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Effects of replacing concentrate by irrigated or rain fed corn hay (pre-mature) on the performance of Awassi lambs

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RAbstract. The ability of premature irrigated (IRR) or Rainfed corn as hay to gradually replace concentrate and barley straw was investigated. 21 Awassi lambs of similar weight (32 kg±3.96) were randomly divided into 3 groups (3 males and 4 females). Feeding was adjusted according to live body weight (LBW) at 3%. The control group was always fed a typical fattening diet composed of 60% concentrates (18% CP; 12MJ ME) and 40% barley straw. At the 1st stage (14 days) and 2nd stage (21 days), 30% and 40% of the concentrate was replaced by IRR or rainfed corn hay. During the 3rd stage (21 days) the concentrate and barley straw were totally replaced by *ad libitum* feeding of either IRRI or Rainfed corn hay. The DM yield as hay was 53625 kg DM/ha from IRR and 21710 kg DM/ha from Rainfed corn. LBWG was similar to the Control group during the 1st and 2nd stage. However, when corn hay was fed *ad libitum*, LBWG was higher but not significantly (P>0.05) for the IRR (197 g/day) and the Rainfed (245 g/day) as compared to control (170 g/day). Corn hay can partially or totally replace concentrate. The cost of feeding corn hay was also lower than concentrate and barley straw. The production, storage and feeding of corn hay was easy to apply by small farmers as compared to silage and reduced the cost of feeding and can improve the health status of animals.

Keywords. Awassi Lambs – Fattening – Concentrate – Corn – Hay – Live body weight – Dry matter intake.

Effet du remplacement du concentré par du foin de maïs prématuré irrigué ou pluvial sur la performance des agneaux Awassi

Résumé. *La capacité du foin de maïs prématuré (IRR irrigué ou pluvial) à remplacer le concentré et la paille d'orge a été étudiée. Vingt un agneaux Awassi de poids similaire (32 kg ± 3,96) ont été divisés au hasard en 3 groupes (3 mâles et 4 femelles). Le groupe témoin a été toujours nourri avec un régime d'engraissement typique ((60% concentrés (18% CP; 12MJ ME)) : 40% paille d'orge). Au 1er stade (14 jours), 30% du concentré a été remplacé par du foin de maïs IRR ou pluvial. A la 2ème étape (21 jours), 40% du concentré a été remplacé par du IRRI ou du foin de maïs pluvial. A la 3ème étape (21 jours), le concentré et la paille d'orge ont été totalement remplacés par l'alimentation* ad libitum *de l'IRRI ou du foin de maïs pluvial. Le rendement en matière sèche du maïs IRR était supérieur (53625 kg MS / ha) à celui du maïs pluvial (21710 kg MS / ha). Le GPV était plus élevé pour l'IRR (197 g / jour) et l'aliment pluvial (245 g / jour) par rapport au groupe témoin (170 g / jour). De plus, le coût de l'alimentation du foin de maïs était plus bas que les prix actuels du concentré et de la paille d'orge. La production et l'alimentation du foin de maïs était facile à appliquer par les petits agriculteurs par rapport à l'ensilage et qu'il réduirait le coût de l'alimentation et améliorerait l'état sanitaire des animaux.*

Mots-clés. *Agneaux Awass – Engraissement – Concentré – Maïs – Foin – Gain de poids vif – Ingestion de matière sèche.*

I – Introduction

The production of the ruminant sector in Lebanon is unable to meet the local demands (Slayman *et al.,* 1986). This is mainly due to the shortage in good quality roughages such as hay and silages (Khazaal, *et al.,* 2001, Hamadeh, *et al.,*1996). Sustainable good quality forage production is not well developed due to the Mediterranean climatic conditions (long dry season) where water resources are becoming limited and, irrigated areas are mostly dedicated for industrial and food crop production.

Because of this, cereal crop residues (i.e straws) are considered as the main source of roughages for farmers. However, straw is known to be of low quality and reduce intake and nutrient supply. Thus, in Lebanon and many developing countries the shortage of good quality forages have forced farmers to rely on low quality forages such as straws and higher proportion of concentrates (up to 60-70% of total ration DM) in order to achieve moderate to high level of production.

Excessive concentrate feeding results in acidic rumen pH (<6), less rumination and saliva production. Thus chronic rumen acidosis and several health problems (reduced fiber digestion, milk fat depression, diarrhea, laminitis, liver abscesses, increased production of bacterial endotoxin and inflammation) (Plaizier, *et al.,* 2008).

The objective of the study was to compare the difference in yield and chemical composition of irrigated and non-irrigated premature corn as hay, and to investigate its potential to replacing concentrate as supplement and its effect on the performance (intake, live weight gain LWG and feed conversion) of growing Awassi lambs.

II – Materials and methods

The local variety of corn used is traditionally planted by farmers for human and livestock feeding and also known for its tolerance for drought. This variety is commonly planted in western Lebanon without irrigation in March. The seeds were planted in the Bikaa valley (eastern Lebanon) with 30 cm between rows and 10 cm between plants. Due to the dry conditions in the Bikaa valley the rain fed field resulted in lower yield and the plants were almost like standing hay (Fig. 1).

Fig. 1. Rain fed corn suffering from water scarcity.

Fig. 2. Sun drying corn Stover for 5-7 days in the field.

The corn plants were harvested after 103 days from planting (stage VT) (Fig. 2), sun dried in the field chopped (1-5 cm) and stored until offered to animals. Crude protein (CP) was determined chemically (AOAC.,1990), and fiber by using NIR.

A total of 21 Awassi lambs (32 kg±3.96) (9 females and 12 males) were randomly distributed into 3 groups, each with 3 females and 4 males. The animals were adapted for 2 weeks on a ration consisting of 60% concentrate (18% CP: 12 MJ ME) and 40% barley straw at 3% DMI in two equal meals (morning and afternoon). This was followed by feeding as shown in Table 1.

Table 1. Feeding regimes for every stage (1st, 2nd and 3rd) for all groups (control, irrigated IRR and rain fed)

	Control	Irrigated (IRR)	Rain fed
1st stage (2 wks)	60% Concentrate	42% Concentrate	42% Concentrate
	40% straw	18% Corn hay (irrigated)	18% Corn hay (rainfed)
		40% straw	40% straw
2nd stage (3 wks)	60% Concentrate	36% Concentrate	36% Concentrate
	40% straw	24% corn hay (irrigated)	24% corn hay (rainfed)
		40% straw	40% straw
3rd stage (3 wks)	60% Concentrate	100% corn hay	100% corn hay
	40% straw	(irrigated) (*ad libitum)*	(rainfed) (*ad libitum)*

Total forage DM yield was estimated at 2 stages of growth based on the representative collected samples from 0.5m^2 from each field at the early stage, and before flowering (i.e. at 30 days after plantation and 103 days respectively). Feed refusal was collected every morning before the new meal was offered. DM intake was determined daily for each group. Animals were individually and weekly weighed to determine live weight gain (LWG). Daily DM and nutrients intake (i.e. CP and ME) were calculated according to chemical analysis or from feeding tables. According to AFRC (1993), the ME content of whole maize silage is 11.3 MJ/kg DM. Other references indicated that the ME value of corn silage was 9.4 (MJ/kg DM at few eared stage) (Howard and Shaver, 2018). As the corn hay in this experiment was harvested at premature stage, the value of 9.4 MJ/kg DM of ME was adopted for both irrigated and rain fed corn hay. For statistical data analysis, SPSS STAT was used. The averages of DM and nutrients (CP and ME) and LBW were subjected to one-way ANOVA test.

III – Results and discussion

The yield of dried corn as hay was higher from the irrigated (IRR) plot as compared to rain fed at early stage (5000 kg & 15000 kg for rain fed and IRR plots respectively). The difference became larger at the pre-mature stage (21710 & 53,625 kg for rain fed and IRR respectively). Due to the dry climate and the low rainfall season, there was a massive difference between IRR and rain fed fields. However, the forage yield of IRR corn was slightly lower from that of corn silage reported in the literature (65,700 kg/ha) (Roth *et al*., 2001). As shown in Table 2, both IRR and rain fed corn hay cost was lower than concentrate and straw.

Table 2. Comparison of the cost of irrigated or rainfed corn hay, concentrate and straw

Cost	Irrigated	Rain fed	Concentrate	Straw*
(US $/kg DM)	0.088	0.139	0.322	0.184
(L.L./kg DM)*	133	210	485	277

* 1 US $= 1507 L.L (Lebanese Pound). # add 25000 LL/ton if transported to other regions.

As shown in Fig. 3, and Table 3, daily DM intakes in the first and 2ndstages were approximately equal in the 3 groups as the DM offered was restricted to about 3% of the animals LW.

However, when corn hay was offered *ad libitum* to the IRR and rain fed groups during stage III, their daily DM intake greatly increased (Table 3) to reach 4.8% of the animals' LW when offered ad libitum corn hay at stage 3.

According to Trotter and Keith (1992), when daily DM intake as a % of body weight is higher than 3% the forage is considered as prime or high quality. Therefore, these observed increases in daily DM intake in IRR and rainfed groups was probably due to the positive impact of the corn hay on the rumen environment (pH, rumination and saliva production) maximizing the rumen microbial ac-

tivity and supply of energy and amino acids. Hence, DM intake was far better in the IRR and rain fed groups compared to that of the control group.

As DM intake was controlled during the 1st and 2nd stage, the daily CP and ME consumption was approximately similar in all the 3 groups. However, in the 3rd stage (*ad libitum corn hay)*, daily CP and ME consumption for the IRR and rainfed groups were largely improved as compared to the control group (Fig. 3, Table 3).

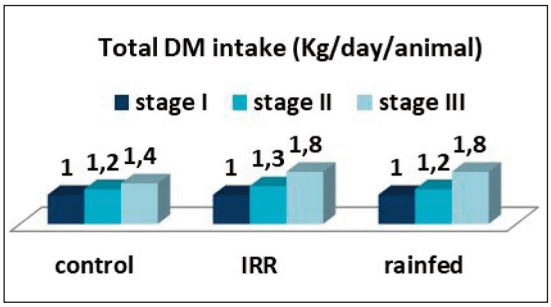

Fig. 3. Total DM intake (Kg/day/animal) of the 3 groups (control, IRR and raid fed).

Table 3. DM intake (%) as a proportion of live bodyweight for the 3 groups of animals at the 3 stages of the experiment

	Stage I	Stage II	Stage III
Control	3.01	3.4	3.45
IRR	2.99@	3.33#	4.9*
Rainfed	3@	3.38#	4.8*

Corn hay: @:30%; #:40%; *:*ad libitum.*

According to the AFRC (1993), the daily nutrients requirement for maintenance of a 40 kg lamb is estimated at 6.5 MJ of ME and 75.4 g of CP. However, in order to gain 200 g of LW per day, the animal and depending on the quality of the diet should be able to consume 1.55 kg of DM and will require 17.9 MJ of ME and a 143.3 g of CP. This level of DMI and estimated nutrients supply was achieved when the animal received corn hay *ad libitum* (Table 3) and as a results achieved 197 g/day and 245 g/day with the rain fed and IRR groups respectively (Fig. 4).

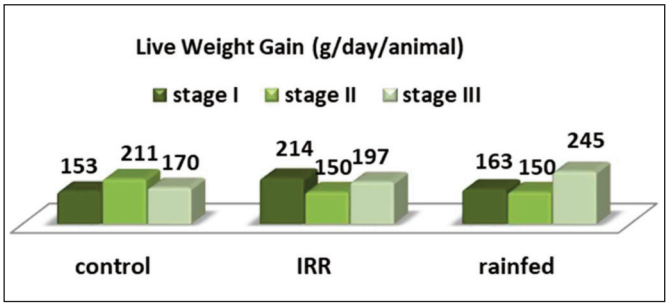

Fig. 4. Average LWG (g/day/animal) in the control, IRR and rain fed groups during the experiment.

IV – Conclusions

The DM yield per hectar, was much higher in IRR than rainfed fields. Thus farmers cannot always rely on rain to irrigate corn especially in drier areas of Lebanon (Bikaa). However, chemically there were no major differences between IRR and rainfed corn hay.

Due to the lower DM yield in rainfed corn hay the cost was higher than IRR corn hay. However, IRR & Rain fed corn hay still cost much less (one third or half) compared to Concentrate, silage or Cereal straw.

The process of producing and feeding corn hay was simple and would be easy to apply by small farmers as compared to the traditional expensive and mechanized silage production process. It can be produced on rainfed or irrigated land.

Premature corn hay can partially or totally replace concentrate and produced better animal performance (DMI &LWG).

Reducing concentrates in the diet will increase profitability, improve animal performance, and reduce animal health risks associated with large quantities of concentrates, such as acidosis, fat liver, fertility, hoof problem and mastitis.

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