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Evaluation of growth performance, cohort dynamics, and economics in sheep under extensive rearing management

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ABSTRACT

The 5-month trial evaluated the live-weight progress, targeted supplementation, and financial returns of eight sheep under an extensive rearing system. Under extensive management, grazing and roughage (including species like Super Napier and Hedge Lucerne) formed the primary forage base, supplemented with a concentrated grain mixture (16.9% Crude Protein) at 2% of body weight to support growth. Health management relied on strategic vaccination schedule and bi-weekly diagnostic fecal monitoring. The flock was divided into two baseline age groups: a younger cohort (89–96 days) and an older cohort (121–130 days). The older cohort achieved a higher mean body weight gain (17.78 kg) compared to the younger cohort (15.70 kg). Despite individual illness, extensive rearing yielded a net profit of ₹33,500 with a Return on Investment (ROI) of 43.79% over 5 months.

Keywords: Extensive rearing, Live-weight gain, Concentrate supplementation, Cohort dynamics, Production economics

Introduction

Extensive sheep rearing systems rely primarily on pasture grazing and opportunistic browsing for basic maintenance and bulk forage intake (Sankhyā *et al.*, 2007 and NRC, 2007) [1]. To overcome natural nutritional deficiencies in extensive ranges, concentrate supplementation is provided to accelerate live-weight gains and improve carcass yield. Maintaining animal health under extensive systems presents distinct challenges, as open grazing increases exposure to gastrointestinal parasite ova and soil-borne pathogens (Waller, 2006) [2]. This article provides a performance analysis comparing younger versus older cohorts under extensive management with semi-controlled supplementation, alongside an itemized financial analysis of total enterprise profitability.

Materials and methods

Husbandry, forage and supplementation protocols:

Animals were reared under extensive management for 5 months. Green forage sources such as Napier grass and Hedge Lucerne (*Desmanthus virgatus*) contributed to daily roughage intake, supplemented with a formulated concentrate feed at 2% of body weight.

Concentrate Supplement Formulation (per 100 kg batch):

Proximate Chemical Composition: 16.9% Crude Protein (CP), 2.63% Ether Extract (EE), and 8.7% Crude Fiber (CF).

Prophylactic Health Regimen:

Item	Quantity (in Kg)
Maize	40 kg
Deoiled Rice Bran / DORB	25 kg
Groundnut Cake / GNC	20 kg
Bajra / Pearl Millet	11.6 kg
Mineral Mixture	2 kg
Common Salt	1 kg

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Prophylactic parameter	Day
Deworming (Fenmec plus)	Day of purchase
Enterotoxaemia (ET) vaccine	Day 5
Hemorrhagic septicemia (HS) vaccine	One month post purchase
Deworming (Piperazine hexahydrate)	Two months post purchase
Bluetongue vaccine	Three months post purchase

Bi-weekly fecal egg counts for targeted anthelmintic therapy.

Comparative analysis: first four vs. last four animals

The extensive rearing batch was categorized into two distinct age cohorts:

1. Younger Cohort (First Four Animals): Tags 23, 22, 17, and 18 aged 89 to 96 days.
2. Older Cohort (Last Four Animals): Tags 16, 30, 19, and 24 aged 121 to 130 days.

Key differences between cohorts

Forage Utilization & Maturity:

Older animals possessed more developed ruminal capacity, allowing for superior intake and digestion of fibrous extensive forage compared to younger lambs (Van Soest, 1994) [3]. Consequently, the older cohort achieved higher average daily gains of approximately 118.47 g/day compared to younger group which gained approximately 104.76 g/day.

Impact of Clinical Illness:

Parameter	Younger Cohort	Older Cohort
Individual Animal Tags	Tag 23, Tag 22, Tag 17, Tag 18	Tag 16, Tag 19, Tag 30, Tag 24

Financial parameter	Cost / Rupees)	Revenue	(in	Percentage of total cost
Purchase cost of stock (8 animals)	54,000			70.59%
Concentrate feed cost	18,000			23.53%
Prophylaxis, health care and transport	4,500			5.88%
Total operational expenditure	76,500			100%
Gross revenue (selling of 8 animals)	1,10,000		-	
Net profit	33,500		-	
Return on investment (ROI)	43.79%		-	

Financial highlights

Low-Cost Health Protection: Prophylactic health costs accounted for only 5.88% of total expenditure (₹562.50/animal). Strategic bi-weekly fecal surveillance protected grazing stock from high parasitic reinfection rates common in extensive systems (Waller, 2006) [2].

Profitability: Planned concentrate supplementation under extensive rearing yielded a net profit of ₹4,187.50 per animal, generating a total net return of ₹33,500 (43.79% ROI).

Discussion

Extensive rearing relies heavily on natural range vegetation, making strategic concentrate supplementation (16.9% CP) vital to sustain growth rates beyond basic maintenance levels (National Research

Parameter	Younger Cohort	Older Cohort
Initial age range	89-96 days (Mean: 93 days)	121-130 days (Mean: 125 days)
Mean initial weight	13.68 kg	20.13 kg
Mean 3-month weight	18.80 kg	27.78 kg
Mean 5-month final weight	29.38 kg	37.90 kg
Mean total weight gain	15.7 kg	17.78 kg
Mean average daily gain	~104.76 g/day	~118.47 g/day
Health variance	Tag 23 was sick, compromised growth (11.6 kg total gain)	Healthy cohort, steady weight gains

The growth disparity was amplified by illness in Tag 23 within the younger group. Tag 23 attained a final body weight of only 23.6 kg. Healthy animals in the younger group averaged a 17.07 kg gain, demonstrating that uncompromised younger lambs can maintain solid growth trajectories under extensive rearing when provided concentrate support.

Market Readiness:

The older cohort achieved higher final live weights (averaging 37.90 kg, with Tag 30 reaching 42.2 kg), offering earlier market capability.

Economic analysis

An evaluation of input costs and gross livestock sales under extensive management demonstrates favorable production economics.

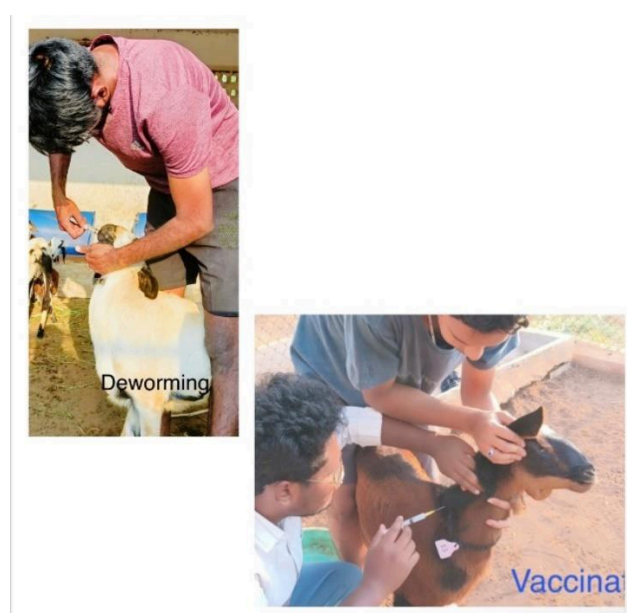
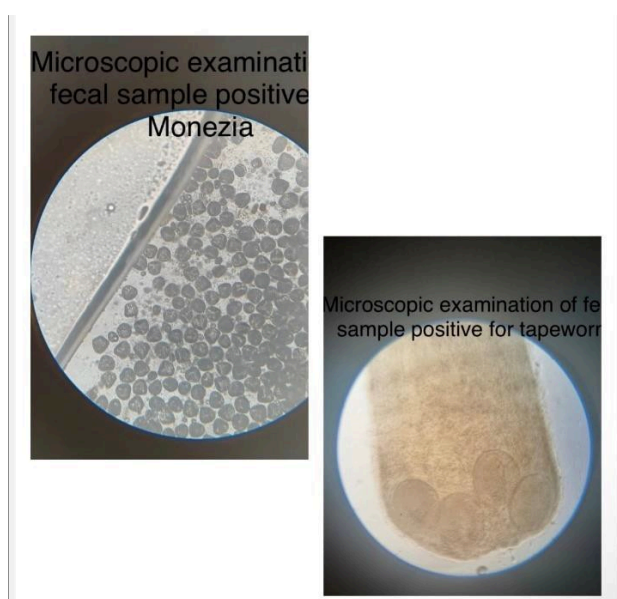
Council (NRC), 2007 and Karim & Santra, 2002) [4]. Older lambs (121–130 days) adapted more efficiently to extensive foraging due to established grazing behaviors and advanced ruminal fiber digestion capabilities (Van Soest, 1994) [3].

In grazing environments, livestock face constant re-exposure to internal parasites (Waller, 2006) [2]. Systematic deworming with broad-spectrum anthelmintics (Fenbendazole + Ivermectin) combined with regular coprological screening prevented clinical parasitism across healthy stock (Kaplan, 2004 and Pugh *et al.*, 2020) [5]. However, the impaired weight gain of Tag 23 demonstrates how clinical morbidity diverts energy toward immune response rather than growth (Colditz, 2002) [6]. Overall, calculated supplementation under extensive systems offers a cost-effective, high-return rearing strategy.

Conclusion

Extensive sheep rearing supported by 16.9% CP concentrate supplementation (at 2% body weight) and green roughages provides strong animal growth and high economic profitability. Older cohorts (121–

130 days) demonstrate superior forage utilization and final weights compared to the younger cohorts. Diagnostic based health management protects grazing stock against environmental pathogen risks, securing an ROI of 43.79%.



Figures



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