

Subabul based feed pellets

as strategic supplements for goats

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This article provides an insight to nutritional limitations of forages and other feed resources under grazing situations of semi-arid Bundelkhand region and the use of supplementation technology by resource poor farmers to optimize production potential of goats. The potential for goat production is limited by many environmental and nutritional factors. Free-grazing goats can select their diet from a complex variety of available native plant species. But forage quality and availability are reduced during dry seasons of the year, affecting nutrient intake and utilization. Moreover, the presence of plant secondary metabolites (PSM) in shrub species reduces the availability of energy to animals. Thus supplementation is required to mitigate both, nutrient deficiencies and the effect of PSM toxicity. Strategic supplementation option with complete feed pellets including leguminous forages can serve as good protein and energy sources for goats. On-farm trials of 90 days duration in both adult as well as growing goats with resource poor farmers in Farmer FIRST Programme villages indicated that adult goats in non-supplemented/control group lost their body weights, while goats in experimental group gained weights. In case of growing goats, experimental/supplemented group (77.6 g) achieved higher daily body weight gain compared to non-supplemented group (34.1 g). The additional income in growing animals due to additional inputs (₹ 207 per goat) in experimental group as compared to control was ₹ 645 per goat. Thus feed pellets as strategic supplement to goats, reared on exclusive grazing, was found profitable.

Key words: Bundelkhand, Goat, Feed pellets, Subabul, Strategic supplements

BUNDELKHAND region covers a geographical area of around 70,000 sq km and includes seven districts (Jhansi, Banda, Chitrakoot, Mahoba, Hamirpur, Lalitpur and Jalaun) of Uttar Pradesh and six districts (Sagar, Panna, Damoh, Tikamgarh, Chhhatarpur and Datia) of Madhy Pradesh. Due to typical soil and climatic condition, the method of crop cultivation, cropping pattern and intensity differ from other region of the states. The rainfall is around 800 mm/annum. Again 80-90% of this rainfall is between July and September when the monsoon crosses the area. Thus, this period is too short and rains are too erratic for most crops. However in livestock,

goat rearing is particularly one of the major occupations and contributes substantially to the income of resource poor farming community and provides stability to rainfed farming systems. Based on the livestock census (20th) conducted in 2019 the population of goats in Bundelkhand region is around 3.21 million heads (Table 1) and reared by more than 75% of households, irrespective of landholding size or caste.

Goats under field conditions are mostly kept on extensive system of management followed by few cases of semi-intensive system indicating that goat rearing is mainly on the basis of extensive production system in the

area (Fig. 1). It has been observed that farmers provided housing just during night time to protect them from the wild animals and thefts. But due to the increasing rate of rangeland degradation and other grazing resources, goat feeding is facing serious problems related to quantitative and qualitative provision of nutrients. Moreover, climate change leading to frequent and extended drought periods, is complicating the situation. Nutrient contents of available feed resources are so low and unbalanced that the provision of complements is necessary for maintenance and production of animals. Concentrate feeds like barley, maize, oil seed cakes



Fig. 1. Goats managed under extensive system

and legumes/pulse straws are commonly used to tackle this problem. However, the impact of such supplementation strategy on performances of animals in terms of economics is often unsatisfactory and sometimes becomes too expensive for resource poor farmers.

Major difficulty and its solution

Ruminants like goats naturally consume high fibrous plant materials, and convert them to a marketable commodity of meat and milk. With fermentation of fibre in the rumen, energy and microbial protein are obtained for productive performances. However, due to the physical and chemical characteristics of high fibrous feeds in semiarid environments of Bundelkhand region, not enough nutrients are provided for cost-efficient goat production. The two most important factors affecting forage quality and utilization are forage species and maturity. Seasonal fluctuations in forage availability and quality are however one of the main causes of nutritional stress that limit animal production in this region. During the dry season, inadequate forage intake that occurs as a result of reduced availability in the rangelands, the low protein level, and an increase in the

lignification and the contents of other fibre components, lead to reduced intake of nutrients such as nitrogen, energy, minerals and vitamins, that are required by goats for their better productive and reproductive performances. Although forage availability becomes as limiting as forage quality to goat performance. Forage quality decreases during the dry season but diet composition depends on availability and botanical profile of rangeland grazed by goats.

Table 1. Goat population in Bundelkhand region

District	Male	Female	Total
<i>Uttar Pradesh</i>			
Jhansi	27,202	233,194	260,396
Banda	49,246	232,146	281,392
Chitrakoot	20,313	155,660	175,973
Mahoba	22,350	183,716	206,066
Hamirpur	35,100	264,230	299,330
Lalitpur	20,953	159,236	180,189
Jalaun	43,790	278,817	322,607
Sub-total	218,954	1506,999	1725,953
<i>Madhya Pradesh</i>			
Sagar	39,309	132,770	172,079
Panna	38,873	164,252	203,125
Tikamgarh	50,526	313,707	364,233
Chhatarpur	74,720	361,245	435,965
Damoh	23,857	127,323	151,180
Datia	16,020	147,717	163,737
Sub-total	243,305	1247,014	1490,319
Total	462,259	2754,013	3216,272

Source: Livestock Census (2019)

Nutrient availability and palatability of certain plant species of rangelands are affected by anti-quality compounds, also known as plant secondary metabolites (PSM), such as tannins, phenolic acids, and alkaloids, which are found in higher concentrations in the diet of free range goats than of other ruminants. Tannins are heterogeneous polyphenolic compounds varying in their molecular weight, with the ability to form complexes with proteins and other nutrients, with the binding properties of their hydroxyl and carboxyl groups. Tannins also induce detrimental effects when consumed by herbivores including goats such as reduced protein availability, lower palatability, gut irritation and systemic toxicity. Studies have indicated that palatability, nutrient digestibility and both energy and nitrogen balance decreased with increasing level of leaves of tannin rich shrubs and trees in the diet. An increased demand for glucose to detoxify the PSM at high intake levels of shrubs suggests that supplements are needed to improve digestibility and availability of nutrients, and provide energy and other nutrients to mitigate the toxic effects of the PSM ingested through shrubs and trees.

Hence, grazing goats need nutrient supplementation but to formulate the correct nutrient supplementation, consideration must be given to animal's requirements in terms of its physiological status, demands of the environment on the animal, and characteristics of the available feed resources. Nutrient supplementation for small ruminants like goats that consume low quality forages under grazing conditions should facilitate the synchronization of nitrogen and carbohydrate degradability in the rumen and increase the supply of nutrients for absorption in the small intestine. However, type and quantity of supplement offered affects forage intake. Overcoming mineral, vitamin or rumen degradable nitrogen deficiencies increase forage intake (complementary response). Consumption of high energy-low protein supplements decreases forage

intake (substitution response) and sometimes supplementation does not affect forage intake (additive response). Thus, goats that consume low quality forages should not be supplemented with large quantities of rapidly available energy sources such as cereal grains, so that a substitution effect does not occur, by reducing forage intake. The supplement should include sources of non-protein nitrogen and true protein, and minerals that are utilized by bacteria to maximize rumen fermentation.

Preparation of feed pellets

Pelleted feeds are defined as agglomerated feeds formed by extruding individual ingredients or mixtures by compacting and forcing through die openings by any mechanical process. Indeed, the purpose of pellet making is to take a finely divided, sometimes even dusty, unpalatable and difficult-to-handle feed material and, by using heat, moisture and pressure, form it into larger particles. These larger particles are easier to handle, more palatable and usually result in improved feeding results when compared to the unpelleted feed resources. It is agreed that animals have better productive performances on pelleted feeds than a meal ration. Since, the heat generated in conditioning and pelleting make the feed resources/ingredients more digestible by breaking down the starches, the pellet simply puts the feed in a concentrated form, and pelleting minimizes waste during the eating process. When pelleted feed is fed, each animal receives a well-balanced diet by preventing the animal from picking and choosing between ingredients. Studies have shown that most animals, if given the choice between the same feed in pellet or mash form, they will prefer the pellets.



Fig. 2. Feed pelleting machine

Pelleting also prevents the segregation of ingredients in a mixing, handling or feeding process. By feeding a pelleted feed, the animal is more apt to receive a totally mixed ration than one that has separated through these processes. It prevents wastage. Bulk density is increased,

which enhances storage capabilities. Transport opportunities are also increased, thereby reducing transport costs. This is particularly noted in fibrous feed ingredients such as straws/stovers.

In the present investigation, feed resources i.e. forages, concentrates and other ingredients need to be incorporated are properly grinded and mixed with desired proportion (wheat straw: subabul leaf: wheat bran: mustard cake: barley: common salt, 20:30: 19: 15:15:1) in a mixer for thorough mixing and equal distribution. The mixed materials are then put in the hopper of animal feed pelleting machine, which in turn apply pressure for densification and release of pellets through die (Fig 2). The pellets are then sun/air dried and made ready to use either for feeding or for transportation to distant places including storage for future use (Fig. 3).

Strategic feeding of pellets and its impact

On-farm trials were conducted on local adult and growing goats during lean periods for 90 days to

Table 2. Growth performance and cost-benefit analysis in goats

Attribute	Adult		Growing	
	G ₁	G ₂	G ₁	G ₂
Animals (n)	37	41	43	43
<i>Growth performance</i>				
Initial body weight (kg)	28.9±0.54	28.8±0.46	16.9±0.41	16.8±0.51
Final body weight (kg)	26.5±0.47	31.9±0.49	20.6±0.44	23.7±0.47
Total weight loss/gain (kg)**	2.40±0.20	3.08±0.11	3.07±0.10	6.98±0.17
Average daily loss/gain (g)**	26.7±2.17	34.2±1.18	34.1±1.16	77.6±1.91
<i>Cost-benefit analysis (per animal basis)</i>				
Total supplement fed (kg)			-	18
Cost of suppl. @ ₹ 11.50/kg (₹)		-	207	
Total live wt (kg) from goats			3.07	6.98
Cost of live wt @ ₹ 165/kg (₹)		507	1152	
Additional income (₹)			-	645
Benefits (₹)			-	3.11

G₁ = Control/non-supplemented group; G₂ = Experimental/ supplemented group; Mean values differed significantly (P<0.01) between control and experimental groups

demonstrate the beneficial effects of complete feed pellets (containing around 15% protein) as strategic supplementation on performances of animals to the resource poor famers in Farmer FIRST Programme (FFP) villages i.e. Pali, Palinda and Dhimarpur of Jhansi district (Uttar Pradesh). The FFP project on 'Scaling up and integration of fodder technologies in existing farming system for sustainable livestock productivity and livelihood security in Bundelkhand region' is being implemented by ICAR-GFRI. Adult and growing goats from farmers were selected and they were divided into control and experimental groups (Table 2). Goats under control group were kept on famer's traditional feeding and grazing practices, while experimental group besides feeding/grazing,

received feed pellets supplementation @ 200 g/head/day (Fig 4). Adult goats in non-supplemented/control group lost their body weights, while goats in experimental group gained weights. In case of growing goats, experimental/supplemented group (77.6 g) achieved higher ($P < 0.01$) daily body weight gain compared to non-supplemented group (34.1 g). The additional income in growing



Fig. 3. Drying of feed pellets



Fig. 4. Feeding of feed pellets to goats

animals due to additional inputs (₹ 207 per goat) in experimental group as compared to control was ₹ 645 per goat. Hence providing feed pellets as strategic supplement to goats, reared on exclusive grazing, was found profitable (₹ 3.11 on ₹ 1.00 spent).

SUMMARY

In Bundelkand region, livelihood

security is highly vulnerable. Livestock, particularly goat farming is an important source of livelihood contributing to household income, employment and nutritional security. However, the potential for goat production is limited by many environmental and nutritional factors, and supplementation is required to mitigate both, nutrient deficiencies and the effect of plant secondary metabolites. Strategic supplementation option with complete feed pellets (consist of wheat straw, subabul leaf meal, wheat bran, mustard cake, barley grain and mineral mixture) can serve as good protein and energy sources for goats. On-farm trials with goat, farmers indicated that providing complete feed pellets as a strategic supplement (@ 200g/head/day or around 1.0% of the body weight) to growing goats, reared on exclusive grazing, increased body weight gain (by 1.27 times) as well as farm income.

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Jai Kisan, Jai Vigyan

- A total of ₹ 788.33 crores have been sanctioned for opening six new agricultural colleges for eastern India under Central Agricultural University, Imphal, and a new Central Agricultural University in Meghalaya.
- For the establishment of two new agricultural research institutes in Asom and Jharkhand, a sum ₹ 100 crores is allocated.
- First academic session of the Rani Lakshmibai Central Agricultural University has been allocated for four new agricultural colleges in Datiya and Jhansi.
- An Memorandum of Understanding was signed for transforming the Rajendra Central Agricultural University, Pusa, Samstipur, Bihar. A proposal of ₹ 400 crores is submitted in EFC.
- Post-Graduate Institute of Horticulture is being established in Amritsar, Punjab.
- Foundation stone of the Indian Institute of Agricultural Biotechnology is laid at Ranchi for promoting agricultural biotechnology.