Effect of intercropping clover with wheat on grain yield and their fodder production on dairy goats performance

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Abstract

This study was conducted to study the effect of Cropping systems compared were mono-cropping of wheat (W), Eg clover (C), and intercropping of both crops(CW) on grain yield , fodder dry matter yield, fodder nutritive value an yield and composition. The first cut of at the level of 15 cm from the land level at 69 days after sowing to evalua systems in providing animal feeds in early stage of crops and preserved as a silage (clover silage (CS) , wheat silage or wheat & clover mixture silage (CWS) and tested them as fodder, silage was open after 45 days. All crops (C, W CW), were left after the first cut up to the harvest. Sixteen lactating goats live body weight 41± 1.3kg were divide four groups, (4 dairy goats per group) through replacing clover hay with one of different kind of silages as foll rations, 1)the first group receive, concentrate feed mixture CFM with clover hay as control group (R1), Second CFM with clover silage (R2) , third ration, consists of CFM concentrate with wheat silage (R3) and fourth conce with wheat with clover mixture silage (R4) experiment lasted for 90 days. Data collected , indicated that intercro significantly (P<0.01) yielded more fodder than mono cropping (27%) but slightly depressed grain yields compa mono wheat cropping. The nutritive value for clover silage (CS) mono cropping as (CP) was significantly (P< higher than intercropping. Meanwhile, NDF and dry matter degradability) of the intercropping fodder was signifi (P≥ 0.05) higher as compare with wheat mono cropping. However, intercropping colver with wheat silage, ger resulted in fodder with lower NDF and higher dry matter degradability than mono cropping fodder. The lowe matter intake (DMI) were recorded with (R1) ration, but there were no significant differences between silage groups main results showed that goats fed ration with (CWS) recorded highest (P<0.01) average daily milk yield (AD Meanwhile the lowest value of milk yield was recorded with (CH) group (R1). The animal fed R4 ration had the h feed effeiciency followed by R2 ration. While R3 recorded the lowest value of feed efficiency..In concl intercropping fodder between wheat and clover increase fodder dry matter yield, without a significant effect on grai and on the mean time, replacement (CH) with (CWS) increase significantly, average daily milk yield, and w significant effect on milk composition.

Keywords : Intercropping, wheat, clover, grain yield, dry matter intake, average milk yield and milk composition.

Introduction

In Egypt, the agricultural land area is about 7.2 million feddan (1 feddan = 0.42 ha), it is only 3 percent of th land area(Sherif, 1997). The entire cultivation area is irrigated except for some rain-fed areas on the Mediter coast.Because Egypt is located in arid climate area, and with an annual average rainfall ranging from 60~190 mm Mediterranean sea coast area to 25~60mm at the Nile delta area, and less than 25 mm in upper Egypt. Food produc the Nile delta has supported Egyptian daily life for long time (Hamdan, 2000). During the same period, the r population growth has increased at a slightly higher rate than the increase in agricultural crop production (Sherif, Therefore it was desired the increase of the agricultural production in the limited agricultural field under the limited resources in Egypt. Egyptian clover, berseem is the major winter forage crop cultivated in the Nile Valley and Berseem is cultivated on about 1.2 million feddans, while wheat is cultivated on about 6 million feddans.

The objective of the present study was to evaluate the intercropping farming system for both human food and anima analyzean effective usage of field by the intercropping of wheat and berseem and their effect on fodder dry yield, fodder nutritive value and dairy goats performance.

Materials and Methods

The field experiment was conducted in the experimental field of Sakha Research Station, Agricultural Research Cer Arab Republic of Egypt. The soil is classified as Vertisols. The bulk density of the soil in the experimental field r from 1.54 to 1.73 gcm^{-3} in 0 to 80 cm deep from the soil surface. Three different crop combinations, wheat monoc (WM), Egyptian clover monoculture (CM) and wheat and clover intercropping (WCI), were compared. Each treatme 3 replications (3 combination of crops) in total 9 plots, and arranged by complete randomized block design v replications. Wheat for both mono-cropping and intercropping were drilling in rows with 20 cm of row-width, seeding rate of 40 kg seeds/feddan. Berseem for mono cropping were broadcasting by hand, at the seeding rate kg/feddan. Meanwhile, Berseem for intercropping were broadcasting by hand, at the seeding rate of 12.5 kg/fedda crops (C, W and CW), were left after the first cut up to the harvest.

Feeding Triale

Sixteen lactating goats live body weight 41+ 1.3kg were divided into four groups, (4 dairy goats per group) th replacing clover hay with one ifferent kind of silages as following rations, 1) the first group received, concentrate mixture CFM,(to cover 50% of protein and energy requirements) with clover hay as control group (R1), Second

CFM with wheat silage (R2) , third ration, consists of CFM concentrate with .Clover silage (R3) and fourth conce with wheat & clover mixture silage (R4) experiment lasted for 90 days. Animals were fed twice daily at 8.00 and 1 clean drinking water was offered to the animals twice daily. Representative samples of different feed ingradients analysed according to A.O.A(9) Milk yield was measured individually one day biweekly through whole experi period . Does were completely hand milked till stripping the udder one mutual meal (morning and evening) daily th two successive days through during milking period. Feed efficiency and economical efficiency of tested diet calculated and expressed in terms of DM (kg), TDN (kg) and DCP (g) required to produce one kg of milk. Feeding tr **were statistically analyzed by using the statistical program according to SAS (2004).** The significance of the **different treatment were analyzed by** Tukey method using software of Statistix 9 (Analytical Co.).

Results and Discussion

Biological yield

Data of yield components for different treatment are presented at Table (1). The final biological yield of wheat decreased after the 1st cut more when intercropped with Egyptian clover.

Table 1. Yield components of wheat and Egyptian clover

Cropping method	Cutting treatment	Wheat				Egyptian Clover	
		Biological yield	Grain No	1000-grain wt [z]	Grain yield [z]	Plant Length	Biological yield
		--- t ha^{-1} --	--- m^{-2} --	--- g ---	--- t ha^{-1} --	-Cm-	--- t ha^{-1} --
Monocultured	No cut	18.9	9370	54.4	5.0	136.4	30.7
	Cut	11.6	10359	35.2	3.6	134.1	16.9
Intercropping	No cut	10.1	8797	50.3	4.4	122.3	8.9
	Cut	4.8	8711	33.7	2.9	136.4	8.5
Cropping method		n.s.	n.s.	n.s.	n.s.	n.s.	*
Cutting treatment		**	n.s.	**	**	n.s.	**
Cropping Cutting		n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

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While, the final biological yield of Egyptian clover was less affected by cutting treatment when intercropped. In case of wheat it was reduced by 47% (18.9 t to 11.3 t ha^{-1}). In case of Egyptian clover it was reduce by 71%. This reduction rate in biological yield of Egyptian clover was more than the difference in seeding rates between mono (86 kg ha^{-1}) and intercropping (43 kg ha^{-1}). All the yield components of wheat were affected by cutting treatment. The grain number was greatly affected by cutting treatment with 57% reduction in monocultured plots. The 1000-grain weight also had influenced the grain yield. As a result, the cutting treatment reduced grain yield of wheat by 28% in monocultured plot, and by 34% in intercropping plot. Although it was not statistically significant, the grain yield and yield components of wheat had a consistent trend to be suppressed by intercropping with Egyptian clover.These results are in harmony with El-Shatnawi et al., (1999) and Lithourgidis et al., (2007) who reported that reported that clipping barley at tillering stage did not affect the final production but clipping to 5 and 10 cm above soil surface at booting stage reduced 52% and 38% of the final shoot weight, respectively. However, it is still an advantage to intercrop wheat with Egyptian clover because intercropping cereals with legumes enhances protein production and then quality of forage (Vasilakoglou and Dhima, 2008).

Chemical analysis

Chemical analysis of different silages and experimental rations are provided in Table (1). The variation in the chemical composition of experimental rations reflected the composition of their ingredients. The CP and EE contents of all experimental rations, were almost similar 12.62 -13.89% and 2.27 -2.73%, respectively. However, the NDF and ADF contents were greater for R2 and R4 rations as compare with R1 ration. This may be due to the accumulation of acid, alkaline and/or neutral detergent insoluble substances in the silage mixtures.

Table (2) chemical analysis of different silages and experimental rations.

Different silages	DM	OM	CP	NDF	ADF	EE	Ash
W	**32.14**	**92.97**	**9.74^{c}**	**50.65^{a}**	**29.82^{a}**	**1.92**	**7.23**
C	**29.85**	**89.72**	**14.90^{a}**	**33.18^{c}**	**24.86**	**1.53**	**10.38**
W+C	**30.72**	**91.38**	**13.18^{ab}**	**45.88^{b}**	**26.92**	**1.67**	**8.62**
Experimental Rations							
R1	**100**	**88.47**	**13.82**	**39.37**	**24.18**	**2.63**	**11.53**
R2	**100**	**90.38**	**12.62**	**45.88**	**26.73**	**2.58**	**9.62**
R3	**100**	**88.68**	**13.89**	**37.27**	**22.96**	**2.41**	**11.32**
R4	**100**	**89.55**	**13.50**	**40.72**	**24.73**	**2.46**	**10.45**

*Wheat =W *Clover = C *Wheat + Clover= WC *R1 =control ration *R2= ration with wheat silage
*R3= ration with clover silage R4= ration with wheat+clover silage

These results are in harmony with Francisco et al ., (2006) who reported that the NDF and ADF concentrations were lower in clover than winter wheat and intermediate in mixtures clover and wheat.

Digestibility coefficients, milk yield and milk composition

Dry matter intake (DMI), Apparent digestibility, and nutritive value of experimental rations are presented in Table (2). The highest (DMI) was detected in the R4 group, meanwhile the lowest value of DMI was detected with control group. The results demonstrated that DM OM, CF, NDF and ADF digestibilities for R3 were significantly higher ($P<0.05$) compare with control group R1.

Table (3) Digestion coefficients of different rations including WS or CS mono crops or WCS intercropping.

Ingredients	Experimental Rations			
	R1	R2	R3	R4
Dry Matter intake kg/head/day				
Total DM intake	1.32^{b}	1.35^{ab}	1.28^{b}	1.38^{a}
Digestion coefficients				
DM	62.71^{c}	63.91^{bc}	66.47^{ab}	67.95^{a}
OM	65.67^{c}	67.10^{bc}	69.13^{ab}	*70.93^{a}*
CP	70.63^{bc}	69.72^{c}	74.92^{ab}	76.84^{a}
NDF	65.66^{c}	67.05^{bc}	69.37^{ab}	70.58^{a}
ADF	61.44^{b}	62.69^{b}	64.69^{ab}	65.78^{a}
NFE	74.62^{b}	76.32^{ab}	77.43^{a}	77.92^{a}
EE	78.34	78.56	78.82	79.18

Wheat Silage = WS Clover silage=CS Wheat &Clover mixer Silage = WCS
R1 = control ration concentrate feed mixers + clover hay R2 = concentrate feed mixers + wheat silage
R3 = concentrate feed mixers + clover silage R4 = concentrate feed mixers + Wheat + Clover mixers silage

These results agree with Francisco et al., (2006) who reported that the clover–wheat mixtures was highest degradibilty than sole clover, possessed adequate nutritive value for high-producing livestock, and mixture silage characteristics were better than sole clover.

Feed efficiency and economic efficiency

The results of feed efficiency and economic efficiency of experimental rations are presented in Table (4). The animal fed R4 ration had the highest feed efficiency followed by R2 ration. While R3 recorded the lowest value of feed efficiency. The return above feeding cost (Table 4) recorded the highest value with R4, whereas the lowest vlaue was recorded with R1 ration. The economic efficiency improved by 42, 48 and 61% for R2,R3 and R4 rations, respectively.

Table (4) :Effect of the experimental rations on feed efficiency and economic efficiency.

Item	Experimental rations			
	R1	R2	R3	R4
Av. Daily milk yield kg/h	1.11	1.05	1.05	1.37
Feed Efficiency				
Av. DM kg /kg milk	1.20	1.17	1.22	1.05
Av. TDN kg/ kg milk	0.76	0.73	0.78	0.69
Av. DCP g/ kg milk	116	113	127	109
Economical efficiency				
Av.daily feed cost/ head LE	3.25	3.1	2.85	2.73
Total feed cost/ head LE	311.5	275.4	256.5	245.7
Total Price milk LE/head	394	428	475	511
Return LE	192.5	205.4	218.5	265.5
Economical efficiency	1.45	1.65	1.85	2.01
Economical efficiency improvement%	-	42	48	61

conclusion

Our results suggest that, although intercropping of wheat-Egyptian clover reduced the yield of individual crop, the intercropping system has possibility to provide food both for human and animal of small-scale farmers with limited land and water resources intercropping fodder between wheat and clover can be used as a suitable management strateg y for producing high quality and quantity forage. Because intercropping improves forage quality compared with cereals monoculture, and produces more dry matter compared with legumes sole crop. In the other word, forage with acceptable degree of quality and quantity can be attained by cereal-legume intercropping.

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