Interventions to increase the contribution that goats make to the livelihoods of landless and land-constrained livestock keepers in the Gangetic plains of Nepal[1]

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Abstract

Four communities (villages) in the Dhanusha district of southern Nepal took part in an experiment lasting one year, which was aimed at developing appropriate strategies to enhance doe productivity and thereby increase the contribution goats make to the livelihoods of landless and land-constrained livestock keepers. In each village, 20 households keeping between three and eight goats participated. Households were divided randomly into one of three groups and managed their goats throughout the experiment according to normal practice. Does' diets were supplemented with one of the following three treatments: 1) DMZ: Does' diets were supplemented with 100 g/d ground maize for two weeks before and six weeks after kidding (n=7 per community); 2) DSE: Does' diets were supplemented with 500 mg selenium and 50 mg Vitamin E for two weeks before and six weeks after kidding (n=7 per community); 3) CON: Does were managed according to normal practice, but finishing goats were supplemented with ground maize (100 g/d) for three weeks before sale (n=6 per community).

A villager recruited by the project to act as a facilitator visited the households every two weeks and maintained individual records (entries, exits, services, incidences of disease and live weights) of all goats, as well as records of household income and debt. The effects of treatment on doe performance and annual potential income (sum of the change in asset value of the flock and income from all sales of goats) were estimated by analysis of variance. Does in DMZ kidded more often (0.85, 0.72, 0.59 kiddings/doe for DMZ, DSE, CON respectively, s.e.m. 0.069, $P<0.05$) and produced more kids (1.6, 1.0, 1.2, s.e.m. 0.17, $P<0.05$). They also gained more live weight in the first two recordings after kidding (2.15, 1.35, 1.29, s.e.m. 0.862 kg, $P<0.001$) as did their kids (1.52, 1.15, 1.08, s.e.m. 0.071, $P<0.001$). This resulted in an almost significant ($P=0.053$) increase in the annual potential income from the goat flock (NRs 4,453, 2,352, 2,669 s.e.m. 803.3 or US$ 68.5, 36.2, 41.1 s.e.m. 12.36). The net benefit of the DMZ treatment (taking into account the cost of treatment) is equivalent to 19 per cent of mean household debt and 69 per

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cent of mean monthly household income. Farmers were positive about both treatments, although the level of adoption of DMZ was greater. It is concluded that energy is limiting in the diets of does, and supplementation with maize, other cereals, or other energy-rich feed resources that might be identified will have a positive impact on the contribution goats make to the livelihoods of resource-poor livestock keepers in Nepal.

Introduction

Goat keeping is widely practiced in Nepal, with 85 per cent of households in rural Nepal keeping at least one goat. Work with four communities (Jamunibas, Kemalipur, Baluwa Bhiman and Birendra Bazaar) in Dhanusha District, Central Development Region of southern Nepal, situated in the Gangetic plain about 100 m above mean sea level, identified two key constraints to goat keeping in this area. These were the high incidence of disease in the wet season (July-September), and infertility in does. The commonest cause of disease in goats in the wet season was identified as infection by helminths (Thakuri *et al.*, 1994), and a range of interventions were investigated with these communities to reduce the incidence of disease and the number of enforced sales of sick goats. The findings from this investigation have been reported previously (Rymer *et al.*, 2004). While evaluating these interventions, it became apparent that doe infertility was another key constraint to goat keeping in this area. Does that failed to conceive after two services are sold, and 21 per cent of households did not keep a multiparous doe, presumably because of difficulties encountered with getting their does into kid a second time. A survey of the does' nutrient balance indicated that energy was limiting, particularly in early lactation when attempts to get her back in kid may begin as the target kidding interval is six months. There was also some evidence that selenium may be a limiting nutrient in this geographical area. The objective of this study was, therefore, to develop appropriate interventions to overcome these two potential nutritional constraints, and determine what effect this might have on the contribution the goat flock makes to goat keepers' livelihoods.

Materials and methods

As in the experiment reported by Rymer *et al.* (2004), 20 households from each community were involved. Each household kept between three and eight goats, the number of adult does being on average 2.8. All goats were treated with broad spectrum anthelmintics (fenbendazole and oxoclozanide) in May and September (at the beginning and end of the wet season) and vaccinated against peste des petits ruminants (PPR). Other than this, goats were managed according to normal practice throughout the experiment apart from the use of the intervention that was being investigated.

Households were randomly divided into three treatment groups. It was assumed there was no carry-over effect from the previous experiment. The treatments investigated were:

1. DMZ: Does' diets were supplemented with 100 g/d ground maize for two weeks before and six weeks after kidding (n=7 per community)
2. DSE: Does' diets were supplemented with 500 mg selenium and 50 mg Vitamin E for two weeks before and six weeks after kidding (n=7 per community)

3. CON: Does were managed according to normal practice, but finishing goats were supplemented with ground maize (100 g/d) for three weeks before sale (n=6 per community).

Individual records of all goats (entries, exits, incidences of disease, reasons for exit and the price obtained (if sold) were maintained by facilitators in each community visiting participating households at fortnightly intervals. Live weight was recorded at monthly intervals, except in the case of pregnant does. In addition, regular records of household income and sources of that income were kept, as were records of the level of household debt. The mean prices obtained from the sale of adult (more than 8 months) male and female goats and young (less than 8 months) male and female goats were used to calculate the asset value of each goat flock at the beginning and end of the experiment. The effects of treatment, community and interaction between treatment and community on doe productivity, live-weight gain of does and kids post-partum, income from goat sales and asset value of the goat flocks were estimated by analysis of variance.

Results

Data relating to the economics and structure of the participating households were reported by Rymer *et al.* (2004). Thirty-three per cent of the households were landless and unable to grow any of their own food. These households were always reliant on either purchased food, or receiving food in part payment for labour. However, food self-sufficiency was only for five months per year across all the households in the study. Goat sales constituted about 11 per cent of household income, and in some months as much as 56 per cent. Mean household debt was NRs 8,468 (US$ 130), which ranged from NRs 0 to 30,286 (US$ 0 to 466), and mean monthly income was NRs 2,392 (US$ 37), ranging from NRs 597 to 9,143 (US$ 9 to 141).

No interactions between community and treatment were observed. The effect of treatment on doe productivity and live-weight gain of kids and does is summarised in Table 1. Does that were supplemented with maize kidded more frequently and produced more kids during the experimental period (one year) than does that received either no supplement or were fed supplementary selenium. Does, and the kids they produced, gained more live weight in the month after kidding if they were supplemented with maize compared with does kept on the other regimes.

Table 1 *Effect of treatments on doe productivity and live-weight gain of kids and does (see text for treatment details)*

	Treatment				
	DMZ	**DSE**	**CON**	**s.e.m.**	**Significance[1]**
Kiddings/doe	0.85	0.72	0.59	0.069	*
Kids/doe	1.6	1.0	1.2	0.17	*
Live-weight gain, kg (difference between the first and second recording of live weight after kidding):					
Kids	1.52	1.15	1.08	0.071	***
Does	2.15	1.35	1.29	0.862	***

[1]* = $P<0.05$; *** = $P<0.001$.

The effect of treatment on the asset value of the flock, income from goat sales and potential income from the goat flock is summarised in Table 2. There was no significant difference between treatments in the asset value of the flocks at the start or end of the experiment, but the change in asset value was affected by treatment ($P<0.05$) with DMZ being associated with a 10 per cent increase in the value of the flock, whereas CON was associated with a 29 per cent decrease in asset value. This was in part offset by the tendency for sales income from goats to be higher with CON than DMZ, but this effect was not significant ($P>0.05$). The net benefit (change in asset value plus sales income) was affected by treatment ($P=0.053$) with DMZ being associated with a 64 per cent return on mean asset value while CON and DSE were associated with returns of 41 and 35 per cent, respectively. This increased potential income from DMZ compared with CON amounted to NRs 1,784 (US$ 27.45). The cost of treatment, with mean adult doe numbers of 2.8 per household, kidding 0.85 times a year, amounted to NRs 133 (US$ 2.05) resulting in a net benefit of NRs 1,651 (US$ 25.40). This is equivalent to 19 per cent of mean household debt and 69 per cent of mean household monthly income.

Table 2 *Effect of treatment on the asset value and sales income from goats (see text for treatment details)*

	Treatment				
	DMZ	DSE	CON	s.e.m.	P[1]
Asset value at start (NRs)[2]	6637	6964	7483	778.7	ns
Asset value at end (NRs)	7370	6314	5608	845.8	ns
Change in asset value (NRs)	733	-650	-1876	736.9	*
Income from goat sales (NRs)	3720	3003	4545	663.5	ns
Potential income from goat flock, NRs (sum of change in asset value and goat sales)	4453	2352	2669	803.3	0.053

[1]ns = not significant, $P>0.05$; * = $P<0.05$

[2] Exchange rate at time of writing is 69.8960 NR to 1 USD

The farmers' evaluations of the different treatments are presented in Tables 3-5. Farmers' evaluation of DMZ was that it had increased doe fertility, halved the kidding interval and increased the value of the kids produced. In all communities, except Birendra Bazaar that reported a shortage of maize, participating farmers, and some of their neighbours, had adopted this technology, although many fed maize less frequently than in the experiment and many used cereals other than maize, which were often cooked with water (*khole*). Although there was no evidence that selenium affected doe fertility, the farmers' evaluation was that it had caused previously infertile does to conceive and they were keen to adopt this technology.

Table 3 *Farmers' comments on supplementing kidding does with maize*

Village	Comments on treatment	Comments on adoption
Baluwa Bhiman (comments from 5 farmers)	Liked treatment because fertility, kid performance and live-weight gain improved, and milk yield increased.	Continued feeding maize to does; one participant said they weren't doing this regularly but were feeding forage *ad libitum*. One participant buys maize to feed her doe. Most are feeding maize (100 g/d) or khole; neighbours are adopting as well. Leftover rice is given to the goats.
Birendra Bazaar (comments from 7 farmers)	All liked the treatment; 2 said this was because kid numbers and live-weight gain increased, 4 said because kidding interval had decreased from 12 to 6 months. Kid price from does fed maize increased (from NRs 600 to NRs 1,000).	Most have not adopted because maize was not available. Will feed does maize when it is available. Neighbours (5 of the 7) are positive about treatment, but they have not adopted it. Some neighbours do not know because results have not been communicated. Message should be extended.
Kemalipur (6 farmers present, 1 absent because of bereavement)	All liked the treatment because it increased prolificacy and growth, and the number of pregnancies doubled (twice a year instead of once). Five of the 13 farmers in group ate the maize rather than giving it to their goats.	Now feeding maize flour with water, one is feeding maize bran. One is feeding flour mixed with water to make a ball. No longer separating does from khassi (castrated males). One (landless) farmer is giving leftover rice, forage and grazing. One giving khole and salt water. Majority of neighbours have adopted.
Jamunibas (comments from 5 farmers)	Liked treatment because goats grew well and does became pregnant. Kidding interval 7-8 months. Good kid performance and goats came back on heat quickly.	Adopted, but not as regularly as in the experiment. Does now fed every 2-3 (or 3-4) d, although one was feeding daily. Does fed every 3-4 d get more (about 2 kg). Lack of time, and maybe feeding leftovers that are not available every day prevent daily feeding. Neighbours have adopted as well. Good message for extension.

Table 4 *Farmers' comments on supplementing kidding does with selenium*

Village	Comments on treatment	Comments on adoption
Baluwa Bhiman	Liked treatment because 19 d after kidding, one doe conceived. Goats became fatter and were ready for the buck quickly.	Want to buy this 'medicine' but don't know where it is available. Message should be extended.
Birendra Bazaar	Kid health improved with treatment, and kidding interval decreased. No problems with infertility, and fertility increased with treatment.	Message should be extended.
Kemalipur	Liked treatment because does became strong, robust and fat. Increased fertility.	Shopkeeper does not know (and, therefore, does not stock) selenium.
Jamunibas (5 present)	Liked treatment.	All want to continue feeding selenium but can't get it. Asked local facilitator about it, who said it was very expensive. Neighbours know about treatment. Facilitator's wife took some and gave it to one of her infertile does which then conceived.

Table 5 *Farmers' comments on supplementing finishing goats with maize*

Village	Comments on treatment	Comments on adoption
Baluwa Bhiman (18 present)	Good; it made the goats healthy. Good because goats were fed the same, small amount each day.	Will adopt (already normal practice) but will revert to feeding irregular amounts of different cereals. Not worth extending, because it is obvious that if you feed goats cereals they will grow and be healthier.
Birendra Bazaar	Beneficial because goats live weight increased. Became active and strong and fattened.	
Kemalipur (3 present)	Liked treatment because goats became strong and healthy. Five of the 13 farmers in group ate the maize rather than giving it to their goats.	
Jamunibas (5 present)	Liked treatment because although goats were already fed, they were not given measured amounts.	Discussed with neighbours, but they have not adopted - all are feeding irregular amounts. Message should be extended.

Conclusions

There was no objective evidence that selenium was a limiting nutrient in this experiment, but energy clearly was. Supplementing goats' diets with energy (in the form of ground maize) improved doe fertility and increased the potential income of the goat flock. In a previous experiment (Rymer *et al.*, 2004), it was observed that maize supplementation also reduced the incidence of disease in the wet season, and there was again a tendency for the potential income from the goat flock to be increased. The supply of dietary energy is clearly a key constraint to goat production by resource-poor livestock keepers in

this area, but finding an affordable means of overcoming this constraint can be a challenge. Providing supplementary energy (in this case in the form of maize) at key times in the goats' life cycle is probably the best means of maximising returns on such an investment. The strategic use of supplementary maize (or another energy source) in the does' diet at times of peak requirements (late pregnancy and early lactation) is affordable by many of the participating farmers, as they have adopted the technology, albeit with some modifications. The effect of this strategic supplementation is a measurable increase in the contribution that the goat flock makes to the livelihood of the household. The level of adoption by one community (Birendra Bazaar) was lower because maize was not available there. Further work needs to be done to identify alternative sources of supplementary energy in these situations, and to communicate the effectiveness of this technology to target institutions working with very poor and landless livestock keepers in Nepal and elsewhere.

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