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STUDIES ON MIXTURE FORAGE BETWEEN CLOVER AND BARLEY CROPS UNDER RAINFED CONDITIONS

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ABSTRACT

Two field experiments were carried out during the two successive growing seasons (2006/2007 and 2007/2008) at El.-hammam farm, Mersa Matrouh, Northern West Coast (NWC) of Egypt. This work was aimed to study the effect of supplementary irrigation treatments (rainfall, one and two supplementary irrigations) and mixture of seeding rates between barley and short life berseem, fahl var., (100% barley, 75% barley+25% berseem, 50% barley+50% berseem, 25% barley+75% berseem and 100% berseem), on fresh, dry forage yields and its components as will as water use efficiency (WUE).

The summarized results indicated that the highest value of fresh and dry yields (Ton/fed.) through the tow growing seasons were obtained from the two supplementary irrigations treatment. The mixture of seeding rates of 25% barley plus75% berseem produced the maximum values of fresh and dry forage yields. Two supplementary irrigations for the seeding rates mixture of 25% barley +75% berseem treatment gave the highest value of fresh and dry forage yields. However, WUE was recorded its maximum value from the interaction between rainfall and seeding rates mixture of 25% barley plus 75% be seem treatment in the two growing seasons. The reverse was true with the interaction between two supplementary irrigations and the same mixture of seeding rate (25% barley + 75% berssem) in the two growing seasons.

Keywords: mixture forage, barley, short life berseem (fahl), supplementary irrigation

INTRODUCTION

Due to low and insufficient rainfall as will as their erratic distribution, supplementary irrigation is the most critical limiting factor for growing any crop under rained conditions in Egypt. In this respect, many countries in WANA region were applied the supplementary irrigation to improve the productivity of the unit area. Moreover, the rainfed area of the North West Coast (NWC), in Egypt, are characterized by harsh agroecological conditions. The major constraint for cereal production under rainfed conditions in NWC region is unsufficient soil moisture content in the root zoon to meet crop water requirements. Sever water stress periods are very common and often coincide with the most sensitive growing stage of the most cereal crops. Therefor, if supplied water through supplemental irrigation applied in adequate amount and at suitable time can enhance crop yield potentiality. The amount and timing of supplementary irrigation are to provide enough water during the critical growing stage to ensure optimal crop yield in terms of yield per unit of water (Owies, 1997; Abu-Awwad and Thrashes, 2000 and Milady, 2006). Moreover, Abu-Awwad (1998) reported that supplemental irrigation through blocked –end furrows significantly increased yield of barley crop.

Mixed cropping is an important factor for self sustaining, low-in put agricultural system. In this regard, Adesogan *et al.* (2002) and Abo-Kresha *et al.*(1996) showed that fresh, dry forage yields and curd protein yield varied significantly with variation in mixture seeding system as compared with pure stand of berseem or barley. Sowing 75% berseem plus 25% barley ,50% berseem+50%barley and 25% berseem plus 75% barley gave more yield than pure stand of berseem. Where the components of the mixture were used the limiting resources more efficiency than that in pure stands, showing resource complementarily (Atis *et al*., 2012a). Cereal/forge legume mixture for forage have been a numerous advantages from increasing dry matter yield, enhanced forges quality, reducing fertilizer in puts, financial stability to the farmers up to sustainability of the agricultural system (Anil *et al*.,1998 and Jabber *et al*., 2011). Despite the advantages associated with mixing cropping system, their management is rather difficult than the sole cropping due to the differences in the agronomic practices of the component crops of the mixture .Differences in sowing time, fertilizer and water requirements, growth behavior phonology and harvesting time of manage the mixtures. Hence, the different ecological zones had been the subject of researcher (Carr *et al*.,1998; Ghanbari-bonjar and Lee, 2003;Tuna and Orak.2007 and Nader *et al*., 2010). However, Caballero *et al*. (1995) reported that in forage production system had a balanced composition of cereal and legume in final produce is quality. Also Ross et al., 2001 recorded that. Intercropping berseem clover with cereals had increased the berseem yield and quality of cereal forage. In this regard Hebernichit and Blake (1999) concluded that crop mixtures clearly have many advantages and are superior to monocultures, providing greater yield and quality, stability and better exploiting all the resources available through enhanced crop plasticity. In the same trend ,(Lithourgidis et al.,2011). In general sole crops required 1to18 %and 1to28% more area to produce dry matter similar to mixtures during first and second respectively. In the same trend.AL-Khateeb, et al,.(2001) ,found that the mixture of 75% Egyptian clover +25% barely or Oat were the suitable might be the recommended mixing fodder yield with best quality of mixture Also ,Moselhy (2001) studied agronomic practices that enhance the productivity of interpolated barley and saltbush (*A triplex nummular L.)* shrubs under rainfed conditions on the North West Coast of Egypt .In additions .They found that application of three supplemental irrigation times at different growth stage increased most of yield component and dry matter yield / fed. However, giving supplemental irrigation in two times gave the highest value of water use efficiency for dry matter yield productions. Also, in this receipt AL-Khateeb et al., (2004) recorded that the increase of irrigation weekly resulted in the highest fresh and dry forage yield, and the dry fodder yield of the Egyptian clover and barley mixture decreased with exposure of mixture plants to drought, increasing. With prolonging the irrigation period, increased the irrigation period from 7 to 14 day and 21 days were associated with more reduction in dry forage yield in the two seasons.

In addition, Nor EL-Din *et al*. (1984) reported that the yield of berseem and barley mixture were higher than yield of legume or grass in pure stand, EL-Hattab *et al*. (1982) found that berseem- barley mixture was superior in green and dry forage yield than mixture –ryegrass,inclouding wheat or-oats.

Also, Sarhan (1987) found that seeding a mixture of 75% berseem plus 25% barley gave the maximum fresh yield, Abo-Kresha *et al*. (1996) showed that fresh and dry forage yield and crude protein yield varied significantly with variation in mixture seeding system as compared with berseem or barley ,sowing 75% berseem plus 25% barley ,50% berseem plus 50% barley and 25% berseem plus 75% barley gave more yield berseem with 21.36 and 13% increase for fresh yield 15.43 and 21.10 for dry yield for the same respective treatments. Therefore, this study was aimed to investigate the response of forage fresh, dry, mixture yield each of short life berseem (fall, Giza cv. 1) and barley cv Giza 126) and WUE to supplemental irrigation and mixing portions each of berseem and barley under Northern West Coastal Zone of Egypt El-Hammam region.

MATERIALS AND METHODS

Two field experiments were carried out during the two successive growing seasons (2006/2007and2007/2008), at EL-Hammam region, Mersa Matrouh Governorate, North West Coast of Egypt. These experiments were conducted to study the effect of supplementary irrigation and different mixture seeding rates of barley and berseem forage crops as well as WUE. Each experiment were included 15 treatments which were combination between three irrigation treatments and five seeding rates of the mixture as following:

A- Supplementary irrigation treatments:

1- Rainfall.
2- One supplementary irrigation (189m^3/fed.).
3- Two supplemental irrigations (378m^3/fed.).

Each Supplementary irrigation treatments were irrigated by 189m^3/fed. during sowing dates at 15 November in both seasons, plus rainfall (99.5 and 98.9 mm in the 1st and 2nd growing seasons, respectively.

B- Mixture seeding rates of berseem and barley crops:

1-100% of the recommended seeding rate of Giza 126 barley cv. (15 Kg/Fed.).
2- 75% of recommended seeding rate of barley +25% of the recommended seeding rate of berseem.
3-50% of the recommended seeding rate of barley +50% of the recommended seedind rate of berseem.
4- 25% of recommended seeding rate of barley + 75% of the recommended seeding rate of berseem berseem.
5- 100% of the recommended seeding rate of short life berseem, fahl, Giza 1 var. (25 Kg/Fed.).

The experimental unit area was 10.5m^2 (3.5m x 3 m). Seed bed for the experimental field areas was well prepared through two perpendiculars plowing, residual of the previous crops and weeds were removed and perfect leveling. During soil preparation, 10m^3compost and 150 Kg super phosphate (15.5% P_2O_5) per feddan were added.

After seed bed preparation, seeding rate of the mixtures were broadcosted and then irrigated by 189 m^3/fed., as sowing irrigation at 15th

Nov. in two growing seasons. However, the 1st and 2nd supplementary irrigations were added at 30 Nov. and Dec., respectively in the two growing seasons. The used water of sowing and supplementary irrigations was saline ground water (ranged from 2000 to2500 ppm) pumped from the local well. Supply water irrigations were added by gated pipe distribution system and the irrigation water quantities measured by flow meter irrigation. The rainfall precipitation amount was 99.5 and 98.9mm in the 1st and 2nd gorwing seasons, respectively.

Soil analysis:

Soil texture was loamy sand in two growing seasons. Chemical properties of the experimental soil area in the two growing seasons was shown in Table (1).

Table (1): Chemical properties of the experimental soil area in the two growing seasons of 2006/2007and 2007/2008:

Sampling depth (cm)	ph	E.C dam 1	Na	K	Ca	Mg	Hco3	Cl	SO4	CO3
2006/2007										
0-15	7.67	0.60	3.35	0.65	0.50	1.25	0.54	4.16	1.10	---
15-30	7.72	0.62	3.24	0.58	0.58	1.19	0.53	4.08	0.85	---
2007/2008										
0-15	7.40	0.92	2.00	0.67	4.62	1.83	.086	7.20	1.00	---
15-30	7.30	0.87	2.03	0.74	0.47	1.73	0.84	7.32	1.03	---

Meteorological data of temperature, dew point and relative humidity which were obtained from the Egyptian Metrological Authority, Agricultural Research Center during the two growing seasons 2006/2007 and 2007/2008 as shown inTable (2).

Table (2): Meteorological parameters* of the experimental site (EL-Hamm am area, Matrouh) during the two studied seasons (2006/2007and 2007/2008).

Month	Temp(c)			Dew point ((mm)			Humidity	
2006/2007								
	Mine	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.
Nov.	16.7	20.1	18.40	8.30	11.20	9.75	50.3	63.7
Dec.	12.3	15.6	13.95	5.00	10.8	7.9	54.7	67.7
Jan.	10.5	18.2	14.35	4.10	10.4	7.25	59.7	69.7
Feb.	10.6	18.5	14.55	5.10	11.7	8.40	57.0	69.7
March.	12.00	20.9	16.45	5.9	12.4	9.15	58.7	67.0
April.	13.7	20.8	17.25	9.00	12.9	10.95	49.0	68.7
May.	17.6	26.0	21.8	7.3	17.3	12.30	59.3	68.7
2007-2008								
Nov.	13.9	24.6	19.25	7.2	15.6	11.4	55.0	63.0
Dec.	10.7	20.2	15.45	6.3	11.1	8.7	53.3	64.0
Jan.	10.1	17.1	13.60	7.2	9.9	8.55	63.7	78.2
Feb.	9.6	17.2	13.4	6.1	8.9	7.5	61.9	76.2
March	12.4	23.0	17.7	5.5	11.4	8.45	57.7	75.2
April.	16.2	24.3	19.15	7.9	12.4	10.15	53.0	70.4
May.	16.2	125.5	20.85	11.9	15.7	13.8	56.4	71.7

***Source: Egyptian Meteorological Authority, Cairo Egypt.**

Yield and its component:

1-No. of branches of berseem/m^2.
2-No. of fertility branches of berseem/m^2.
3-Plant height of berseem (cm) .
4-Fresh yield of berseem (Ton/fed.).
5-Forage yield (Ton/fed).
6-Plant height of barley (cm).
7-No. of tillers/m^2 of barley.
8-No. of fertility tillers/m^2 of barley.
9-Fresh yield of barley (Ton/fed.).
10-Fresh yield of mixture forage (Ton/fed.).
11-Dry yield of mixture forage (Ton/fed.).

$$12\text{- WUE} = \frac{\text{Fresh and dry yield of mixture forage (kg)}}{\text{amount of total water received (m}^3\text{/fed.)}}$$

Statistical analysis:

The experiments were arranged in split plot design with three replicates.

Irrigation treatments were occupied the main plots, while the subplots were assigned with seeding rate mixture. The statistical analysis were done according to Nedcor and Cochran(1980) .The L.S.D Test at 5% significance level was used to compare the differences between means value.

RESULTS AND DISCUSSION

1. Effect of the supplementary irrigation on the berseem forage yield and its components of the forage mixture:

Results in Table (3) indicated that fresh forage yield of berseem and its components were significantly affected by supplementary irrigation in two growing seasons. The highest values of the studied characters, i.e. plant height (cm), No. of branches/m^2, No. of fertility branches/m^2 and fresh yield (Ton/fed.) of berseem were obtained from two supplementary irrigations in both seasons. Moreover, results cleared that fresh forage yield of berseem was increased significantly with increasing supplementary irrigation in two growing seasons. These results may be due to insignificant and/or significant increase in one or more yield components, i.e. plant height (cm), No. of branches and No. of fertility branche/m^2 of berseem plants. These results were in harmony with those obtained by Owies (1997); Abu-Awwad and Kharabsheh (2000) and Milady (2006). Moreover, Abu-Awwad (1998) reported that supplementary irrigation through blocked end furrows significantly increased yield of barley crop.

Table (3): Effect of supplementary irrigation on yield and its components of berseem in the forage mixture in two growing seasons (2006/2007 and 2007/2008).

Supplementary irrigation treatments	Plant height (cm)	No. of branches/m^2	No. of fertility branches/m^2	Fresh yield (ton/fed.)
2006/2007				
Rainfall	63.3	677.97	79.12	15.92
One irrigation	69.3	817.22	80.84	18.45
Two irrigations	73.4	955.33	96.17	19.31
LSD (5%) level	9.55	57.21	7.33	1.25
2007/2008				
Rainfall	68.84	736.93	86.00	16.76
One irrigation	75.33	884.80	87.87	20.05
Two irrigations	79.83	1038.4	104.53	20.99
LSD (5%) level	10.38	62.19	7.97	1.36

2-Effect of mixture seeding rates on berseem forage yield and its components:

It is clear that, from data in Table (4), No. of branches, fertility branches per m^2 and forage yield were decreased significantly with decreasing seeding rates of berseem. However, plant ht. did not affected significantly by seeding rates in the two growing seasons. Results are in harmony with those obtained by EL-Karamany *et al.,* (2009), Blaser *et al.,* (2007), and Hussein and EL-Latif (1982). In this respect, Hassan *et al*. (2014) reported that a noticable depression effect on the companion fresh and dry forage yields of alfalfa was detected with increasing wheat sowing rates from 0 (as pure stand of alfalfa crop) to the highest seeding rate of 60 Kg/fed. intercropped with alfalfa crop.

Table (4): Effect of the seeding rates of the mixture on berseem forage yield and its components (2006/2007and 2007/2008 growing seasons)

Mixture seeding rates treatments	Plant height(cm)	No. of branches/m^2	No of fertility branches/m^2	Fresh yield of berseem (ton/fed)
2006/2007				
100% berseem	86.02	1355.16	160.08	28.538
75% barley+25%berseem	89.8	761.76	58.512	17.673
50%barley+50%berseem	84.87	886.88	87.952	19.946
25%barley++75%berseem	90.99	1075.48	115.48	22.438
LSD (5%) level	7.81	78.51	11.021	1.564
2007/2008				
100%berseem	93.5	1473.00	174.00	31.02
75% barley+25%berseem	97.6	828.00	63.3	19.21
50% barley+50%berseem	92.25	964.00	95.6	21.68
25%barley+75%berseem	98.90	1169.00	126.00	24.39
LSD (5%) level	8.49	85.34	11.98	1.7

3-Effect of the interaction between supplementary irrigation and mixture seeding rates on berseem forage yield and its components:

Results recorded in the Table (5) show that the effect of the interaction between supplementary irrigation and mixture seeding rates of berseem and barley crops on plant ht., No. of branches/m2, No. of fertitly branches/m2, and fresh forage yield of berseem. The maximum value of fresh forage yield was obtained from two supplementary irrigations and berseem (100%) as sole crop in two growing seasons. These results may be attributed to the highest value of No. of branches/m2 as well as the higher values of plant ht. in two growing seasons. Results are in harmony with obtained by AL-Khateeb 2004).

Table (5): Effect of the interaction between supplementary irrigation and mixture seeding rates..

Treatments	Plant ht. (cm)	No. of pranches/m^2	No. of fertility pranches/m^2	Fresh yield of berseem (ton/fed)
2006/2007				
1* +100% berseem	81.2	1121.5	150.00	22.57
75%barley+25%berseem	83.3	639.74	57.00	22.57
50%barley+50%berseem	77.6	775.6	63.00	17.37
25%barley+75%berseem	74.6	855.00	109.00	19.75
1**+100%berseem	88.20	1306.4	14.00	29.2
75%barley+25%berseem	89.90	834.00	64.00	18.57
50%barley+50%berseem	85.3	836.00	85.00	21.77
25%barley+75%berseem	83.2	1093.00	113.00	22.67
1***+100%berseem	88.8	1638.00	190.00	33.89
75%barley+25%berseem	96.3	811.00	54.00	16.98
50%barley+50%berseem	91.7	1050.00	99.00	20.78
25%barley+75%berseem	90.4	1278.00	126.00	24.90
LSD (5%) level	13.5	135.9	19.09	2.71
2007/2008				
1*+100%berseem	88.3	1219.00	163.00	24.47
75%barley+25%bersee	90.5	695.00	62.00	18.94
50%barley+50%berseem	84.3	843.00	68.700	18.85
25%barley+75%berseem	81.1	929.00	118.00	21.45
1**+100%berseem	95.8	1420.0	155.00	31.79
75%barley+25%berseem	97.7	907.00	69.30	20.25
50%barley+50%berses	92.7	909.00	92.00	23.63
25%barley+75%berseem	90.4	1188.0	123.00	24.58
1***+100%berseem	96.5	1780.0	206.00	36.81
75%barley+25%berseem	104.7	881.00	59.00	18.44
50%barley+50%berseem	99.7	1141.0	108.00	22.55
25%barley+75%berseem	98.	1389.0	137.00	27.01
LSD (5%) level	14.7	147.81	147.81	2.95

1*rainfall+ planting irrigation -1rainfall+ planting irrigation (45mm/fed) + one supplemental irrigation (45mm/fed)**

1*rainfall + planting irrigation (45mm/fed) +two supplemental irrigation (2x45mm/fed)**

4. Effect of the supplementary irrigation on the barley forage yield and its components of the forage mixture:

The recorded results in Table (6) showed that plant height, number of tiller/m^2, number of fertility tillers/m^2 and the fresh yield of barley (Ton/fed.) were significantly affected by the supplementary irrigation treatments. The highest value of the abovementioned traits were obtained by using two supplementary irrigations during the two growing seasons. However, the differences of forage yield and its attributes of barley crop did not reach a significant level in two seasons. On the other hand, the lower values of barley forage yield and its attributes were obtained from rainfall or one supplementary irrigation treatments in two growing seasons. These results are in harmony with those obtained by Owies (1997); AL-Khateeb (2004) and EL-Khateeb *et al*. (2001).

Table (6): The effect of the supplemental irrigation on barley yield and its component in the mixture forage at growing seasons (2006/2007and /2007/2008

Supplementary irrigation treatments	Plant height (cm)	No. of tillers/m^2	No. of ferity tillers/m^2	Fresh yield (ton/fed)
2006/2007				
Rainfall	93.3	135.7	114.00	3.89
One irrigation	91.58	162.3	146.3	4.33
Two irrigations	101.63	297.7	287.00	11.12
LSD (5%) level	8.27	30.28	32.7	0.94
2007/2008				
Rainfall	85.84	124.84	104.88	3.57
One irrigation	84.25	149.32	134.6	3.98
Two irrigations	93.5	273.88	264.04	10.23
LSD (5%) level	7.6	27.86	30.08	0.86

5-Effect of mixture seeding rates on barley forage yield and its components:

Results in Table (7) showed that the studied characters were significantly affected by mixture seeding rates of berseem and barley in both seasons. These results indicated that the highest value of plant height of barley plants was obtained by mixing seeding rates of 75% barley plus 25% berseem.Whereas, the highest number of tillers/m^2, number of fertility tillers/m^2 and barley forage yield were obtained by seeding rate of 100% barley in both seasons. The lowest value of barley forage yield and yield attributes were obtained from mixture seeding rates of 25% barley plus 75% berseem in both seasons. These results are in harmony with those obtained by EL-Khateeb *et al*. (2004), who reported that the best dry matter percentage was recorded from 25% clover plus 75% barley. Moreover, Atis *et al*. (2012a) and Sarhan (1987) revealed that seeding rates of 75% berseem plus 25% barley gave the maximum fresh forage yield.

Table (7): Effect of mixture seeding rates on barley forage yield and its components during 2006/2007and 2007/2008 growing seasons.

Mixture seeding rates treatments	Plant height (cm)	No. of tillers/m^2	No. of fertility tillers/m^2	Fresh yield (ton/fed.)
2006/2007				
100% barley	87.00	492.0	473.4	18.86
75% barley +25%berseem	93.30	215.8	196.2	6.05
50%barley+ 50% berseem	88.00	181.4	170.2	5.95
25% barley + 75% berseem	85.70	156.2	142.3	5.66
LSD (5%) level	6.18	19.34	24.17	1.17
2007/2008				
100% barley	93.60	529.00	509.00	20.28
75% barley +25%berseem	101.00	232.00	211.00	6.50
50%barley+ 50% berseem	94.60	195.00	183.00	6.40
25% barley + 75% berseem	92.20	168.00	153.00	6.09
LSD (5%) level	6.65	20.80	25.99	1.260

6-Effect of the interaction between supplementary irrigation and mixture seeding rates on barley forage yield and its components:

Results in the Table (8) showed that the forage yield of barley and its components were significantly affected by the interaction between supplementary irrigation and mixture seeding rates of berseem and barley crops during the two seasons. The interaction between supplementary irrigation and mixture seeding rates had a significant effect on plant height, number of tillers/m^2, number of fertility tillers/m^2, and forage yield of barley plants in the two growing seasons. The highest values of the most yield attributes were recorded by adding two supplementary irrigations with seeding rates of 100% barley, as pure stand, in two growing seasons. However , the lowest value of plant height was obtained from rainfall treatment with seeding rate of 100% barley in two growing seasons. While, this was true for No. of tillers and fertility tillers of barley plnt per/m^2 in two growing seasons with rainfall and mixture seeding rates of 25% barley plus75% berseem. The lowest values of barley forage yield (ton/fed.) was obtained from rainfall and seeding rates of 75% barley plus 25% berseem in the 1st growing season, and seeding rate of 25% barley plus 75% berseem in the 2nd one.

Table (8): Effect of the interaction between supplemental irrigation and mixture seeding rates berseem and barley on fresh yield of barley and its components in two growing seasons (2006/2007and2007/2008).

Treatments	Plant height(cm)	No. of tiller /m^{2}of barley	No. of fertility tiller/m^2 of barley	Fresh yield of barley (ton/fed)
2006/2007				
Rainfall+(100% barley)	80.2	406.4	376.4	15.03
Rainfall +(75%barley+25% berseem)	94.6	151.6	119.0	3.19
Rainfall +(50%barley+50% berseem)	85.80	127.4	110.70	4.015
Rainfall +(25%barley+75% berseem)	82.4	99.5	88.4	3.50
One irrig.+(100% barley)	82.3	428.7	467.8	19.64
One irrig.+(75%barley+25% berseem)	88.4	183.2	168.3	4.21
One irrig.+(50%barley+50% berseem)	87.4	147.9	134.9	3.69
One irrig.+(25%barley+75% berseem)	82.6	121.8	105.1	4.17
Tw o irrig.+(100% barley)	98.7	586.8	575.7	21.91
Tw o irrig.+(75%barley+25% berseem)	100.0	313.4	302.3	10.71
Tw o irrig.+(50%barley+50% berseem)	90.7	268.8	256.1	10.96
Tw o irrig.+(25%barley+75% berseem)	89.6	248.3	233.4	9.24
LSD (5%) level		33.51	41.87	2.03
2007/2008				
Rainfall+(100% barley)	86.20	519.0	503.0	20.12
Rainfall +(75%barley+25% berseem)	101.5	163.0	128.0	4.53
Rainfall +(50%barley+50% berseem)	92.3	137.0	119.0	4.46
Rainfall +(25%barley+75% berseem)	89.4	107.0	95.0	3.79
One irrig.+(100% barley)	88.5	519.0	503.0	21.12
One irrig.+(75%barley+25% berseem)	95.00	197.0	181.0	4.53
One irrig.+(50%barley+50% berseem)	94.00	159.0	145.0	3.97
One irrig.+(25%barley+75% berseem)	88.8	131.0	113.0	4.48
Tw o irrig.+(100% barley)	106.1	631.0	503.0	23.56
Tw o irrig.+(75%barley+25% berseem)	105.4	337.0	325.0	11.79
Tw o irrig.+(50%barley+50% berseem)	97.5	289.0	285.0	11.52
Tw o irrig.+(25%barley+75% berseem)	97.5	267.0	251.0	9.94
LSD (5%) level	11.52	36.03	45.02	2.18

7- Effect of interaction between supplementary irrigation and mixture seeding rates on total fresh forage yield (Ton/fed.) and water use efficiency:

Results in Table (9) showed a significant effect of the interaction between supplementary irrigation and mixture seeding rates of berseem and barley forage crops on total fresh forage yield (Ton/fed.) and WUE (Kg fodder yield/mm rainfall). The interaction between two supplementary irrigations with mixture seeding rates of 75% berseem plus 25% barley recorded the heaviest value of total fresh forage yield in two growing seasons. While the lowest value was noticed by rainfall with seeding rate of 100% barley in the two growing seasons.

Concerning WUE, mixture seeding rates of 25% barley plus 75% berseem with rainfall produced the highest value of WUE in two seasons. However, the reverse was true for seeding rate of 100% barley with rainfall treatment as shown in the same Table (9). This means that mixture seeding rates of 25% barley plus 75% berseem under rainfall was more efficient in WUE than the other treatments. In other words, increasing water supply reduced WUE. Wheraes total forage yield was increased with increasing water supply irrespective mixture seeding rates. In this respect, Owies (1997) and Abu-Awwad and Kharabsheh (2000) reported that the amount of supplementary irrigation could be suitable to provide enough water during the critical growth stage of cereal crops to ensure optimal crop yield supply. These in terms of yield per unit of water supply. Similar findings were observed by Singh and Kumar (1981).

Table (9): Effect of the interaction between supplementary irrigation and mixture seeding rates on total fresh forage yield (Ton/fed.) and water use efficiency during 2006/2007and 2007/2008 growing seasons.

Irrigation treatments	Mixture seeding rates				
	100% Barley	100% Berseem	75%barley +25% berseem	50%barley +50% berseem	25%barley +75% berseem
2006/2007					
Rainfall: Yield (kg/fed.)	14.16	21.45	19.60	20.24	22.12
WUE	26.48	40.23	36.87	38.32	41.49
One irrigation: Yield (kg/fed.)	18.50	27.85	22.94	24.18	25.47
WUE	25.62	38.58	31.87	33.49	35.27
Two irrigations: Yield (kg/fed.)	20.64	32.28	26.25	30.37	32.37
WUE	22.66	25.45	28.81	33.41	35.54
LSD (5%) level			3.045		
2007/2008					
Rainfall: Yield (kg/fed.)	15.39	23.31	21.31	22.20	24.04
WUE	28.78	43.73	39.98	41.65	45.10
One irrigation: Yield (kg/fed.)	20.11	30.27	24.94	26.28	27.68
WUE	27.85	41.93	34.54	36.40	38.34
Two irrigations: Yield (kg/fed.)	22.44	35.06	28.53	33.08	35.19
WUE	24.63	38.49	31.32	36.31	38.63
LSD (5%) level			3.31		

8- Effect of the interaction between supplementary irrigation and mixture seeding rates on total dry yield (Ton/fed) and water use efficiency:

Results in Table (10) showed that dry forage yield of barley and berseem mixtures were significantly affected by the interaction between supplementary irrigation and different seeding rates of the mixture. The maximum of total dry forage yield (7.68 and 8.06 Ton/fed. in the 1st and 2nd growing seasons, respectively) were obtained by the interaction of two supplementary irrigation and mixture seeding rates of 25% barley + 75% berseem. However, the minimum vaule of total dry fodder yield was produced from the interaction between rainfall and pure stand of barley plants (100%) in the two growing seasons.

Regarding WUE, the mixture seeding rate of 25% barley pluse 75% berseem with two supplementary irrigations gave the highest value in two growing seasons. Whereas, barley, as pure stand (100%), with two supplementary irrigations produced the minimum value of WUE in two growing seasons. Generally, a gradually increase in total dry forage yield, of the most mixture seeding rates, was noticed with increasing supplementary irrigations from rainfall up to two supplementary irrigations. While, increasing supplementary irrigation did not gave the obvious trend for WUE in two growing seasons. These results were in harmony with those obtained by Sarhan (1987), Abo-Kresha *et al*. (1996) and Nor EL-Din *et al*. (1984).

Table (10): Effect of the interaction between supplementary irrigation and mixture seeding rates on total dry fodder yield (Ton/fed.) and water use efficiency during 2006/2007and 2007/2008 growing seasons.

Irrigation treatments	Mixture seeding rates				
	100% barley	100% berseem	75%barl +25% berseem	50%barl +50% berseem	25%barley +75% berseem
	2006/2007				
Rainfall: Yield (kg/fed.)	3.40	3.68	3.92	3.87	3.67
WUE	6.34	7.06	6.97	7.32	7.65
One irrigation: Yield (kg/fed.)	4.53	5.78	4.68	5.46	4.87
WUE	6.27	7.87	6.54	7.45	6.87
Two irrigations: Yield (kg/fed.)	4.43	6.54	6.54	6.53	7.68
WUE	4.86	7.85	6.87	6.94	7.96
LSD (5%) level	0.441				
	2007/2008				
Rainfall: Yield (kg/fed.)	3.75	4.18	4.12	4.19	4.05
WUE	7.04	7.84	7.73	7.86	7.60
One irrigation: Yield (kg/fed.)	5.03	6.31	5.10	5.83	5.35
WUE	6.97	8.74	7.06	8.07	7.41
Two irrigations: Yield (kg/fed.)	4.92	7.11	6.92	7.01	8.06
WUE	5.4	7.80	7.60	7.69	8.85
LSD (5%) level	0.49				

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دراسات على المخاليط العلفية بين البرسيم والشعير تحت ظروف الزراعة المطرية

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اقيمت تجربتان حقليتان بمنطقة الحمام بمحافظة مطروح بالساحل الشمالى الغربى لمصر خلال الموسمين الزراعيين ٢٠٠٦/ ٢٠٠٧ & ٢٠٠٧/٢٠٠٨ لدراسة تاثير الرى التكميلى ونسب الخلطات العلفية بين البرسيم الفحل والشعير (مطرى فقط+ رية الزراعة (٤٥مم/ فدان) ،مطرى + رية الزراعة + رية تكميلية (٤٥مم/ فدان) ،مطرى + رية الزراعة + عدد ٢ رية تكميلية (٢x ٤٥مم/فدان) ، ونسب الخلطات العلفية بين البرسيم الفحل والشعير (١٠٠% برسيم ، ١٠٠% شعير) ، ٧٥%برسيم + ٢٥% شعير،٥٠% برسيم + ٥٠% شعير ، ٢٥% برسيم + ٧٥% شعير) على المحصول العلفى للفدان ومكوناتة لكل من البرسيم والشعير ومكوناتة وكذلك المحصول البيولوجى العلفى الغض والجاف للخلطات العلفية بالفدان بالاضافة الى تقدير كفاءة استخدام المياة الرى خلال الموسمين وتلخيص النتائج المتحصل عليها كالاتى :

١- اشارت النتائج الى استجابة معنوية بصفة عامة خلال موسمى الدراسة لمحصول البرسيم والشعير ومكونات المحصول وكذلك المحصول البيولوجى الغض والجاف وايضا كفاءة استخدام مياة الرى ونسب الخلط والتفاعل بينهما

٢-اوضحت النتائج ان اعلى القيم للمحصول الغض للبرسيم باستخدام معاملات الرى (٢٠.٩٩&١٩.٣١ طن/فدان) خلال الموسم الثانى والاول على التولى باستخدام ريتين تكميليتين ، ونفس الاتجاة تحصل علية باستخدام معاملة الخلط حيث تحصل على اعلى محصول للبرسيم الغض (٢٤.٣٩&٢٢.٤٤طن/فدان) خلال الموسم الثانى والاول على التوالى باستخدام نسب الخاط ٧٥% برسيم + ٢٥%شعير وكذلك اظهرت النتائج ان معاملة التفاعل (٧٥%برسيم +٢٥% شعير) xاضافة ريتين تكميليتين الى المحصول على اعلى محصول غض للبرسيم (٢٧.٠١&٢٤.٩طن/فدان) للموسم الثانى والاول على التوالى

٣- اظهرت النتائج استجابة محصول الشعيرومكوناتة معنويا باستخدام معاملات الرى ونسب الخلط بين البرسيم والشعير والتفاعل بينهما وان اعلى محصول غض للشعير (١١.١٢&١٠.٢٣طن /فدان) خلال الموسم الاول والثانى على التوالى باستخدام ريتين تكميليتين ، وكذلك كان لاستخدام معاملة ٧٥%شعير +٢٥%برسيم اكبر الاثر فى الحصول على اعلى محصول غض للشعير (٦.٥&٦.٠٥طن/فدان) خلال الموسم الثانى والاول على التوالى وقد وصل المحصول الغض للشعير لاعلى القيم (١١.٧٩&طن/فدان١٠.٧١) باستخدام معاملة التفاعل (ريتين تكميليتين X٧٥% شعير + ٢٥% برسيم) خلال الموسم الثانى والاول على التوالى

٤- اشارت النتائج ان المحصول البيولوجى الغض وصل اقصاة (٣٥.١٩&٣٢.٣٧طن /فدان) خلال الموسم الثانى والاول على التوالى باستخدام معاملة التفاعل (ريتين تكميليتين x٧٥% برسيم + ٢٥%شعير) بينما وصلت كفاءة استخدام المياة الرى الى اقصاها (٤١.٤٩&٤٥.١٠كجم/م٣) باستخدام معاملة التفاعل (رى مطرى فقط x٧٥%برسيم + ٢٥شعير%)خلال الموسم الاول والثانى على التوالى

٥-اوضحت النتائج ان المحصول البيولوجى الجاف وصل اقصاة (٨.٠٦&٧.٦٨طن/فدان)باستخدام معاملة التفاعل (ريتين تكميليتين x٧٥%برسيم + ٢٥% شعير) خلال الموسم الثانى والاول على التوالى ايضا نفس المعاملة ادت الى الحصول على اعلى القيم (٨.٨٥ & ٧.٩٦ كجم/ م٣) خلال الموسم الثانى والاول على التوالى