

Economic Assessments of Hormonal and Nutritional Treatments for Improvement of Awassi Sheep Production in Jordan

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ABSTRACT : The animal production sector in Jordan is characterized by shortages of locally produced feedstuffs derived from rangeland, forage plants or from human food crops as by products. This is exacerbated by insufficient rainfall, overgrazing, early grazing and high stocking rate. Thus, subject to these constraints, other technological improvements are highly desirable to meet the needs of crop growth and animal production. Alternative adapted technologies are also desirable in order to meet the increased demand for red meat in relation to population growth along with the changes in the price subsidy for feedstuff. The technologies are those, which have been introduced to the animal production sector, obtained in agricultural research stations besides on-farm demonstrations. They include technologies suited for increasing birth and twinning rates, synchronizing the mating period, introducing the early weaning method, and animal feed and sheep production. Economic assessments conducted in this study demonstrate promising results of hormonal and nutritional practices in improving production efficiency of Awassi sheep in Jordan. Jordanian published data between 1991 and 1998 were used. The examined practices were: 1) use of PMSG in estrus synchronization in ewes, 2) introduction of early lamb weaning program, 3) supplementation with AD₃E for ewes and 4) the use of agro-industrial feed block as a feed supplement for grazing lambs. Production data were then subjected to partial budgeting for economical evaluation. The use of PMSG outperformed the control groups in fertility and net returns per ewe by US\$ 8.36/ewe. The early weaning of lambs increased the net returns by US\$ 3.90/lamb. The injection with vitamin AD₃E showed an average additional net return of US\$ 5.66/ewe. Feeding agriculture by-product blocks improved weight gain in the feed block groups and resulted in additional net returns of US\$ 3.5/lamb. The economic viability and reproductive performance indicators demonstrate that efforts should be undertaken to disseminate these new practices in the development program. (*Asian-Aust. J. Anim. Sci. 2002, Vol 15, No. 8 : 1110-1114*)

Key Words : Production Efficiency, PMSG, AD₃E, Economics

INTRODUCTION

Agriculture is considered one of the important sectors in the Jordanian economy. Although its contribution to the gross domestic production has decreased sharply in recent years from US\$ 345.5 million in 1991 to US\$ 211.2 million in 1997, its share of the GDP, however, has generally remained around 6% (CBJ, 1998). This sector is the main source of income for about 20% of the population (DOS, 1998). The study conducted by Nör and Ströbel (1996) concluded that the small ruminant sector in Jordan is not competitive with the world market. Shortages of locally produced feedstuffs, overgrazing, and the lack of use of modern managerial farming practices are the major constraints in the animal production sector in Jordan. Many of these modern managerial practices were demonstrated to sheepherders under a national program in a close collaboration with ICARDA Mashreq and Mashreq/Maghreb projects. They included practices suited for increasing birth and twinning rates, synchronizing the lambing period, introducing the early lamb weaning method

and modification in animal feed and nutritional supplements (ICARDA, 1991; 1992; 1993; 1994; 1995; 1996; 1997 and 1998). The objective of this study was to carry out preliminary economic assessments of the outputs generated by these practices.

MATERIALS AND METHODS

The treatments were carried out on farmer's flocks, with the farmer taking full responsibility of their implementation on their own animals. The implementation of the program was carried out in a close cooperation between researchers, extensionists and farmers. Farmer had the main role in demonstration followed by extensionist and research worker.

The demonstration practices included a) Intravaginal sponges impregnated with progesterone and Pregnant Mare Serum Gonadotrophin hormone (PMSG) treatment to synchronize estrous and increase twinning rate (Lubbadeh, 1986a,b; Scott, 1982), b) Early weaning technology to increase the economic return from sheep husbandry (Awawdeh, 1994), c) Vitamin AD₃E injection to increase sheep fertility (Al-Haboby et al., 1997) and d) Using agro-industrial feed blocks as a complementary feeding (Salman et al., 1997).

For the intravaginal sponges impregnated with progesterone and PMSG experiments. Fluorogesterone acetate were placed in experimental ewes. After 14 days,

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the sponges were removed. Ewes were then injected with 600 IU of PMSG 24 h before removing the sponges. Ewes were introduced to rams after 48 h of sponge removal at a ratio of 1 ram to 10 ewes. The full procedure is described by Lubbadah, 1986a.

For the early weaning experiments, every selected flock in a given year was divided into to lamb groups. The first group was left as a control to be handled in a conventional method. Lambs in the second group were weaned gradually, with a complete weaning at 60 days of age. The treatment started when lambs were 21 days of age. Lambs in the control group were weaned at 83 days of age. Special feed provided to the weaned lambs consisted of 17% CP concentrate mix.

For vitamin AD₃E treatments, every selected flock in a given year was divided into two groups. The first group (control) was left untreated whereas the 2nd group was injected with 2 AD₃E injections. First injection was prior to the mating season whereas the second injection was introduced 2 months before lambing.

For the feed block experiments, every selected flock in a given year was divided into two groups. The first group (control) was reared following conventional farm management practices. The second group was reared using feed blocks, which consisted mainly of wheat bran, poultry, litter, lime, cement, urea and salt (approximately, 40, 35, 10, 5, 5, 5% DM basis). The feeding period was 30 days.

Partial budgeting is used for the evaluation of the profitability of new techniques of production that emerges from farmer's field demonstrations. Partial budgets are useful to evaluate changes such as: adopting a new technology, expanding an enterprise, alternative enterprises different production practices, hiring a custom operation

rather than purchasing equipment, making a capital improvement and determining the value of a marketing plan change (Norton, 1988). Thus partial budget was used to evaluate profitability of demonstration from production data obtained on farmer's field.

Due to the differences in flock size over the years the additional lambs per treated ewe were estimated using the following formula:

$$L = \frac{L_t - \left(\frac{L_c}{E_c} E_t \right)}{E_t}$$

Where L represents the additional lamb per treated ewe. L_t weaned lambs in treatment, L_c weaned lambs in control, E_c ewes exposed to rams in control and E_t ewes exposed to rams in treatment.

Costs and returns data generated in the study were, therefore, used to calculate the partial budgets for these practices demonstrated on farmers' herds to assess their relative efficacy in the development program. Costs are those of supplementary operations and inputs required by a given practice in comparison to the control, whereas returns are the additional value of meat and/or milk produced per ewe.

RESULTS AND DISCUSSION

PMSG hormonal treatment

In all demonstrations conducted on sheep flocks under semi-intensive management systems during the period (1991-1998), the ewes with treatment of sponge and PMSG outperformed the control groups in lambing rate (table 1). The seven season average lambing rate increased from

Table 1. Economical assessment of productivity for ewes treated with PMSG compared with untreated ewes

Years	1991	1992	1992	1993	1993	1994	1994	1995	1995	1996	1996	1997	1997	1998	Average
Treatments	Cont.	PMSG	Cont.	PMSG	Cont.	PMSG	Cont.	PMSG	Cont.	PMSG	Cont.	PMSG	Cont.	PMSG	Cont.
No. Flocks*	5	5	4	4	2	2	3	3	3	3	2	2	3	3	-
No. Ewes exposed to rams*	71	60	381	143	105	105	115	118	113	111	141	139	150	150	-
No. Ewes giving birth*	44	49	276	131	74	94	75	96	67	89	96	122	51	117	-
No. Ewes giving twins*	2	19	14	32	4	27	0	19	1	32	3	47	1	32	-
No. of born lambs*	46	69	290	157	78	125	75	115	68	128	99	169	52	149	-
Lambing rate*, %	64.8	115.0	76.1	109.8	74.3	119.0	65.2	97.5	60.2	115.3	70.2	121.6	34.7	99.3	65.8
Additional cost, US\$/ewe	-	6.97	-	6.97	-	7.20	-	6.82	-	7.09	-	7.26	-	6.90	-
Additional return, US\$/ewe	-	15.33	-	13.25	-	20.55	-	13.20	-	25.99	-	21.89	-	26.37	-
Net additional return, US\$/ewe	-	8.36	-	6.28	-	13.35	-	6.37	-	18.90	-	14.63	-	19.47	-

* Compiled from Mashreq project annual reports (1991-1995) and Mashreq-Maghreb project annual reports (1996-1998).

65.8% in the control group to 110.4% in the PMSG group. As a result, every treated ewe gave an average of 0.38 additional lamb.

The average lambing rate at a national level in Jordan is 80% as reported by Nör and Ströbel (1996).

The additional cost of this practice consisted of the cost of sponges and PMSG, the extra feed cost of additional lambs and labor cost. This was US\$ 7.03/ewe. The total return in treatment and control groups is a product of lamb weaning weight by the corresponding average liveweight price. The additional return is the difference between the total return with treatment and total return without treatment; there is no reduced income as a result of this technology. The average additional return was US\$ 19.51/ewe. Thus the net returns per ewe due to this practice was US\$ 12.48/ewe as shown in (table 1). Therefore, the use of sponge and PMSG hormone treatment on sheep during regular mating season increases farmers' income.

Early weaning treatment

Results of early weaning of lambs showed a considerable increase in milk production. The early supply of milk as a result of adopting this technology, when the seasonal price is high, had also resulted in a substantial increase in farm profitability. The additional feed cost and labor associated with this practice was US\$ 3.90/lamb, whereas the additional income was US\$ 9.14/lamb. Thus the net additional income to farmer ranged from US\$ 1.63

to US\$ 6.34. The average net additional return of seven seasons is US\$ 5.24/lamb (table 2). On the other hand, early weaning resulted in an extra milk production for sale ranged between 8.5-16.8 kg/ewe/season. The average additional milk of seven seasons is 12.85 kg/ewe.

Vitamins AD₃E injection treatment

This practice was demonstrated to farmers during (1992-1998) period (table 3). The average five seasons treatment with Vitamin AD₃E indicates that fertility rate increases from 70.7% to 80.9%. The total net cash revenue in this study is a product of lamb weaning weight and its sale price. The additional return is the difference between the total return with treatment and total return without treatment. The incremental cost associated with treatment was very low, the average cost of Vitamin AD₃E injections is US\$ 0.03/ewe, whereas there was no direct additional cost of labor, and therefore was neglected from the analysis. Moreover, there was no reduced income as a result of the treatment. The return from lambs' sale per ewe has increased from US\$ 38.6 to US\$ 44.3. The average additional net returns for five years study per treated ewes was US\$ 5.66 (table 3). The high net returns resulted from vitamins AD₃E treatment compared to previously studied treatments is due to the low cost of this approach compared to the others. The incremental 10% in the average fertility rate could be achieved with minimum additional cost.

Table 2. Comparison of productivity and economics of early weaning (EW) of lambs and control (Cont.) treatments

Years	1991	1992	1992	1993	1993	1994	1994	1995	1995	1996	1996	1997	1997	1998	Average	
Treatments	Cont.	EW	Cont.	EW	Cont.	EW	Cont.	EW	Cont.	EW	Cont.	EW	Cont.	EW	Cont.	EW
No. of farms	4	4	3	3	3	3	3	3	4	4	3	3	2	2	-	-
No. of lambs*	89	89	85	105	61	69	86	96	75	81	62	62	15	15	-	-
Daily weight gain, g/lamb/day*	141	164	169	190	167	191	261	262	228	227	217	208	88	93	182	191
Avg. additional milk kg/ewe*	-	12.0	-	16.8	-	8.5	-	15.6	-	16.4	-	10.7	-	9.7	-	12.8
Additional feed cost, US\$/lamb	-	1.7	-	4.5	-	3.9	-	2.6	-	3.8	-	2.7	-	3.4	-	3.2
Reduced income, US\$/lamb	-	1.4	-	0.0	-	0.2	-	2.0	-	0.0	-	0.8	-	0.0	-	0.6
Total reduced benefits, US\$/lamb	-	3.1	-	4.5	-	4.1	-	4.6	-	3.8	-	3.6	-	3.4	-	3.9
Milk additional income, US\$/ewe	-	7.2	-	10.3	-	4.9	-	8.9	-	9.9	-	6.8	-	6.3	-	7.7
Additional income, US\$/lamb	-	1.5	-	1.8	-	0.8	-	1.9	-	0.3	-	0.9	-	2.0	-	1.3
Total increases benefits, US\$/lamb	-	8.7	-	12.2	-	5.7	-	10.8	-	10.2	-	7.8	-	8.3	-	9.1
Net additional return, US\$/lamb	-	5.6	-	7.7	-	1.6	-	6.1	-	6.3	-	4.2	-	4.8	-	5.2

* Compiled from Mashreq project annual reports (1991-1995) and Mashreq-Maghreb project annual reports (1996-1998).

Table 3. Comparison of productivity and economics of vitamins AD₃E treated ewes versus control treatments

Years	1992	1993	1993	1994	1994	1995	1996	1997	1997	1998	Average	
Treatments	Control	AD ₃ E	Control	AD ₃ E	Control	AD ₃ E	Control	AD ₃ E	Control	AD ₃ E	Control	AD ₃ E
No. of farms	2	2	2	2	2	2	3	3	1	1	-	-
No. of ewes treated*	56	165	85	144	85	88	150	150	25	25	-	-
Fertility rate*	74.3	85.0	81.7	85.5	72.8	79.1	68.6	74.6	56.0	80.0	70.7	80.8
Return from lambs sale, US\$/ewe	41.9	46.2	47.1	49.3	40.6	44.8	36.2	42.2	26.8	38.5	38.5	44.2
Net additional return, US\$/ewe	-	4.2	-	2.2	-	4.1	-	5.9	-	11.7	-	5.6

* Compiled from Mashreq project annual reports (1991-1995) and Mashreq-Maghreb project annual reports (1996-1998).

Feeding agro-industrial by-product feed blocks treatment

The effect of feeding agriculture by-product blocks demonstration conducted in three seasons showed that average weight gain during a period of 51 days was 26 g/lamb/day greater compared with the control group (table 4). Partial budgeting analyses showed that there was an increase on average net returns per lamb. The average additional cost of feed block was US\$ 0.29/lamb, whereas the additional return was US\$ 3.8/lamb. The increase in the farmer's average net additional returns is US\$ 3.5/lamb. However, concentrate substitution in the feed ration was more important to farmers than the additional weight gain as a result of feeding feed blocks.

The available data is not sufficient to make judgment about the substitution possibility between feed block and concentrate. But the most important results of feed block were the possibility of using wasted agro-industrial by-product in feeding small ruminants.

CONCLUSION

This study has focused on the economics of the new technologies introduced to the animal production sector in

Jordan. These technologies suited for increasing birth and twinning rates, synchronizing the mating period, introducing the early weaning method, and animal feed and sheep production.

All technologies tested in animal production sector showed positive difference in farmer's net return and superiority to the prevailing conventional technologies. The treatment groups outperformed the control groups in both fertility levels and net returns per ewe.

In case of availability of highly subsidized animal feed, farmers might feel that there is no need to apply these technologies. On the other hand, if government policies toward prices change, then adoption of these technologies is likely to occur, net farm income will be enhanced and animal production will become profitable. This will reduce the flow of rural migration, increase the overall supply of red meat and other animal products and in turn, will generate higher benefits to the national economy. However, in order to pass a more sound economic judgment, these technologies should be tested using farm level data. A thorough economic study on these technologies and their level of adoption by farmers will be very useful in the future.

Table 4. Comparison of productivity and economics of lambs fed feed blocks (F-Block) versus control treatments

Years	1993	1994	1994	1995	1997	1998	Average	
Treatments	Control	F-Block	Control	F-Block	Control	F-Block	Control	F-Block
No. of farms	1	1	2	2	1	1	-	-
No. of lambs*	11	12	15	20	7	7	-	-
Avg. Initial weight*, kg	29.7	28.8	37.5	38.9	30.1	30.0	-	-
Avg. final weight*, kg	31.5	31.3	43.6	46.2	33.4	35.3	-	-
No. of days*	30	30	70	70	53	53	-	-
Total weight gain*, kg/head	1.8	2.5	6.1	7.3	3.3	5.3	3.7	5.0
Daily weight gain*, g/day/head	61.3	83.3	87.1	104.3	61.5	100.0	70.0	95.9
Additional cost, US\$/head	-	0.21	-	0.25	-	0.42	-	0.29
Incremental weight, kg/head	-	0.66	-	1.20	-	2.04	-	1.30
Additional return, US\$/head	-	1.93	-	3.50	-	5.96	-	3.80
Net additional return, US\$/head	-	1.72	-	3.25	-	5.54	-	3.50

* Compiled from Mashreq project annual reports (1994-1995) and Mashreq-Maghreb project annual report (1997/1998).

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