexandriam* L.) is a type of mono-cut annual winter forage leguminous crop. A full-season forage production is allowed by the multi-cut types, whereas, short- season forages production is related with mono-cut ″Fahl″ type, it means that only has one cut or seed yield (single- cut type). Fahl is a stem-branching type, buds are vertically distributed along the main stem and that can be cut only once **Bakheit (1996), Abd El-Naby *et al.* (2014) and Vijay *et al*. (2017)**.

In fact, it will supplement the soil nutrients between two grass crops **Hamdany *et al*., (2016)** and provide quantity of up-goodness quality forage proper for fresh feeding and hay or silage making.

Besides, fahl berseem demands least water with water output reaching 21.23 kg/ m^2, similed to about 13.85 and 10.83 kg/m^2 for long and short berseem, therefore fahl variety berseem clover is more efficient in terms of water utilize **Saleh (2017).**

Fahl is a dominant before early summer preceding cash crops like cotton and recently wheat (a crop sequence following the early maturing rice cultivars or corn after followed by fahl berseem and wheat) which would fill a gap and enrich nitrogen content of soil by fixing atmospheric nitrogen, in addition to improve soil proprieties and organic matter and therefore soil fertility **Ahmed and Rady (2018)** and **Salama and Nawar (2021).**

Fahl is a potent type. Fahl berseem has higher tolerance to dry land conditions than Meskawi multi-cut **Frame (2019)** and providing higher dry matter yield gathering green forage suitable for hay production.

The objective of this research was to study the effect of sowing dates and seeding rates on green forage and seed yields productivity and chemical composition of fahl Egyptian clover.

MATERIALS AND METHODS

Two field experiments were conducted at the experimental farm of Shandaweel Agricultural Research Station Agric. Res. Center, Sohag Governorate, Egypt through the two growing winter seasons 2020/2021 and 2021/2022 to study the impact of sowing dates and seeding rates on green forage and seed yields of Egyptian clover monocut fahl (*Trifolium alexandrinum* L.).

The experimental design was split plot with three replications. The main plots were for sowing dates, as well as seeding rates occupied in the sub plots. Plot area was $6m^2$ (1.5 m *4 m). The preceding crop was Maize in the two seasons. During land preparation phosphatic fertilizers was added with 150 kg fad^{-1} in the compose of superphosphate (15.5% P_2 O_5) and 50 kg fad^{-1} of potassium sulphate (48% k_2O). 15 kg N fad^{-1} as Ammonium Nitrate (33.5% N) was added before the first irrigation. The normal cultural practices of processing Egyptian clover plants had applied as recommended.

The treatments studied were as the following:

Green Forage Yield

Main plots including (five sowing dates)

1- 1st October (A1)

2- 15th October (A2)

3- 1st November (A3)

4- 15th November (A4)

5- 1st December (A5)

Sub plots including (three seeding rates)

1- 20 kg fad^{-1} (B1)

2- 25 kg fad^{-1} (B2)

3- 30 kg fad^{-1} (B3)

One cut was taken after ninety days from sowing dates.

Data recorded on green yield as follows:

Vegetative Characteristics

Fresh forage yield (kg/plot)

After 90 days from sowing date each plot was manually harvested to estimate the fresh forage yield (kg/plot).

Dry forage yield (kg/plot)

Evaluated by using fresh forage yield of each plot and multiplied by the conforming amount of dry percentage.

Plant height (cm)

Five plants were measured randomly from each experimental plot, estimated from level of the soil exterior until the top most end of plant and recorded as the average of five measurements.

Number of branches/ plant

Recorded from five plants and counted branches every plot.

Leaves/Stem ratio (fresh weight)

A sample of fresh plants (200 g.) and by hand split up leaves and stem. Every component was weighed presently to determine the percent.

Leaves/Stem ratio (dry weight)

Fractions of leaves and stems (fresh weight) were reweighed after drying in an oven 70 °c till weight constancy.

Chemical Analyses

A sample of fresh plants (200 g) dried at 70°C, milling in a Willy mill and then digested by H_2SO_4 as **Parkinson and Allen (1975).**

Protein

The digested samples were analyzed for nitrogen percentage which was determined by micro Kjeldahl method according to **AOAC (2000).**

Crude fiber (CF) content

Crude fiber content was determined as described by **AOAC (1995).**

Seed Yield

The treatments studied for seed yield as follows:

Main plots including (five sowing dates)

1- 1st November (A1)

2- 15th November (A2)

3- 1st December (A3)

4- 15th December (A4)

5- 1st January (A5)

Sub plots contain (three seeding rates)

1- 12 kg $fad.^{-1}$ (B1)

2- 15 kg $fad.^{-1}$ (B2)

3- 18 kg $fad.^{-1}$ (B3)

At the seed maturity stage each plot were harvested for seed yield were clipped by hand sickle.

Data recorded on seed yield were as follow:

Number of branches/ plant

Recorded from five plants and counted branches every plot

Number of heads/ plant

A random sample of five plants had taken from each plot.

The average number of heads (inflorescences) per plant had recorded.

Number of flowers/ head

A random sample of ten heads from each plot had taken to laboratory forage, where,

flowers had separated and counted. The average per head had recorded.

Number of seeds/head

From the flowers-counted ten heads, the average number of seeds per head had scored.

Percentage seed setting

The percentage of seed number to number of flowers per head.

Thousand seed weight (seed index) (g)

From each plot, five samples contain 1000 seeds was weighted (g), The average per plot had recorded.

Seed yield (g/plot)

Estimated from each plot (6 m^2). Plants had harvested at seed maturity stage, where manually threshed.

Straw weight (kg/plot)

Determined after threshed plants and separated seeds from each plot.

Some physical and chemical properties of the experimental soil at a depth of 0-30 cm using an auger for estimating some mechanical and chemical properties of soil for two seasons described by **Jackson (1973)** and **Chapman and Pratt (1978)**. The data of soil analysis are shown in the two seasons (Table 1).

Statistical Analysis

Data were statistically analyzed according to **Snedecor and Cochran (1982)** using **MSTAT Computer V4 (1986)** split plot arrangement. Bartlett's test was done according to **Bartlett (1937)** to test the homogeneity of error variance. The test was not significant for all assessed traits, so, the two season's data were combined. As the two season's treatment influences were showed non-significant for all studied parameters, data were combined over the two experimental seasons and statistically analyzed, as an RCBD with split-plot arrangement of treatments, where sowing dates were the main plots; however seeding rates were the sub-plots, according to the following type:

$$Y_{ijk}=\mu+Ri+SD_j+e_{ij}+SR_k+(SD*SR)_{jk}+s_{ijk}$$

Where μ is the overall mean, Ri is the replication (i=1,2,3), SDj is the sowing dates impact (j=1,2,3,4,5), eij is the influence of main plot, SR_k is the seeding rates effect (k = 1,2,3), (SD*SR) jk is the effect of the interaction between the sowing dates and seeding rates, and s_{ijk} is the effect of sub-plot.

The experimental design of combined analysis was carried out for all studied traits in both seasons to estimate treatments mean differences, least significant difference (LSD) was used at 1% level of significance ($P\leq 0.01$).

RESULTS AND DISCUSSION

Fresh and Dry Forage Yields

Effect of sowing dates

The results in Table 4 show the highly significant effect for sowing dates and seeding rates on fresh and dry forage yields on fahl berseem in the two seasons and over the two seasons.

Maximum fresh and dry forage yields (38.63 and 4.756 kg/plot) were obtained in early sowing date on 1st October (A1), but the minimum yields (18.07 and 2.782 kg/plot) were recorded in late sowing date on 1st December (A5). The increase in fresh and dry forage yields by sowing on 1st October (A1) compared to late sowing date on 1st December (A5) were (103.5, 126.8 and 113.8%) and (65.7, 75.8 and 71%) in the two seasons and their combined, respectively. Fresh and dry forage yields decreased with delay in sowing date attributed to low temperature at growth period because of decrease in maximum centigrade in December compared with October (Table 3). Sowing date 1st October (A1) was the optimum weather to grow berseem about 60 days, while 1st December

Table 1. Mean performance of some soil chemical properties of the two experimental sites before cultivation

Soil depth (cm)	pH	SP[1]	EC mmbos/ cm 25ºC	Ca	Saturation Extract mg/1					
					Mg^{+2}	Na^{+}	K^{+}	Co^{-2}	HCO_3	Cl^{-}
0-30	7.4	33	1.11	-	5.1	2.5	0.32	-	5	2

Table 2. Mean performance of some physical properties of the two experimental sites before cultivation

Soil depth (cm)	Particle size distribution (%)			Texture class	Bulk density (gcm^{-3})	$CaCO_3$ (%)
	Sand	Silt	Clay			
0-30	24.00	28.20	37.80	17.20	10.00	178

Table 3.Average values of meteorological data recorded at Shandaweel Agricultural Research Station at 2020/2021 and 2021/2022 growing seasons

Month	2020/2021					2021/2022				
	Max.	Min.	RH.	WS	SR	Max.	Min.	RH	WS	SR
	------ºC-------		%	m/sec	$MJ/m^2/day$	-------ºC--------		%	m/sec	$MJ/m^2/day$
October	31.0	23.2	38	-	-	32.2	22.8	43	-	-
November	26.6	13.0	54	2.3	13	28.8	14.5	59	2.3	17
December	20.3	7.1	65	2.5	15	21.7	7.9	58	2.4	15
January	18.8	5.0	60	2.1	15	18.3	4.3	58	2.5	15
February	21.5	7.1	48	2.6	18	21.4	6.6	52	2.6	19
March	25.1	9.1	35	2.9	23	27.2	10.6	45	3.1	22
April	30.1	13.8	34	3.2	24	30.1	14.0	37	3.4	25
May	38.4	20.8	30	3.0	27	36.0	19.8	36	3.4	27
June	38.8	25.1	26	-	-	38.1	23.0	29	-	-
July	38.5	25.5	25	-	-	38.0	24.2	27	-	-

(Min.) = minimum temperature, (Max.) = maximum temperature, (RH)= relative humidity, (WS) = wind speed and (SR)= solar radiation.

Table 4. Effect of sowing dates and seeding rates on the mean performance for fresh and dry forage yields of fahl berseem in the two seasons and their combined

Treatment		Fresh forage yield (kg/plot)			Dry forage yield (kg/plot)		
		2020/2021	2021/2022	Combined	2020/2021	2021/2022	Combined
Sowing date (A)	A1	35.20	42.70	38.63	4.397	5.116	4.756
	A2	29.83	35.00	32.42	3.913	4.513	4.213
	A3	25.82	30.36	28.09	3.487	4.040	3.763
	A4	22.53	26.90	24.72	3.127	3.693	3.410
	A5	17.30	18.83	18.07	2.653	2.910	2.782
F test		**	**	**	**	**	**
LSD 0.01		1,57	2.39	1.53	0.033	0.031	0.038
Seeding rate (B)	B1	24.50	28.64	26.57	3.358	3.856	3.607
	B2	26.09	30.51	28.30	3.502	4.035	3.769
	B3	27.82	32.74	30.28	3.686	4.272	3.979
F test		**	**	**	**	**	**
LSD 0.01		1.41	1.36	0.94	0.073	0.033	0.017
A x B	A1B1	34.00	40.00	37.00	4.320	4.960	4.640
	A1B2	35.40	42.00	38.70	4.430	5.087	4.758
	A1B3	36.20	44.20	40.20	4.440	5.300	4.870
	A2B1	28.00	33.00	30.50	3.750	4.320	4.035
	A2B2	29.50	35.00	32.25	3.860	4.520	4.190
	A2B3	32.00	37.00	34.50	4.130	4.700	4.415
	A3B1	24.00	28.00	26.00	3.320	3.800	3.560
	A3B2	25.97	30.07	28.02	3.480	4.020	3.750
	A3B3	27.50	33.00	30.25	3.660	4.300	3.980
	A4B1	21.00	25.20	23.10	2.980	3.500	3.240
	A4B2	22.60	27.00	24.80	3.140	3.700	3.420
	A4B3	24.00	28.50	26.25	3.260	3.880	3.570
	A5B1	15.50	17.00	16.25	2.420	2.700	2.560
	A5B2	17.00	18.50	17.75	2.600	2.850	2.725
	A5B3	19.40	21.00	20.20	2.940	3.180	3.060
F test		NS	NS	NS	**	**	**
LSD 0.01		-	-	-	0.073	0.073	0.049

**, NS: Highly significant at level 0.01 and not significant probability.

A1, A2, A3, A4 and A5 are sowing dates on 1st Oct., 15th Oct., 1st Nov., 15th Nov. and 1st Dec., respectively. B1, B2 and B3 are seeding rates i. e. 20, 25 and 30 kg/fad.

(A5) with 60 days was less weather for vegetative growth. As well as all fresh yield components were the highest (plant height, No. of branches/plant, fresh and dry leaf/ stem percent) at the sowing date 1st October (A1). These results are in agreement with those of **Sardana and Narwal (2000), Abdel-Gawad (2003), Salem *et al.* (2013), Badawy *et al.* (2016), Bakheit *et al.* (2017)** and **Singh *et al.* (2019).**

Effect of seeding rates

The obtained results in Table 4 notice that seeding rate 30 kg fed^{-1}(B3) was the highest in each of fresh and dry yields where it was (30.28 and 3.978 kg/ plot), but seeding rate 20 kg fad^{-1} (B1) was the lowest one which recorded (26.57 and 3.607 kg/plot) for fresh and dry forage yields over the two seasons, respectively. Occasionally, results reported the second season was higher than the first season may be the climatic conditions temperature Table 3 in the second season was appropriate for the highest yield. The increase in fresh and dry yield using seeding rates 30 kg/fad., compared with 20 kg/fad., were recorded (13.6, 14.3 and 14%) and (9.8, 10.8 and 10.3 %) in the two seasons and their combined, respectively. The increase in fresh and dry forage yields resulted due to increasing seeding rate from 20 to 30 kg / fad might be due to taller plants and more number of stems/ plant **Sarhan and Abd El- Maksoud (2002).** Also, **kandil *et al.* (2005)** who found that sowing berseem at the rate of 30 kg/ fad recorded the highest fresh and dry forage yields (ton/fad) from 15 to 30 kg/fad in the two seasons.

These results had harmony with **Salem *et al.* (2019)** who showed that increased in seeding rate up to 30 kg fad^{-1} was a positive effect on total fresh and dry forage yields in combined for Egyptian clover. On contrast, **Tufail *et al.* (2019)** who found decrease of green forage yield on Agiatti berseem - 2002 when seeding rates had 20 and 25 kg/ ha gave 53.31 and 50.47 t/ha, respectively.

Effect of the interaction

Regarding to Table 4 results illustrated that interaction among sowing dates and seeding rates had insignificant effect for fresh forage yield. Maximum interaction effect was that of sowing date 1st October (A1) and seeding rate 30 kg fad^{-1} (B3) gave the highest values which it were 40.20 and 4.870 kg/plot for fresh and dry forage yields, respectively. Whereas the interaction between the date 1st December (A5) and seeding rate 20 kg fad^{-1} (B1) had the lowest values which it were 16.25 and 2.560 kg/plot for fresh and dry forage yields over the two seasons, respectively. The same trend with noted by **Abdel-Gawad (2003)** and **Kandil *et al.* (2004).** Similar to **Kandil *et al.* (2005)** who reported that the interaction among fresh and dry forage yields were the highest from increasing seeding rates to 30 kg fad^{-1}.

Plant Height and No. of Branches/ Plant

Effect of sowing dates

Results in Table 5 reveal that the sowing dates and seeding rates had highly significant effect on plant height in the two seasons and over the two seasons. Tallest plant height was recorded of sowing date 1st October (A1) with an average (90.5, 98.3 and 94.4 cm). While, the shortest plant height was estimated at the sowing date 1st December (A5) with average were (72.9, 77.3 and 75.1 cm). The increase in plant height on the early sowing date 1st October (A1) compared with the delay sowing date 1st December (A5) which it were (24.1, 27.2 and 25.7%) in the two seasons and over the two seasons, respectively. These results are in harmony with **Kandil *et al.* (2005)** and **Tufail *et al.* (2019).**

Table 5. Effect of sowing dates and seeding rates on the mean performance of plant height and No. of branches/ plant for fahl berseem in the two seasons and their combined

Treatment		Plant height (cm)			No. of branches/plant		
		2020/2021	2021/2022	Combined	2020/2021	2021/2022	Combined
Sowing date (A)	A1	90.5	98.3	94.4	4.0	4.2	4.1
	A2	86.2	92.6	89.4	3.7	4.0	3.9
	A3	81.9	87.3	84.6	3.4	3.8	3.6
	A4	78.7	84.2	81.4	3.2	3.5	3.4
	A5	72.9	77.3	75.1	2.8	3.0	2.9
F test		**	**	**	**	**	**
LSD 0.01		2.6	1.5	1.6	0.3	0.2	0.2
Seeding rate (B)	B1	80.0	85.6	82.8	3.8	4.1	4.0
	B2	81.9	87.8	84.8	3.4	3.7	3.5
	B3	84.3	90.5	87.4	3.2	3.3	3.2
F test		**	**	**	**	**	**
LSD 0.01		1.8	1.4	0.30	0.1	0.2	0.1
A x B	A1B1	88.0	96.0	92.0	4.4	4.7	4.5
	A1B2	90.0	98.0	94.0	4.0	4.0	4.0
	A1B3	93.5	101.0	97.3	3.7	3.8	3.8
	A2B1	84.0	90.0	87.0	4.0	4.6	4.3
	A2B2	86.2	92.5	89.4	3.7	4.0	3.9
	A2B3	88.4	95.3	91.9	3.4	3.5	3.5
	A3B1	80.0	85.0	82.5	3.7	4.2	4.0
	A3B2	81.8	87.0	84.4	3.4	3.8	3.6
	A3B3	84.0	90.0	87.0	3.2	3.4	3.3
	A4B1	77.0	82.0	79.5	3.5	3.8	3.7
	A4B2	78.8	84.5	81.7	3.2	3.5	3.4
	A4B3	80.3	86.0	83.2	3.0	3.1	3.1
	A5B1	71.0	75.0	73.0	3.2	3.4	3.3
	A5B2	72.6	77.0	74.8	2.8	3.0	2.9
	A5B3	75.2	80.0	77.6	2.5	2.5	2.5
F test		NS	NS	NS	NS	NS	NS
LSD 0.01		-	-	-	-	-	-

**, NS: Highly significant at level 0.01 and not significant probability. A1, A2, A3, A4 and A5 are sowing dates on 1st Oct., 15th Oct., 1st Nov., 15th Nov. and 1st Dec., respectively. B1, B2 and B3 are seeding rates i. e. 20, 25 and 30 kg/ fad.

These results might be due to low temperature during vegetative growth stage **Surinder *et al.* (2019)** and **Salim *et al.* (2019).** Also**, Bakheit *et al.* (2017)** who mentioned that plant height decreased gradually by delay in sowing dates. The increase in plant height following increase in plant density was related to the increase in the inter-plant competition over light, water and nutrients, under these conditions, plant height increases when environmental parameters such as moisture and soil fertility do not limit the growth of plants **Imam and Ranjbar (2000).**

Effect of seeding rates

Results in Table 5 indicate the highly significant effect in plant height with seeding rates in fahl berseem. The best seeding rate 30 kg/fad., (B3) in plant height which it were (84.3, 90.5 and 87.4 cm). While the lowest seeding rate 20 kg/fad. (B1), were obtained (80.0, 85.6 and 82.8 cm) in the two seasons and over the two seasons, respectively. Increase seeding rates up to 30 kg/fed relative to 20 kg/fad., had indicated plant height by (5.4, 5.7 and 5.6%) in both seasons and their combined, respectively. These results are harmony with **Kandil *et al.* (2005), Bakheit *et al.* (2012)** and **Seyyed *et al*. (2012)** who reported that the increase in plant height due to increasing seeding rates may have attributed to more competition in the dense population for light, so caused plant elongation. Similar to, **Salem *et al*. (2013)** who decided that plant height of fahl berseem responded significantly to seeding rates in Ismalia and New Valley locations after 75 days from sowing and the best seeding rate was 30 kg fad^{-1}.

Effect of the interaction

The interaction among sowing dates and seeding rates Table 5 had insignificant effect on plant height in the two seasons and over two seasons, respectively. The highest average for interaction plant height was obtained when fahl berseem had sown in 1st October (A1) with seeding rate of 30 kg $fad.^{-1}$ (B3) was 97.3 cm in the over two seasons. While the lowest average was obtained from other sowing dates and seeding rates in fahl clover when sown in 1st December (A5) with seeding rate of 20 kg $fad,^{-1}$ (B1) which it was 73.0 cm over the two seasons. These results are in agreement with **Salem *et al.* (2019)** who studied the interaction between sowing dates and seeding rates and found that the highest plants had estimated when berseem clover was sown at October 15th with seeding rate of 30 kg fad^{-1}, while the lowest average values was at November 15th and 20 kg $fad.^{-1}$ seeding rate. On the other hand, **Tufail *et al.* (2019)** noticed that decreased in plant height with increased in seeding rates from 20 to 25 kg/ha with average were 27.34 and 26.75 cm, respectively.

Number of Branches/ Plant

Effect of sowing dates

Results in Table 5 state that highly significant effects on No. of branches/plant for sowing dates and seeding rates in fahl berseem. Number of branches /plant decreased with delay of sowing dates, No. of branches /plant with sowing date 1st October which were (4.0, 4.2 and 4.1) in the two seasons and over the two seasons. Whereas, minimum No. of branches /plant with sowing date 1st December which had (2.8, 3.0 and 2.9) in the two seasons and over the two seasons, respectively. Higher No. of branches/plant in 1st October resulted due to the suitable environment condition. This result is in harmony with **Salem *et al.* (2019)** and **Surinder *et al.* (2019).** The increase in No. of branches by using sowing date 1st October (A1) compared with the delay in sowing date 1st December (A5) had recorded (42.9, 40 and 41.4%) in fahl berseem in the two seasons and combined, respectively.

Effect of seeding rates

The obtained results from Table 5 show that increasing seeding rates decreased No. of branches/plant. Seeding rate 20 kg fad.$^{-1}$ gave the highest No. of branches/plant which was (3.8, 4.1 and 4.0) in the two seasons and over the two seasons, respectively. While seeding rate 30 kg fad.$^{-1}$ had the lowest No. of branches/ plant (3.2, 3.3 and 3.2) in the two seasons and over the two seasons, respectively. The increase in seeding rates when seeding rates to 20 kg/fad. Compared with 30 kg/fad. were recorded (18.8, 24.2 and 21.2%) in the both seasons and over two seasons, respectively.

Effect of the interaction

Regarding to Table 5 results revealed that the interaction between sowing dates and seeding rates on No. of branches/plant had insignificant in the two seasons and over the two seasons.

Fresh and Dry Leaf/ Stem Ratio

Effect of sowing dates

Results in Table 6 indicated that fresh and dry leaf/stem ratio of fahl berseem were highly significant effect.

The results noticed that the best sowing date was 1st October (A1) which had (43.9, 46.0 and 45.0) and (58.2, 61.0 and 59.6) for fresh and dry leaf/stem ratio in the two seasons and over two seasons, respectively. Whereas, the lowest sowing date 1st December (A5) which were (29.1, 31.0 and 30.0) and (42.3, 45.3 and 43.8) for fresh and dry leaf/ stem ratio in the two seasons and over the two seasons, respectively. The increase of fresh and dry leaf/stem ratio when sowing date was 1st October (A1) compared with the last sowing date (A5) 1st December were recorded (50.9, 48.4 and 50%) and (37.6, 34.7 and 36.1%) in the two seasons and over the two seasons, respectively.

Effect of seeding rates

The results in Table 6 reveal that highly significant effect due to different seeding rates of fahl berseem for fresh and dry leaf/stem ratio. The results indicated that the maximize seeding rate was 30 kg fad.$^{-1}$ (B3) which had (37.8, 41.0 and 39.4) and (53.2, 56.4 and 54.8) for fresh and dry leaf/stem ratio at the two seasons and their combined. Also, results in Table 6 show the increase of fresh and dry leaf/stem ratio by increasing seeding rate to 30 kg/fad. (B3) compared with 20 kg/fad. (B1) were recorded (8.3, 7.9 and 7.9%) and (9.9, 8.9 and 9.4%), respectively. The reason for increase attributed to lack of stem weight under the high density. These results are in harmony with **Garza and Marquez (1994), Pandey *et al.* (1997)** and **Salem *et al.* (2019).**

Effect of the interaction

The interaction between sowing dates and seeding rates Table 6 had insignificantly fresh and dry leaf/stem ratio.

Protein (%) and Fiber (%)

Protein percent had the principle factor to evaluate the best quality of fodder while a feed uptake.

Effect of sowing dates

Regarding to Table 7, results illustrated that crude protein (%) of fahl berseem was insignificantly differed in the 1st season but it had highly significant in the 2nd season and over the two seasons for sowing date. Concerning, crude fiber (%) differences in protein were highly significant in the two seasons and over the two seasons, respectively.

The highest of protein (%) was estimated for sowing date 1st October (14.46, 14.66 and 14.56%), while the lowest values were recorded at the late sowing date 1st December had (13.67, 13.40 and 13.53%) in the two seasons and over the two seasons, respectively. Contrast, the best fiber (%)

Table 6. Effect of sowing dates and seeding rates on the mean performance of fresh and dry leaf/stem ratio of fahl berseem in the two seasons and their combined

Treatment		Fresh leaf/stem ratio			Dry leaf/stem ratio		
		2020/2021	2021/2022	Combined	2020/2021	2021/2022	Combined
Sowing date (A)	A1	43.9	46.0	45.0	58.2	61.0	59.6
	A2	41.6	44.9	43.3	55.2	58.7	56.9
	A3	35.3	39.2	37.3	50.5	55.0	52.8
	A4	31.6	36.5	34.0	47.7	50.7	49.2
	A5	29.1	31.0	30.0	42.3	45.3	43.8
F test		**	**	**	**	**	**
LSD 0.01		1.9	1.5	1.3	1.6	2.5	1.6
Seeding rate (B)	B1	34.9	38.0	36.5	48.4	51.8	50.1
	B2	36.2	39.6	37.9	50.7	54.2	52.5
	B3	37.8	41.0	39.4	53.2	56.4	54.8
F test		**	**	**	**	**	**
LSD 0.01		1.3	1.7	1.0	1.5	1.3	0.9
A x B	A1B1	42.0	44.0	43.0	56.0	58.0	57.0
	A1B2	44.0	46.0	45.0	58.0	61.0	59.5
	A1B3	45.8	48.0	46.9	60.5	64.0	62.3
	A2B1	40.2	43.0	41.6	53.0	56.0	54.5
	A2B2	41.8	45.0	43.4	55.0	59.0	57.0
	A2B3	42.9	46.6	44.8	57.5	61.0	59.3
	A3B1	34.5	38.0	36.3	48.0	53.0	50.5
	A3B2	34.0	39.2	36.6	50.5	55.0	52.8
	A3B3	37.5	40.4	39.0	53.0	57.0	55.0
	A4B1	30.0	35.0	32.5	45.0	48.0	46.5
	A4B2	32.0	36.6	34.3	48.0	51.0	49.5
	A4B3	32.8	37.8	35.3	50.0	53.2	51.6
	A5B1	28.0	30.0	29.0	40.0	44.0	42.0
	A5B2	29.0	31.0	30.0	42.0	45.0	43.5
	A5B3	30.2	32.0	31.1	45.0	47.0	46.0
F test		NS	NS	NS	NS	NS	NS
LSD 0.01		-	-	-	-	-	-

**, NS: Highly significant at level 0.01 and not significant probability.

A1, A2, A3, A4 and A5 are sowing dates on 1st Oct., 15th Oct., 1st Nov., 15th Nov. and 1st Dec., respectively. B1, B2 and B3 are seeding rates i. e. 20, 25 and 30 kg/fad.

was evaluated for sowing date 1st December (31.0, 30.33 and 30.67%), while the lowest values were noted with sowing date 1st October (27.67, 27.00 and 27.33%) in the two seasons and over the two seasons, respectively. The increase in protein when sowing date 1st October (A1) compared with 1st December (A5) recorded (5.8, 9.4 and 7.6%) in the two seasons and over the two seasons, respectively. While the increase in fiber when sowing date 1st December (A5) compared with the sowing date 1st October had observed (12.03, 12.33 and 12.22 %) in the two seasons and over the two seasons, respectively. The reason of increasing might be due to leaf/ stem ratio Table 7. These results are in harmony with **Pea and Bin (2001), Abdel-Gawad (2003)** and **Salem *et al.* (2019).**

Effect of seeding rates

The obtained results (Table 7) show that seeding rates effect on protein (%) in the 1st season was insignificant but, it was highly significant in the 2nd season and their combined, respectively. While, fiber percent was highly significant affected by seeding rates in the two seasons and over the two seasons, respectively. The highest seeding rate 30 kg fad.$^{-1}$ (B3) produced higher (14.26, 14.19 and 14.23%) protein percent, while the lowest seeding rate 20 kg fad^{-1} (B1) produced lower protein (%) (13.86, 13.86 and 13.86%) in the two seasons and over the two seasons, respectively. Contrast, the highest fiber percent was combined with low seeding rate 20 kg fad.$^{-1}$ (B1) (29.80, 30.20 and 30.00%) but the lowest fiber (%) was obtained from seeding rate 30 kg fad.$^{-1}$ (B3) and valued (27.80, 27.80 and 27.80%) in the two seasons and over the two seasons, respectively. The increase in protein using seeding rate 30 kg fad.$^{-1}$ (B3) compared with seeding rate 20 kg fad.$^{-1}$ (B1) were recorded (2.9, 2.4 and 2.7%), whereas the increase in fiber percent using seeding rate 20 kg fad^{-1} (B1) compared with seeding rate 30 kg fad^{-1} (B3) had (7.2, 8.6 and 7.9%) in the two seasons and over the two seasons, respectively. These results are in harmony with **Kandil *et al.* (2005), Salem *et al.* (2013)** and **Salem *et al.* (2019).**

Effect of the interaction

Results in Table 7 show that the interaction among sowing dates and seeding rates had insignificant crude protein (%) and crude fiber (%) in the two seasons and over the two seasons, respectively.

Seed Yield and its Components

No. of branches/plant and No. of heads / plant

Effect of sowing dates

Results in Table 8 illustrate that highly significant effect for sowing dates on No. of branches/plant and No. of head/plant in the two seasons and combined of fahl berseem.

The highest No. of branches/plant and No. of heads/plant for sowing date 15th November (A2) which it were (4.9, 4.9 and 4.9) and (18.0, 20.0 and 19.0) in the two seasons and over the two seasons, respectively. But the lowest No. of branches/plant and No. of heads/plant for sowing date 1st January (A5) which had (3.3, 3.4 and 3.4) and (10.3, 11.1 and 10.7) in the two seasons and over the two seasons, respectively. The decrease percent by delaying in sowing dates from 15th November to 1st January were (48.5, 44.1 and 44.1%) and (74.8, 80.2 and 77.6%) in the two seasons and over the two seasons, respectively. These results might be due to the relation between No. of branches/plant and No. of heads/plant in the same sowing date. These results are in agreement with **Iannucci (2001), Usmani-Khalil *et al.* (2001), El- Zanaty (2005), Salem *et al.* (2019) and Surinder *et al*. (2019).**

Effect of seeding rates

Regaring to Table 8 results indicate highly significant difference for seeding rates on

Table 7. Effect of sowing dates and seeding rates on protein (%) and fiber (%) for fahl berseem in the two seasons and their combined

Treatment		Protein (%)			Fiber (%)		
		2020/2021	2021/2022	Combined	2020/2021	2021/2022	Combined
Sowing date (A)	A1	14.46	14.66	14.56	27.67	27.00	27.33
	A2	14.30	14.43	14.37	28.00	28.00	28.00
	A3	14.00	13.93	13.97	28.00	29.33	28.67
	A4	13.90	13.77	13.83	30.33	30.00	30.17
	A5	13.67	13.40	13.53	31.00	30.33	30.67
F test		NS	**	**	**	**	**
LSD 0.01		-	0.30	0.53	1.61	1.67	1.24
Seeding rate (B)	B1	13.86	13.86	13.86	29.80	30.20	30.00
	B2	14.07	14.06	14.07	29.40	28.80	29.10
	B3	14.26	14.19	14.23	27.80	27.80	27.80
F test		NS	**	**	**	**	**
LSD 0.01		-	0.16	0.30	1.46	1.12	0.87
A x B	A1B1	14.10	14.40	14.25	29.00	28.00	28.50
	A1B2	14.47	14.70	14.58	28.00	27.00	27.50
	A1B3	14.80	14.87	14.83	26.00	26.00	26.00
	A2B1	14.00	14.20	14.10	29.00	29.00	29.00
	A2B2	14.30	14.50	14.40	28.00	28.00	28.00
	A2B3	14.60	14.60	14.60	27.00	27.00	27.00
	A3B1	13.90	13.80	13.85	28.00	31.00	29.50
	A3B2	14.00	13.90	13.95	29.00	29.00	29.00
	A3B3	14.10	14.10	14.10	27.00	28.00	27.50
	A4B1	13.80	13.60	13.70	31.00	31.00	31.00
	A4B2	13.90	13.80	13.85	31.00	30.00	30.50
	A4B3	14.00	13.90	13.95	29.00	29.00	29.00
	A5B1	13.50	13.30	13.40	32.00	32.00	32.00
	A5B2	13.70	13.40	13.55	31.00	30.00	30.50
	A5B3	13.80	13.50	13.65	30.00	29.00	29.50
F test		NS	NS	NS	NS	NS	NS
LSD 0.01		-	-	-	-	-	-

**, NS: Highly significant at level 0.01 and not significant probability.

A1, A2, A3, A4 and A5 are sowing dates on 1st Oct., 15th Oct., 1st Nov., 15th Nov. and 1st Dec., respectively. B1, B2 and B3 are seeding rates i. e. 20, 25 and 30 kg/fad.

Table 8. Effect of sowing dates and seeding rates for No. of branches/plant and No. of heads/plant of fahl berseem in the two seasons and their combined

Treatment		No. of branches/plant			No. of heads/plant		
		2020/2021	2021/2022	Combined	2020/2021	2021/2022	Combined
Sowing date (A)	A1	4.6	4.8	4.7	17.2	17.9	17.6
	A2	4.9	4.9	4.9	18.0	20.0	19.0
	A3	4.4	4.5	4.5	15.3	16.3	15.8
	A4	3.7	3.6	3.7	12.7	13.3	13.0
	A5	3.3	3.4	3.4	10.3	11.1	10.7
F test		**	**	**	**	**	**
LSD 0.01		0.5	0.4	0.3	0.3	0.5	0.3
Seeding rate (B)	B1	4.4	4.5	4.5	16.3	17.6	17.0
	B2	4.3	4.4	4.4	15.6	16.7	16.1
	B3	3.8	3.8	3.8	12.2	12.9	12.6
F test		**	**	**	**	**	**
LSD 0.01		0.3	0.2	0.2	0.3	0.2	0.2
A x B	A1B1	4.8	5.0	4.9	18.5	20.0	19.3
	A1B2	4.7	4.9	4.8	18.0	18.8	18.4
	A1B3	4.2	4.4	4.3	15.0	15.0	15.0
	A2B1	5.1	5.1	5.1	20.0	22.0	21.0
	A2B2	5.0	5.1	5.1	19.0	21.0	20.0
	A2B3	4.6	4.6	4.6	15.0	17.0	16.0
	A3B1	4.7	4.8	4.8	17.0	18.0	17.5
	A3B2	4.6	4.8	4.7	16.0	17.0	16.5
	A3B3	4.0	4.0	4.0	13.0	14.0	13.5
	A4B1	4.0	4.0	4.0	14.0	15.0	14.5
	A4B2	3.9	3.8	3.9	14.0	14.3	14.1
	A4B3	3.2	3.0	3.1	10.0	10.5	10.3
	A5B1	3.6	3.7	3.7	12.0	13.0	12.5
	A5B2	3.4	3.6	3.5	11.0	12.2	11.6
	A5B3	3.0	3.0	3.0	8.0	8.0	8.0
F test		NS	NS	NS	NS	NS	NS
LSD 0.01		-	-	-	-	-	-

**, NS: Highly significant at level 0.01 and not significant probability. A1, A2, A3, A4 and A5 are sowing dates i. e. 1st Nov., 15th Nov., 1st Dec. and 1st Jan. B1, B2 and B3 are seeding rates i. e. 12, 15 and 18kg/fad in the same respective order.

No. of branches/plant and No. of heads/ plant in fahl berseem in the two seasons and over the two seasons, respectively. The best seeding rate was 12 kg fad,$^{-1}$ (B1) recorded branch and head nunbers (4.4, 4.5 and 4.5) and (16.3, 17.6 and 17.0), but the lowest seeding rate of 18 kg fad.$^{-1}$ (B3) recorded branch and head nunbers (3.8, 3.8 and 3.8) and (12.2, 12.9 and 12.6) in the two seasons and over the two seasons, respectively. The reducing by using 18 kg fad^{-1} were 15.8, 18.4 and 18.4) and (33.6, 36.4 and 34.9) in the two seasons and their combined, respectively. These results disagreement with **Tufail *et al*. (2019)** and **Surinder *et al.* (2019).**

Effect of the interaction

The obtained results in Table 8 reveal insignificant difference for No. of branches / plant and No. of heads/plant in the two seasons and over the two seasons, respectively.

No. of flowers/head and No. of seeds/ head

Effect of sowing dates

Results in Table 9 reveal that No. of flowers/head and No. of seeds/head for fahl berseem were highly significant affected by different sowing dates.

Sowing date 15th November (A2) had the highest No. of flowers/head and No. of seeds/head (65.7, 68.3 and 67.0) and (50.7, 53.7 and 52.2) in the two seasons and over the two seasons, respectively. While the lowest values were for sowing date 1st January (A5) (50.3, 51.0 and 51.0) and (33.3, 35.7 and 34.5) in No. of flowers/head and seeds/head in the two seasons and over the two seasons, respectively. The increasing in No. of flowers/head and No. of seeds/ head obtained in sowing date 15th November compared with delayed sowing date 1st January were (30.6, 33.9 and 31.4%) and (52.3, 50.4 and 51.3%) in the two seasons and their combined, respectively. These results are in agreement with **Yadav *et al.* (2015), Srivastava (2016)** and **Karjule** and **Shelar (2021)** who decided reduce in No. of seeds/head attributed to epidemic temperature at maturity.

Effect of seeding rates

The obtained results in Table 9 indicate highly significant effect on No. of flowers/ head and No. of seeds/head under seeding rates. The highest impact was for seeding rate 12 kg fad.$^{-1}$ (B1) which it had (61.4, 63.4 and 62.4) and (45.6, 48.0 and 46.8) in the two seasons and their combined, respectively. Concerning, the lowest values were obtained for seeding rate 18 kg fad.$^{-1}$ (B3) were stated (55.5, 57.2 and 56.4) and (40.2, 42.2 and 41.2) No. of flowers/ head and No. of seeds/ head for fahl berseem in the two seasons and over the two seasons, respectively. The decrease in No. of flowers / head and No. of seeds/ head by increasing seeding rate from 12 kg fad^{-1} (B1) to 18 kg fad^{-1} (B3) were (10.6, 10.8 and 10.6 %) and (13.4, 13.7 and 13.6%) in both seasons and over two seasons, respectively.

Effect of the interaction:

Regarding to results Table 9 showed that interaction had not significant effects on No. of flowers/ head and No. of seeds/head for fahl berseem in the two seasons and over two seasons, respectively.

Seed Setting (%) and 1000 Seed Weight

Effect of sowing dates

Results in Table 10 illustrate that seed setting (%) and 1000 seed weight (seed index) of fahl berseem had highly significant difference in the two seasons and their combined, respectively.

The highest seed setting and 1000 seed weight obtained from sowing date 15th November (A2) which it were (77.6, 79.1 and 78.4) and (3.7, 3.9 and 3.8) in the two seasons and their combined, respectively. However, the lowest values were achieved with the sowing date 1st January (A5) which had (66.1, 69.0 and 67.6) and (3.0, 3.1 and

Table 9. Effect of sowing dates and seeding rates on No. of flowers/head and No. of seeds/head for fahl berseem in the two seasons and their combined

Treatment		No. of flowers/head			No. of seeds/head		
		2020/2021	2021/2022	Combined	2020/2021	2021/2022	Combined
Sowing date (A)	A1	61.3	64.3	62.8	48.3	51.3	49.8
	A2	65.7	68.3	67.0	50.7	53.7	52.2
	A3	61.8	63.7	62.8	47.1	49.7	48.4
	A4	55.7	57.0	56.3	37.3	39.0	38.2
	A5	50.3	51.0	51.0	33.3	35.7	34.5
F test		**	**	**	**	**	**
LSD 0.01		2.4	2.3	1.7	2.1	2.3	1.7
Seeding rate (B)	B1	61.4	63.4	62.4	45.6	48.0	46.8
	B2	60.0	62.4	61.2	44.8	47.4	45.8
	B3	55.5	57.2	56.4	40.2	42.2	41.2
F test		**	**	**	**	**	**
LSD 0.01		1.5	1.3	1.0	1.2	1.3	0.8
A x B	A1B1	64.0	67.0	65.5	50.0	53.0	51.5
	A1B2	63.0	66.0	64.5	49.0	52.0	50.5
	A1B3	57.0	60.0	58.5	45.0	48.0	46.5
	A2B1	67.0	69.0	68.0	53.0	55.0	54.0
	A2B2	66.5	70.0	68.3	51.0	56.0	53.5
	A2B3	62.5	65.0	63.8	48.0	50.0	49.0
	A3B1	64.0	66.0	65.0	49.2	52.0	50.6
	A3B2	62.5	65.0	63.8	48.0	51.0	49.5
	A3B3	59.0	60.0	59.5	44.0	46.0	45.0
	A4B1	58.0	60.0	59.0	40.0	42.0	41.0
	A4B2	57.0	58.0	57.5	38.0	40.0	39.0
	A4B3	52.0	53.0	52.5	34.0	35.0	34.5
	A5B1	53.0	54.0	53.5	30.0	38.0	37.0
	A5B2	51.0	53.0	52.0	34.0	37.0	35.5
	A5B3	47.0	48.0	47.0	34.0	32.0	31.0
F test		NS	NS	NS	NS	NS	NS
LSD 0.01		-	-	-	-	-	-

**, N.S: Highly significant at level 0.01 and not significant probability.

A1, A2, A3, A4 and A5 are sowing dates i. e. 1st Nov., 15th Nov., 1st Dec. and 1st Jan. B1, B2 and B3 are seeding rates i. e. 12, 15 and 18kg/fad in the same respective order.

Table 10. Effect of sowing dates and seeding rates on seed setting (%) and 1000 seed weight for fahl berseem in the two seasons and their combined

Treatment		Seed setting (%)			1000 seed weight (g)		
		2020/2021	2021/2022	Combined	2020/2021	2021/2022	Combined
Sowing date (A)	A1	78.3	78.1	78.2	3.5	3.7	3.6
	A2	77.6	79.1	78.4	3.7	3.9	3.8
	A3	76.1	78.0	77.1	3.5	3.6	3.6
	A4	67.4	68.7	78.1	3.4	3.4	3.4
	A5	66.1	69.0	67.6	3.0	3.1	3.0
F test		**	**	**	**	**	**
LSD 0.01		1.8	2.7	1.8	0.3	0.5	0.3
Seeding rate (B)	B1	73.9	75.7	74.8	3.6	3.7	3.7
	B2	73.8	75.7	74.5	3.5	3.6	3.5
	B3	71.6	72.3	72.0	3.2	3.3	3.2
F test		**	**	**	**	**	**
LSD 0.01		1.7	1.8	1.2	0.2	0.2	0.1
A x B	A1B1	78.0	79.1	78.6	3.7	3.9	3.8
	A1B2	77.8	78.8	78.3	3.6	3.8	3.7
	A1B3	77.6	75.0	76.3	3.2	3.4	3.3
	A2B1	79.1	79.7	79.4	3.9	4.1	4.0
	A2B2	76.7	80.0	78.4	3.8	4.0	3.9
	A2B3	76.8	76.9	76.9	3.4	3.5	3.4
	A3B1	76.9	78.8	77.9	3.6	3.8	3.7
	A3B2	76.9	78.5	77.7	3.5	3.7	3.6
	A3B3	74.6	76.7	75.7	3.3	3.4	3.4
	A4B1	69.0	70.0	69.5	3.5	3.6	3.6
	A4B2	67.9	70.0	69.0	3.4	3.5	3.5
	A4B3	65.4	66.0	65.7	3.3	3.2	3.3
	A5B1	67.9	70.4	69.2	3.2	3.3	3.3
	A5B2	66.7	69.8	68.3	3.0	3.1	3.1
	A5B3	63.8	66.7	65.3	2.8	2.8	2.8
F test		N.S	N.S	N.S	N.S	N.S	N.S
LSD 0.01		-	-	-	-	-	-

** ,N.S: Highly significant at level 0.01 and not significant probability.

A1, A2, A3, A4 and A5 are sowing dates i. e. 1st Nov., 15th Nov., 1st Dec. and 1st Jan. B1, B2 and B3 are seeding rates i. e. 12, 15 and 18kg/fad in the same respective order.

3.3.0) in the two seasons and over the two seasons, respectively. The increase in sowing date 15th November (A2) compared with the delaying sowing date 1st January were (17.4, 14.6 and 16%) and (23.3, 25.8 and 26.7%) for seed setting and 1000 seed weight in the two seasons and over the two seasons, respectively. These results mentioned that the second sowing date 15th November was the most favorable date for flowering and pollination with activity by honey bees so increasing seed setting **Bakheit *et al.* (2012), Mohamed *et al.* (2017) and Badawy *et al.* (2022).**

Effect of seeding rates

Results in Table 10 show that seed setting (%) and 1000 seed weight were highly significant affected in the two seasons and over two seasons, respectively. The maximum seed setting and 1000 seed weight was from seed rate 12 kg fad.$^{-1}$ which it were (73.9, 75.7 and 74.8) and (3.6, 3.7 and 3.7) in the two seasons and over the two seasons, respectively. Whereas, the minimum one was for seeding rate 18 kg fad.$^{-1}$ had recorded (71.6, 72.3 and 72.0) and (3.2, 3.3 and 3.2) in the two seasons and their combined, respectively. The increase due to using seeding rate 12 kg fad^{-1} (B1) compared with seeding rate 18 kg fad^{-1} had recorded (3.2, 4.7 and 3.9%) and (12.5, 12.1and 12.1%) in the two seasons and over the two seasons, respectively. These results are agreement with **Salem *et al.* (2019)**. Furthermore, **Salem *et al.* (2013)** found that increase seeding rates from (20, 25 and 30 kg fad^{-1}) increase weight 1000 seeds as the follow (2.90, 3.20 and 3.37 g) and (2.90, 2.95 and 3.03 g) in Ismailia and New valley locations, respectively.

Effect of the interaction

The obtained results in Table 10 reveal insignificant effect for interaction of sowing dates and seeding rates on seed setting and 1000 seed weight in the two seasons and over two seasons, respectively.

Seed Yield and Straw Weight

Effect of sowing dates

Results in Table 11 indicate that sowing dates and seeding rates had highly significant effects on seed yield and straw yield of fahl berseem in the two seasons and their combined, respectively.

Maximum seed yield and straw weight were obtained from sowing date 15th November which it were (0.519, 0.540 and 0.529 g/ plot) and (6.2, 6.5 and 6.3 kg/plot), whereas, minimum values were at sowing date 1st January which had (0.349, 0.357 and 0.352 g/plot) and (4.2, 4.3 and 4.3 kg/plot) in the two seasons and over the two seasons, respectively. Maximum seed yield was recorded by (A2), whereas minimum seed yield had obtained in (A5) referred to appropriate climatic conditions and related to seed components as in Tables 8, 9 and 10 **Sardana and Narwal (2000), Mohamed *et al.* (2017).** Otherwise, **Surinder *et al.* (2019)** who found that seed yield increased with delay in time sowing in berseem, **Pravez *et al.* (2017)** and **Tufail *et al.* (2019).** The increase by sowing date 15th November (A2) compared with sowing date 1st January (A5) were recorded (48.7, 51.3 and 50.3 %) and (47.6, 51.2 and 46.5 %) in the two seasons and their combined, respectively.

Effect of seeding rates

Results in Table 11 indicate that sowing dates and seeding rates had highly significant effects on seed yield and straw weight of fahl berseem in the two seasons and over two seasons, respectively. The best seed yield and straw weight for seeding rate was 15 kg fad.$^{-1}$ (B2) which it were (0.474, 0.488 and 0.481 g/plot) but the minimum seed yield for seeding rate had 18 kg fed^{-1} (B3) were obtained (0.418, 0.430 and 0.424 g/plot) in the two seasons and over the two seasons, respectively. The increase results in using seeding rate 15 kg fad.$^{-1}$ (B2) compared with seeding rate 18 kg fad.$^{-1}$ (B3) was recorded (13.4, 13.5 and 13.4 %) and in the two seasons and over the

Table 11. Effect of sowing dates and seeding rates on seed yield and straw weight for fahl berseem in the two seasons and their combined

Treatment		Seed yield (g/ plot)			Straw weight (kg/plot)		
		2020/2021	2021/2022	Combined	2020/2021	2021/2022	Combined
Sowing date (A)	A1	0.460	0.487	0.473	5.8	6.1	6.0
	A2	0.519	0.540	0.529	6.2	6.5	6.3
	A3	0.457	0.477	0.467	5.5	5.7	5.6
	A4	0.419	0.410	0.414	4.7	4.9	4.8
	A5	0.349	0.357	0.352	4.2	4.3	4.3
F test		**	**	**	**	**	**
LSD 0.01		0.031	0.031	0.023	0.4	0.2	0.2
Seeding rate (B)	B1	0.429	0.444	0.436	5.1	5.4	5.3
	B2	0.474	0.488	0.481	5.3	5.5	5.4
	B3	0.418	0.430	0.424	5.4	5.6	5.5
F test		**	**	**	**	**	**
LSD 0.01		0.015	0.018	0.012	0.2	0.5	0.1
A x B	A1B1	0.440	0.480	0.460	5.7	6.0	5.9
	A1B2	0.500	0.520	0.510	5.8	6.1	6.0
	A1B3	0.440	0.460	0.450	5.9	6.2	6.1
	A2B1	0.507	0.530	0.518	6.0	6.3	6.2
	A2B2	0.550	0.570	0.560	6.2	6.5	6.4
	A2B3	0.500	0.520	0.510	6.3	6.6	6.5
	A3B1	0.450	0.460	0.455	5.3	5.5	5.4
	A3B2	0.490	0.510	0.500	5.5	5.7	5.6
	A3B3	0.430	0.460	0.445	5.6	5.8	5.7
	A4B1	0.407	0.400	0.403	4.6	4.8	4.7
	A4B2	0.450	0.450	0.450	4.7	4.9	4.8
	A4B3	0.400	0.380	0.390	4.9	5.1	5.0
	A5B1	0.340	0.350	0.345	4.1	4.2	4.2
	A5B2	0.380	0.390	0.385	4.2	4.3	4.3
	A5B3	0.320	0.330	0.325	4.4	4.5	4.5
F test		NS	NS	NS	NS	NS	NS
LSD 0.01		-	-	-	-	-	-

**, N.S: Highly significant at level 0.01 and not significant probability. A1, A2, A3, A4 and A5 are sowing dates i. e. 1st Nov., 15th Nov., 1st Dec. and 1st Jan. B1, B2 and B3 are seeding rates i. e. 12, 15 and 18kg/fad in the same respective order.

two seasons, respectively. These results are in agreement with **Salem *et al*. (2019)** and **Tufail *et al*. (2019). Also, Rashidi *et al.* (2009),** reported that, increased seeding rates of lucerne reduced seed yield due to competition with adjacent angle plants.

Concerning the effect of seeding rate on straw weight results in Table 10 found that the highest seeding rate was 18 kg fad.$^{-1}$ (B3) were observed (5.4, 5.6 and 5.5 kg/plot) whereas seeding rate 12 kg fad.$^{-1}$ (B1) gave the minimum straw weight (5.1, 5.4 and 5.3 kg/plot) in the two seasons and over the two seasons, respectively. The increase resulted in seeding rate from 12 kg/fad., (B1) to 18 kg/fad., (B3) had recorded (5.9, 3.7 and 3.8%) in the two seasons and over the two seasons, respectively.

Effect of the interaction

The obtained results in Table 11 reveal that not significant in both seed yield and straw weight of fahl berseem in the two seasons and over two seasons.

Conclusion

It was concluded in this investigation to knowledge the optimum sowing date and seeding rate in fahl berseem under condition of Shandaweel Station in Sohag Governorate South Egypt to gain both high green and seed forage yields. First, to obtain high forage yield, it is suggested that sowing date 1st October with seeding rate 30 kg fad^{-1}. Second, to get maximum seed yield prefer using sowing date 15th November with seeding rate 12 kg fad^{-1}.

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الملخص العربي

تأثير مواعيد الزراعة ومعدلات التقاوي على انتاجية العلف الاخضر ومحصول البذرة للبرسيم الفحل

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أقيمت تجربتان حقليتان بمحطة البحوث الزراعيه بشندويل محافظة سوهاج خلال موسمي ٢٠٢١/٢٠٢٠، ٢٠٢٢/٢٠٢١ لدراسة تأثير مواعيد الزراعة (١ أكتوبر، ١٥أكتوبر، ١ نوفمبر، ١٥ نوفمبر، ١ ديسمبر) ومعدلات التقاوى (٢٠ كجم، ٢٥ كجم، ٣٠ كجم/ فدان) للحصول على اعلى إنتاجية محصول العلف الأخضر ومكوناته في البرسيم المصري وحيد الحشه فحل.وفى التجربه الثانيه كانت مواعيد الزراعة (١ نوفمبر، ١٥ نوفمبر، ١ ديسمبر، ١٥ ديسمبر، ١ يناير) مع معدلات تقاوي (١٢، ١٥، ١٨ كجم/ فدان) لإنتاج تقاوي البرسيم الفحل. استخدم تصميم القطاعات الكاملة العشوائيه في قطع منشقه مره واحدة في ثلاث مكررات لكل من التجربتين. لخصت النتائج فيما يلى: سجلت مواعيد الزراعة، ومعدلات التقاوى تأثيرا عالى المعنويه على محصول العلف الأخضر، الجاف، ارتفاع النبات، عدد الفروع/ نبات، نسبة أوراق/ سيقان اخضر وجاف، نسبة البروتين ونسبة الالياف في الموسمين والتحليل التجميعي لهما. كانت اعلى القيم لهذه الصفات عند ميعاد زراعة ١ أكتوبر بينما سجلت اقل القيم عند ميعاد زراعة ١ ديسمبر عدا نسبة الالياف أعطت اعلى القيم في ميعاد زراعة ١ ديسمبر بينما سجلت اقل القيم مع ميعاد زراعة ١ أكتوبر لكلا الموسمين والتحليل التجميعي لهما. سجلت اعلى القيم للصفات السابقة عند معدل تقاوي ٣٠ كجم/فدان عدا صفة نسبة الالياف حيث أعطت اعلى القيم عند معدل تقاوي ١٢ كجم/فدان. كان تأثير التفاعل بين مواعيد الزراعة ومعدلات التقاوى المختلفة عالى المعنوية لصفة المحصول الجاف فقط وغير معنولى لباقى الصفات الخضرية الأخرى لكلا الموسمين والتحليل التجميعي لهما. ** سجلت مواعيد الزراعة ومعدلات التقاوي لمحصول البذرة ومكوناته تأثير عالى المعنويه لكل من عدد الفروع/ نبات، عدد النورات/ نبات، عدد الازهار/ نورة، عدد البذور/نورة، نسبة عقد البذور، وزن الـ١٠٠٠ بذرة، محصول البذرة، محصول القش لكلا الموسمين والتحليل التجميعي لهما. أعطت اعلى إنتاجية لعدد السيقان/نبات، عدد النورات /نبات، عدد الازهار/ نورة، عدد البذور/نورة، نسبة عقد البذور، وزن الـ ١٠٠٠ بذرة، محصول البذرة، محصول القش عند الزراعة في ١٥ نوفمبر مع معدل تقاوي ١٥ كجم/فدان، أيضا محصول القش عند معدل تقاوى ١٨ كجم/ فدان. سجلت اقل القيم لعدد السيقان/نبات، عدد النورات/ نبات، عدد الازهار/ نورة، عدد الذور/نورة، نسبة عقد البذور، وزن ال١٠٠٠ بذرة، محصول البذرة، محصول القش عند الزراعة في ١ يناير مع معدل تقاوى ١٨ كجم/ فدان عدا صفة محصول القش بعدل تقاوى ١٢ كجم/فدان في البرسيم الفحل. أظهرت النتائج عدم وجود تأثير للتفاعل لمحصول البذرة ومكوناته لكلا الموسمين والتحليل التجميعى لهما. افضل المعاملات لإنتاج العلف الاخضر للبرسيم الفحل الزراعه فى بداية اكتوبر ومعدل تقاوى ٣٠كجم/فدان ولإنتاج البذرة الزراعة فى ١٥ نوفمبر ومعدل تقاوى ١٥ كجم/فدن تجت ظروف محافظة سوهاج.

الكلمات الإسترشادية: البرسيم الفحل، وحيد الحشه، ميعاد الزراعة، معدل التقاوى، محصول العلف والبذرة، الجودة.

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