

Stubble Grazing by Sheep

T T Treacher (1), S Rihawi (2) and E Owen (3)

(1) Departamento de Produccion Animal, Escuela Superior Tecnica de Ingenieros Agronomos y de Montes, Apartado 3048, 14080 Cordoba, Spain

(2) Pasture, Forage and Livestock Programme, International Centre for Agricultural Research in the Dry Areas, P O Box 5466, Aleppo, Syria

(3) Dept of Agriculture, University of Reading, Reading RG6 2AT, UK

Abstract

In most small ruminant systems in the Mediterranean basin and west Asia, cereal stubble is the major source of feed in late summer, when mating generally occurs. In spite of its importance, there has been little research on stubble grazing. A programme in ICARDA surveyed farm practice in northern Syria and examined the effects of stocking rate and supplementation on intake of barley stubble by Awassi sheep grazing for 28 day periods. Heads were removed in the first 4 to 8 days of grazing in a new area of stubble. Intake of stem increased when most of the leaf had been removed. Mean intakes of dry matter (DM) in 28 days were 1.10 and 0.83 kg/day in unsupplemented sheep at stocking rates of 20 and 40 sheep/ha, respectively. Intakes of ME were approximately 2.5 maintenance (M) in days 1 to 4 irrespective of stocking rate and declined to 0.70 to 0.35 M in days 23 to 28. Supplementation with 200-360 g/day of barley decreased intake of stubble in the first 4 to 6 days on a new area of stubble but, as intake was subsequently higher, total intake of stubble DM in 28 days was not affected. Supplementation with 200-360 g/day of cotton seed meal (CSM) or barley and CSM slightly increased intake of stem. Supplements, especially those with higher protein contents, had large effects on weight change and reduced the time taken for the ewes to become pregnant. More research is needed to obtain a clear understanding of the effects of different types and levels of supplementation on intake and performance in sheep grazing barley and

wheat stubbles.

KEY WORDS: Stubble, barley, sheep, ewe, stocking rate, supplementation, intake

Introduction

In the Mediterranean Basin and West Asia, livestock production and crop farming have always been integrated. Cereal stubble and straw are important feed resources not only for animals based in the areas where crops are grown but also for the very large numbers of small ruminants that graze steppe pastures and move into crop growing areas after harvest. Degradation of steppe vegetation in the last 40 years has increased the dependence of livestock production on feeds from the cropping zones (eg Boutonnet, 1989).

In many small ruminant systems in the Mediterranean and west Asia, the period in summer when stubbles are available for grazing coincides with mating and early pregnancy. As nutrition before mating and in the first month of pregnancy affects fertility and prolificacy, the stubble grazing period may have an important effect on the performance of flocks during the whole year. The start of stubble grazing often results in an improvement in nutrition and a surge in oestrous activity in breeds that, although not inherently seasonally anoestrus, often have a period of anoestrus in spring, as a result of poor nutrition or low body condition.

In contrast with the enormous number of studies on all aspects of harvested straw, little research has been carried out on grazing of stubbles or on responses to supplementation during stubble grazing. Some work has been done in Morocco (eg Guessous *et al.*, 1989 and Outmani *et al.*, 1991) and in Spain (Valderrabano, 1991 and Cabello *et al.*, 1992). There are more results from Australia (eg Mulholland, 1976), but these are of limited relevance to the Mediterranean and west Asia as both the crop and sheep husbandry are very different.

Estimates of the Quantity of Stubble

There are wide variations in the amount of dry matter present in stubble before grazing and in the proportions of straw, grain and green material. These result from a great number of factors that occur in the cereal crop before harvest (eg. seed rate, rainfall, irrigation), during harvesting (eg. cutting height, removal of straw for winter feeding) and harvesting and grazing (eg. rain storms).

Under dryland conditions estimates of total stubble mass before grazing vary from 1.20-2.76 t DM/ha for barley and 0.94-1.80 t DM/ha for wheat, with cutting heights of 14-18 cm (Cabello *et al.*, 1992 and Valderrabano, 1991), to 3.5-4.0 t DM/ha for barley and 5.2-5.6 t DM/ha for wheat in Australia, at a cutting height of 45 cm (Mulholland *et al.*, 1976 and Butler, 1981).

Studies of Stubble Grazing in Icarda

The programme on barley stubble started in 1991 consisted of:

- a survey of the practice of stubble grazing on farms in Syria
- studies of a quadrat technique to estimate intake of stubble
- experiments in three successive years

Field Study of Stubble Grazing

Thirty-nine farmers in northern and eastern Syria were interviewed about stubble grazing, to help define management decisions for subsequent experimentation (ICARDA, 1992).

The main results were:

- farmers who had a mean flock size of 170 ewes grazed stubble for a mean of 97 days (15-160 days);
- they preferred barley stubble, although 13% of farmers stated that some wheat varieties were palatable and could be grazed successfully by sheep;
- the mean duration of grazing was 12.5 h/day (8-16 h/day);
- supplementation was very rare, as the stubble grazing period was considered a period of plentiful feed availability;
- the combine harvester cutting height varied from 10 to 20 cm.

Method of Estimating Intake

As rain rarely occurs in Syria before the end of October, alteration in stubble composition during the grazing period is unlikely to occur, except as a result of grazing. It was, therefore, decided to use a quadrat sampling technique to estimate the rate of removal of particular fractions and the intake of nutrients.

Examination of the stubble suggested that the use of a quadrat of the same size as the cutting width of the combine harvester (4.25 m), placed at right angles to the direction of the combine cut, would result in a systematic sampling of the stubble. A comparison of samples cut, using quadrats of 1.0 x 1.0 m (S), which had been used in earlier studies, and 4.25 x 0.47 m (R), showed a large reduction in the coefficient of variation from 23% with S to 9% with R. The means of total biomass were 1.88 +/- 8 (range 1.20-2.81) and 1.22 +/- 20 (1.06-1.54) t/ha for S and R, respectively.

In the subsequent experiments, removal during grazing of head, leaf and stem fractions was estimated by cutting 10 quadrats (5 in experiments 2 and 3) to ground level on days 0, 3, 5, 7, 9, 14, 19, 24 and 29 of each grazing period. The material was separated into head, leaf and stem. Metabolisable energy (ME) intake was calculated from 0.15 x digestible organic matter in the DM (DOMD). Daily intakes of ME and crude protein (CP) were calculated as the difference between successive samplings divided by the number of sheep and days.

Experimentation

Three experiments were carried out on barley stubble (var. Arabi Abiad) cut by combine at a height of approximately 10 cm. Mean mass before grazing was 1110, 1215 and 1140 kg DM/ha in experiments 1, 2 and 3, respectively. The proportions of head, leaf and stem before grazing were approximately 0.05, 0.55 and 0.40, with contents of DOMD of 0.86, 0.54 and 0.36 and CP of 103, 41 and 14 g/kg DM, respectively.

Supplements were fed to the individually yoked sheep in the evening. All sheep received adequate mineral supplementation.

Experiment 1. Effect of Stocking Rate on the Intake of Stubble Fractions

Objective

To record the pattern of removal of head, leaf and stem from stubble and measure intakes of ME and CP

Design

Stocking rates of 20, 40 and 60 sheep/ha applied in 3 successive periods of 28 days

Material and Methods

- 2-year-old Awassi wethers, initial weight 55 kg
- grazed for 9.5 hr with a two hr break at midday

Results

There was a clear effect of SR on the removal of the stubble fractions. Heads were removed in the first 6-8 days on a new area of stubble and contributed 4-6%, 6-8% and 12-14% of the total intake in 28 days of DM, ME and CP, respectively (Table 1). Leaf was preferentially selected until the amount of leaf present on the stubble was low. Leaf comprised 68% of the total DM intake at SR 20 and approximately 55% at SRs 40 and 60. Total intakes of ME declined from 2-2.5 times maintenance (M) in days 1-4 to approximately 0.5, 0.25 and 0.13 M in days 23-28 at SRs 20, 40 and 60, respectively. The stubble was almost completely utilised. The wethers maintained weight at SR 20 and made substantial losses at SRs 40 and 60.

Table 1. Experiment 1. Effect of stocking rate on mean daily intakes of stubble DM, ME and CP and initial weight and weight change

Stocking Rate (ewes/ha)	20	40	60	Significance
Mean intake of DM (kg)	1.06	0.79	0.55	***
Intake of ME (MJ) Mean	8.7	6.0	4.1	***
- days 1-4	15.2	15.0	11.9	ns
- days 23-28	4.6	1.7	0.7	***
Intake of CP (g)	43	26	17	***
Initial weight (kg)	54.8	53.9	55.0	ns
Mean weight change (kg)	0.3	-2.1	-3.2	***

Experiment 2. Effects of Stocking Rate and Supplementation on Intake of Stubble Fractions

Objectives

To assess the effects of stocking rate and supplementation on the pattern of removal of head, leaf and stem, intakes of ME and CP and on the weight changes and the time for the ewes to become pregnant

Design

2 x 3 factorial with: Stocking rates of 20 and 40 ewes/ha applied in 3 successive periods of 28 days Supplementation:

- no supplement (none)
- 200 g/day of cotton seed meal (CSM), providing 2.2 MJ of ME and 67 g CP
- 200 g/day of barley (B), providing 2.7 MJ of ME and 20 g CP

Material and Methods

- 1.5 year-old Awassi ewes, initial weight 42 kg
- grazed for 10.25 h with a one hour break at midday
- from the start of the second grazing period, two rams were kept with the ewes during the night

Results

Supplementation with barley significantly reduced the intake of heads until day 13 and of total stubble in days 1-4, but not over the whole 28 day period, as the total intake was higher later in the period. Supplementation with CSM increased the intake of stem, but the effect was only significant when expressed as ME with mean stem ME intakes in 28 days of 2.71, 2.02 and 2.03 MJ/day for CSM, B and none, respectively. Over the whole 28 day period mean intakes of DM, ME and CP were not affected by supplementation (Table 5). In spite of the small differences in nutrient intakes from stubble, supplementation had large and significant effects on liveweight gain. The barley supplement increased weight change from 0.1 to 2.9 kg and from -1.7 to 1.5 at SRs 20 and 40, respectively. The CSM supplement further increased gains to 4.4 and 2.2 kg at SRs 20 and 40.

As in the previous experiment, stocking rate had a significant effect on intakes of DM, ME and CP and on liveweight change. The intakes of nutrients and liveweight changes of the unsupplemented sheep were similar to those in the previous experiment.

Both SR and supplementation affected the mean number of days for the ewes to become pregnant, which was much greater in the unsupplemented ewes at the higher SR.

Table 2. Experiment 2. Effect of stocking rate and supplementation on mean daily intakes of stubble DM, ME and CP and initial weight, weight change and days to become pregnant

Stocking Rate (ewes/ha)	----- 20 -----			----- 40 -----			Signif	
	CSM	B	None	CSM	B	None	SR	Supp
Supplement								
Mean intake (kg DM)	1.19	1.14	1.09	0.93	0.85	0.82	***	ns
Intake of ME (MJ)								
- Mean	10.0	9.2	9.3	6.4	5.9	6.2	***	ns
- days 1-4	16.9	8.9	14.8	11.7	10.1	13.4	*	**
- days 23-28	4.9	5.0	3.1	1.7	2.0	1.8	***	ns
Mean intake of CP (g)	46	48	49	31	28	31	***	ns
Initial weight (kg)	43.0	41.8	40.9	43.0	42.0	43.5	ns	ns
Weight change (kg)	4.4	2.9	0.1	2.2	1.5	-1.7	***	***
Days to become pregnant	30	40	36	42	29	66(1)	***	**

(1) = mean of 6 ewes, as 2 ewes failed to become pregnant

Experiment 3. Effects of Stocking Rate and of Level and Type of Supplement on the Removal of Different Stubble Fractions

Objectives

To assess the effects of stocking rate and supplementation on the pattern of removal of head, leaf and stem, intakes of ME and CP and on the weight changes and the time for the ewes to become pregnant.

Design

2 x 3 x 2 factorial with two replications: Stocking rates of 20 and 40 sheep/ha applied in 2 successive periods of 28 days Supplementation with two diets at two levels of intake:

- no supplement (none)
- 300 and 150 g/day of barley (300B and 150B), providing 3.6 and 1.8 MJ of ME and 27.0 and 13.5 g CP, respectively
- 320 and 160 g/day of a mixture of 65% barley and 35% cotton seed meal (320M and 160M), providing 3.6 and 1.8 MJ of ME and 54 and 27 g CP, respectively

Material and Methods

- 1.5 year-old Awassi ewes, initial weight 40 kg
- grazed for 9.30 h with a one hour break at midday

Results

Supplementation had significant effects on the intake of stubble in all periods, but, as intake was initially depressed in days 1-6 and subsequently increased by feeding supplements, mean intake over 28 days was not significantly different between treatments. Intake of stem was affected by supplementation, but, in contrast to experiment 2, was higher with the barley supplement. Although supplementation did not significantly affect total intake of stubble DM, ME or CP, it had a large effect on weight change (Table 3). As in the previous experiments, there were significant effects of SR on intake of stubble and liveweight change. The mean number of days for the ewes to become pregnant was affected by both SR and supplementation.

Table 3. Experiment 3. Mean daily intakes of stubble DM, ME and CP and initial weight and weight change

Stocking Rate (ewes/ha)	----- 20 -----			----- 40 -----			Signif	
	M(1)	B(2)	None	M(1)	B(2)	None	SR	Supp
Supplement								
Mean DM intake (kg)	1.09	1.16	1.15	0.85	0.92	0.87	***	ns
ME intake (MJ)								
Mean	11.1	11.5	10.9	6.8	7.6	7.3	***	ns
- days 1-4	22.3	18.7	17.4	13.6	14.1	16.4	*	ns
- days 23-28	6.6	6.3	5.8	2.4	3.0	2.8	***	ns
Mean CP intake (g)	41	41	48	25	29	27	***	ns
Initial weight (kg)	39.9	39.2	38.4	40.6	40.4	40.1	ns	ns
Mean wt change (kg)	7.1	3.8	0.6	3.0	0.6	-1.2	***	***
Days to get pregnant	15	29	42	30	45	46	***	***

(1) = Mean of treatments M320 and M160

(2) = Mean of treatments B300 and B150

Conclusions

The results of these experiments show that, where there is no rain in the grazing period, the patterns of removal of the different stubble fractions can be described, using frequent sampling with a quadrat the same length as the combine cutting width, which allows systematic sampling of all the material on the stubble.

There were clear patterns in the removal of different fractions from stubble by grazing sheep. Heads were selected first and removed in the

first 4 to 8 days of grazing at stocking rates of 20-60 sheep/ha. Intake of stem increased when most of the leaf had been removed. Mean contributions of head, leaf and stem to total DM intake on the unsupplemented treatments in the three experiments were 7, 64 and 29% at SR 20 and 5, 61 and 34% at SR 40. Supplementation with barley decreased intake of stubble in the first 4 to 6 days on a new area of stubble but, as intake was subsequently higher, total intake of stubble DM in 28 days was not significantly affected. Intake of stem was increased by supplementation with CSM in experiment 2, but not by the supplement with a higher protein content in experiment 3. Supplements, especially those with higher protein contents, had large effects on weight change and reduced the time taken for the ewes to become pregnant. More research is needed to obtain a clear understanding of the effects of different types and levels of supplementation on intake of stubble by sheep and on their performance.

In view of the importance of stubble as a source of feed in small ruminant systems in west Asia, more research is needed on grazing not only of barley, but also of wheat stubble, under dryland farming.

References

- Boutonnet, J. P. 1989. La speculation ovine en Algerie. INRA Serie Notes et Documents No 90.
- Butler, L.G. 1981. Supplementary feeding of Merino wethers grazing weed-free stubble pastures. *Australian Journal of Experimental Agriculture and Animal Husbandry*. 21, 272-276.
- Caballero, R., Rioperez, J., Fernandez, E., Arauzo, M. and Hernaiz, P.J. 1992. Performance of Manchega ewes grazing cereal stubbles and cultivated pastures. *Small Ruminant Research*. 7, 315-329.
- Guessous, F., Luginbuhl, J.-M., Rihani, N. and Pond, K.R. 1991. Influence of supplementation on the performance of gestating ewes grazing wheat stubble pastures. *Animal Feed Science and Technology*, 35, 95-103.

- Guessous, F., Rihani, N., Kabbali, A. and Johnson, W. L. 1989. Improving feeding systems for sheep in a Mediterranean rain-fed cereals/livestock area of Morocco. *Journal of Animal Science*. 67, 3080-3086.
- ICARDA 1992. Pasture, Forage and Livestock Program Annual Report for 1990/1991. Survey of methods of feeding barley straw and of grazing stubble in Syria. pp 149-153.
- Mulholland, J.G., Coombe, J.B., Freer, M. and McManus, W.R. 1976. An evaluation of cereal stubbles for sheep production. *Australian Journal of Agricultural Research*, 27, 881-893.
- Outmani, A., Luginbuhl, J.-P., Guessous, F. and Johnson, W.L. 1991. Utilization of wheat stubble pastures by gestating sheep. *Small Ruminant Research*. 4, 257-267.
- Valderrabano, J. 1991. Utilizacion de las rastrojeras de cereal por el ganado ovino. 31 Reunion cientifica de la SEEP. Murcia 1991. pp 368-372.