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### Feed effect on milk production and yogurt quality

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#### Abstract

Cost reducing diets (CRD) were tested on 56 Awassi ewes in Syria, at the International Center for Agricultural Research in the Dry Areas to counterbalance high and increasing feeding costs faced by farmers during the milk production period in Middle Eastern countries. Milk production and yogurt firmness produced under the traditional diet used by farmers (control) was contrasted with production under 6 CRD that included barley, ammoniated wheat straw and other unconventional locally available feedstuffs: molasses cotton seed cake, wheat bran and sugar beet pulp. Animals in all CRD treatments were kept on grazing as a basal diet, supplemented with the same level of crude protein (229 g) and energy (18MJ). Under the traditional feeding ewes received less protein (190 g/d) and similar energy levels as in the CRD. Milk production of ewes under 5 out of the 6 CRD was 48% higher than that of control ewes. One CRD containing 34% molasses caused a decrease in milk production. Texture profile analysis (TPA) on a set type of yogurt showed an effect of diets on hardness which reflects on yogurt firmness ( $P < 0.001$ ), an important characteristic of yogurt pricing in the Middle East. In 4 out of 6 CRD, hardness increased from 6-23% over the control group, whereas in two CRD diets, including the molasses-CRD, the hardness declined from 9 to 10%. A trend to increase hardness as the milking period advances, was observed in three CRD and the control ( $P < 0.05$ ). Organoleptic and visual characteristics affecting yogurt price (texture, smell, taste and appearance) were assessed by local dairy product middlemen in yogurt produced under all diets. The sensory data analysis using a link to a cumulative logits revealed that texture, smell and taste were positively improved by the CRD over the control. A lesser effect on appearance was observed and a decrease in this trait recorded in yogurt produced under the molasses-CRD. The proposed CRD containing the tested byproducts and urea treated wheat straw are apparently options for resource-poor small-scale farmers in the Middle Eastern region to increase their productivity and income without affecting the main quality components of yogurt.

#### Introduction

The rapid increase in human population is leading to important changes in the market scenarios for agricultural products in the Middle East. This increase is associated with an expansion of markets and a raising demand for animal products. Yogurt widely consumed directly or as a component of the local cuisine, is among the highly demanded products that dairy sheep farmers

of Syria are producing to benefit from these market opportunities. It is estimated that, most of this product is produced by resource-poor farmers in Syria.

This trend parallels a decline in the productivity of ranges due to progressive overgrazing. The interaction of overgrazing with recurrent periods of drought in the region exacerbated this processes and imposed serious constraint to livestock production systems. To target the market prospects for traditional products, farmers are resorting to intensify their production systems and purchasing feeds whenever needed to compensate for the lack of fodder in the range. Feeding costs then represent the most limiting factor for farmers to target the markets. Climate change and biodiesel production add to this complex of problems with a concomitant fodder price increasing effect.

Reduce cost of diets using unconventional low cost feedstuffs have been proposed by the International Center for Agricultural Research in the Dry Areas in Syria (ICARDA) to counterbalance the increase in feed prices during the milk production period in dairy sheep systems. This study is an integral part of research at ICARDA to assess not only the suitability of alternative diets to reduce feeding costs in milk production, but also to assess the possible effects of some unconventional ingredients on milk and milk product quality in relation to dairy sheep production in Syria.

## Material and methods

### Diets

A rapid survey on dairy sheep farms was conducted in Aleppo province to characterize dairy production system and assess the type of average diets used by farmers during the milk production period (control diet).

Seven diets were then tested each on 8 Awassi milking ewes at ICARDA sheep facility near Aleppo, Syria. These included the control and six cost reducing diets (CRD). The CRD options include conventional feeds such as barley grain, cotton seed cake (CSC) and wheat bran, as well as unconventional low cost feeds such as ammoniated wheat straw, molasses and sugar beet pulp (SBP).

Animals in all CRD treatments were kept on strip grazing as a basal diet with a feed supplement so that all diets had the same level of crude protein and energy, except the control as this treatment was set to resemble the 'average' diet used by farmers. All animals grazed on range except those under CRD 6 that grazed on vetch (*Vicia sativa*) (Table 1).

**Table 1.** Cost reducing diets composition.

	Control	CRD 1	CRD 2	CRD 3	CRD 4	CRD 5	CRD 6
Barley	+	+	+	+	+		
SBP			+		+	+	+
Molasses			+		+	+	+
CSC		+	+	+	+	+	
Wheat bran	+	+		+		+	+
Urea treated straw		+	+				
Barley straw	+			+	+	+	+
Rangeland	+	+	+	+	+	+	
Vetch pasture							+

The design was such that each animal received 229g of crude protein and 18MJ of ME. per day. Under the traditional feeding regime (control), ewes received less protein (180g) and similar energy levels as those of CRD. In the CRD involving vetch grazing, the supplement contributed with 72g of crude protein and 9.8 MJ of energy, vetch was covering the remaining fractions of crude protein and energy.

### Costs and Income

Costs involved only feed cost and were calculated taking into account actual market prices of feed and yogurt. Net income was estimated as the difference between yogurt produced per diet and feeding cost.

### Milk production, Yogurt production and yogurt quality

Milk production in all groups was recorded on weekly basis until the ewes produced 200 g of milk/day. A set type of yogurt was processed using bulk milk, under a given CRD, and a commercial culture YC 180 CHR-Hansen, Denmark was used.

Yogurt firmness was determined by measuring the penetration force using texture analyzer TX-X2i Stable Micro Systems. Organoleptic and visual characteristics that affect yogurt price (texture, smell, taste and appearance) for all diets were assessed by a panel of 10 professional middlemen. A random ranking method with a 1-5 scale (1 = worst, 5 = best) was used to score four quality traits: appearance, texture, smell and taste.

### Statistical analysis

Milk production and yogurt firmness data were analyzed by linear models using GLM-SAS procedures and sensory data using GENMOD-SAS procedures linking to a cumulative logits (SAS software, Version 9.1).

## Results and Discussion

### Milk production and costs

Milk production of ewes under five of the six CRD was up to 48% higher than that of control ewes ( $P < 0.001$ ). With 34% molasses in its composition, CRD 6 caused a decrease in milk production in relation to the control ( $P < 0.001$ ) (Fig. 1). The feeding cost per day per ewe of all CRD offered was slightly higher than the control diet except the CRD6 cost that was the lowest. The total net income per season per ewe was higher in all CRD except CRD6 compared with the control diet. Paralleling feed costs, total income in CRD6 was the lowest (Fig. 1)

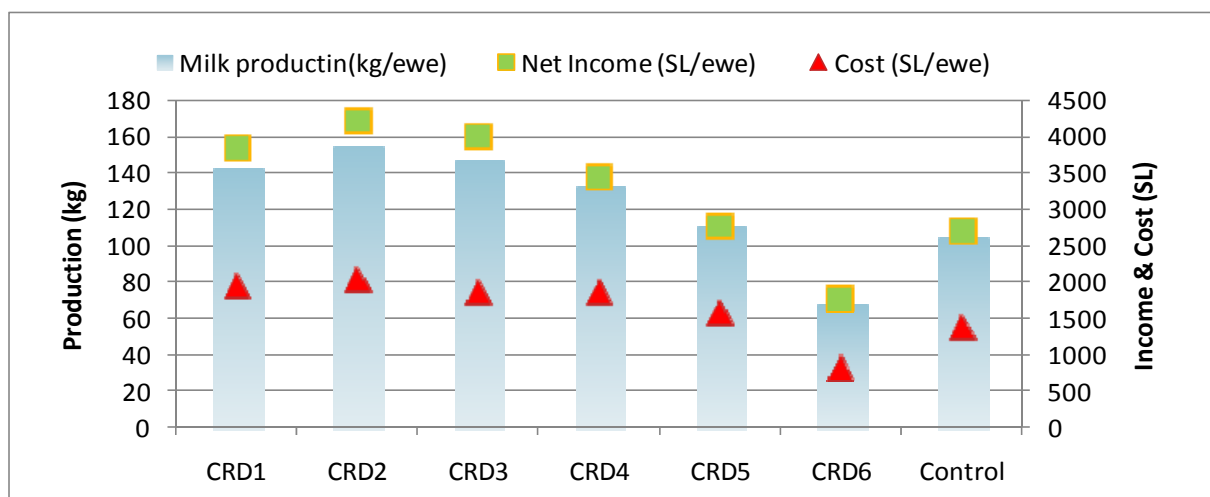


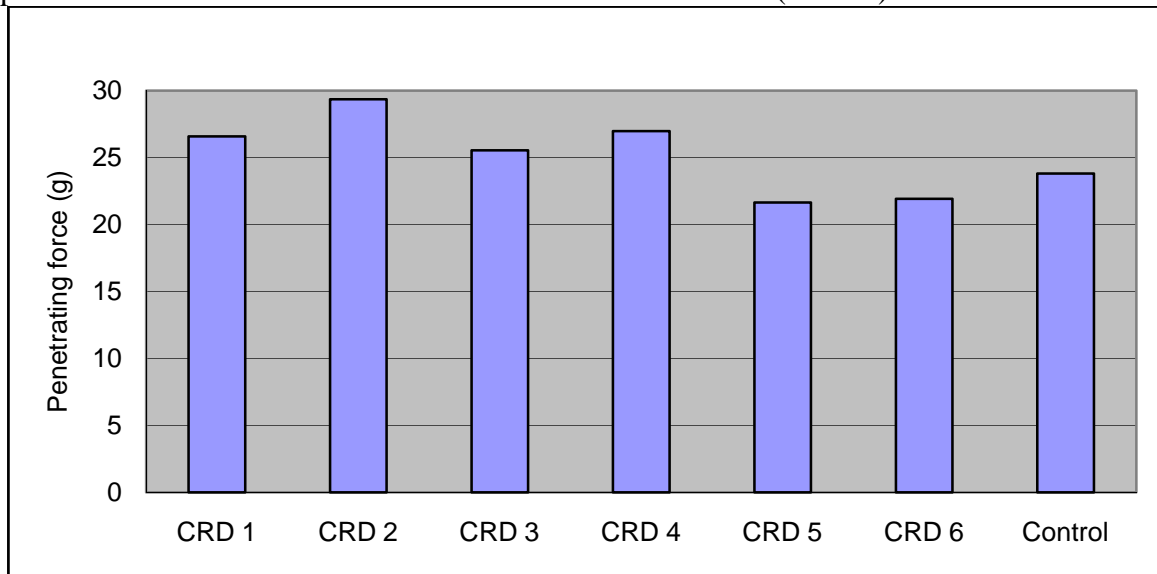
Figure 1. Effect of diets on total milk production, total costs and total net income .

### Yogurt quality

#### Yogurt firmness

Texture profile analysis (TPA) revealed an effect of the CRD's on consistency which reflects on yogurt firmness ( $P < 0.001$ ), an important characteristic of yogurt pricing in the Middle East. In four out of six CRD, the firmness increased from 6 to 23% over the control group. In the

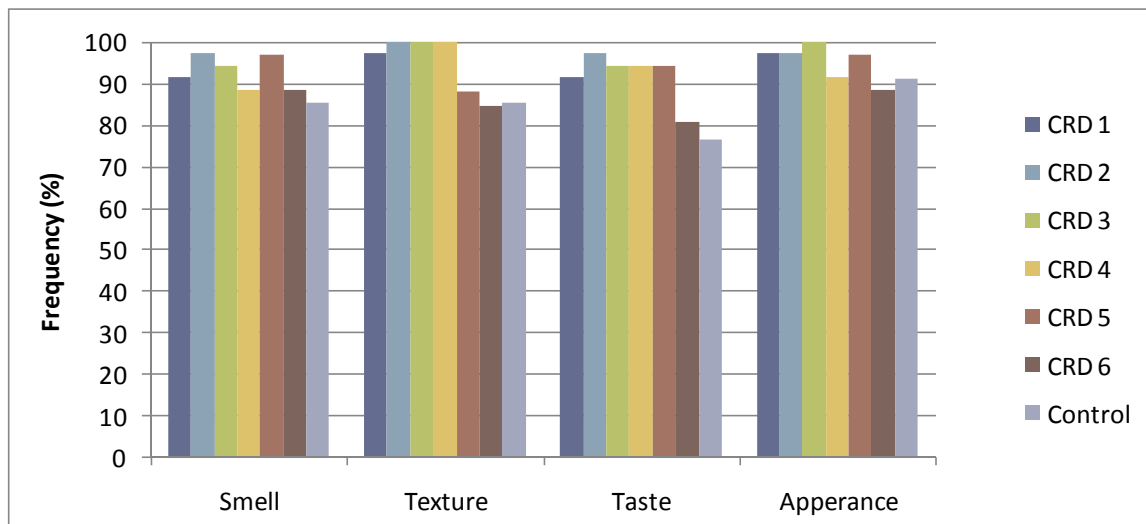
remaining two CRD diets (5 and 6, respectively) that included molasses, the firmness declined from 9 to 10% compared to the group (Fig. 2). A trend to increasing firmness as the milking period advances was observed in three CRD and the control ( $P < 0.05$ ).



**Figure 2.** Effect of diets on yogurt firmness

### Organoleptic properties

Texture, except in CRD 6 (molasses diet), and taste, were positively improved by the CRD over C ( $P < 0.01$ ) (Fig. 3). The effects of diets on smell and appearance were not significant. Yogurt produced under the molasses-diet CRD 6 ranked lower than the other CRD's in relation to all analyzed traits ( $P < 0.01$ ).



**Figure 3.** Effect of diets on organoleptic properties (sum of the three highest scores)

### Conclusion

The proposed diets using non conventional feeds, effectively decreased the feeding costs and increased productivity of dairy sheep systems without affecting the main quality components of yogurt. Actually the proposed diets enhanced yogurt quality (in 5 out of the 6 CRD's) and texture properties (in 4 out of the 6 CRD's).