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Influence of weather parameters on growth of sheep in sheep based farming system

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ABSTRACT

In an experiment conducted at Agricultural Research Station, Anantapur during 1999 and 2000 on growth of sheep, the treatments consisted of two seasons and two methods of feeding. Sheep were raised in summer and winter under (a) stall feeding with groundnut haulm and (b) grazing for six hours followed by stall feeding with groundnut haulm. Correlations between weather parameters and growth and growth rate of sheep indicated that there was significant and negative correlation with temperatures, wind velocity and evaporation. Regression analysis showed that morning relative humidity, wind velocity and maximum temperature combined together explained 87% variation in growth.

Key words : Weather, sheep grazing, stall feeding, groundnut haulms

With the inclusion of livestock into the existing cropping system, a small farmer having limited resources (i.e., land and capital) can convert relatively cheap material to value added product. Interaction of crop, livestock and social systems are continuous in any given farming system. Understanding and analysis of these systems are imperative to maximise on-farm income and in turn, employment generation. In arid regions of Anantapur, the crop yields under rainfed conditions are not only low but also unstable due to low and erratic rainfall. Groundnut is an important oilseed crop grown in an area around 7.5 lakh hectares. The groundnut haulm is mainly used as cattle feed. But those farmers who do not possess the cattle dispose off the haulms at cheaper rate. Under this situation, the economic returns of the haulms farmers can be improved by rearing sheep on groundnut haulms. Inclusion of sheep component in the farming systems gave not only higher income but also more employment in scarce rainfall zone of Andhra Pradesh (Anonymous, 1996). Weather parameters significantly influence growth and growth rate of sheep.

The production of meat occurs when the meteorological elements are

within a certain range. Outside this range, the animal has to combat meteorological stress. This requires energy that would otherwise be available to productive process (Rosenberg *et al.*, 1983).

MATERIALS AND METHODS

An experiment was conducted during the years 1999 and 2000 – 2001 at the Agricultural Research Station, Anantapur to study the influence of season and method of feeding on growth of sheep. The treatments consisted of two seasons (summer and winter) and two methods of feeding (a) stall feeding (b) grazing followed by supplemental stall feeding. Three months old ram lambs of Nellore brown breed weighing between 10 and 12 kg each were selected for the experimental purpose. Ten sheep were fed with the groundnut haulms obtained from one hectare under groundnut. In 1999 the sheep were reared during summer between 12 April and 16 September, while during 2000 they were reared between 15 September 2000 and 15 January 2001. Each sheep was fed with 1.5 kg of groundnut haulm per day under stall feeding during first month and 2.0 kg for subsequent months. The each animal was provided with 100 g of concentrates per day during first month and 150 g for subsequent months.Under grazing method the sheep were allowed to graze 6 hours per day and supplemented with groundnut haulms and concentrates. Weights of the animals were recorded at weekly interval. The data recorded at class B observatory located at Agricultural Research Station, Anantapur were used. The range of weather data during the two seasons. are presented in Table 1. Correlations between the weather parameters and the growth and growth rate of sheep were estimated as per Panse and Sukhatme (1978) and regression analysis as outlined by Drapper and Smith (1986).

RESULTS AND DISCUSSIONS

The data on growth and growth rate of sheep pertaining to two seasons and two methods of feeding are presented in Table 2. Among the seasons, the growth and growth rate of sheep were higher during winter as compared to summer season. Within the summer season, the growth and growth rate were higher under grazing over stall feeding. However, during winter the growth and growth rate of sheep did not show much difference between stall feeding and grazing.

The results on correlation (Table 3) indicated that both under stall feeding and grazing, the growth and growth rate of sheep were significantly and negatively correlated with maximum/ minimum temperatures, wind velocity

Table 1: Range of weather parameters during two searsons

Weather parameters	Summer (April 12 to Sept. 16 1999)	Winter (July 12, 2000 to Jan 15, 2001)
Maximum temp. (T_{max}°C)	32.1 – 41.3	29.6 – 34.5
Minimum temp. (T_{min}°C)	18.1 – 25.8	12.7 – 23.3
Morning relative humidity (RH_1 %)	53 – 72	73 – 95
Afternoon relative humidity (RH_2 %)	19 – 40	34 – 49
Wind (WS kmph)	4.7 – 23.0	2.4 - 8.3
Evaporation (EP, mm day^{-1})	7.4 – 12.7	4.8 – 9.3

and evaporation. Similar results of negative correlation with maximum temperature were also observed by Danielov and Gringof (1990). The growth and growth rate of sheep were significantly and positively influenced by both morning and evening relative humidity.

Regression equations

Regression analysis was carried out between the weather parameters, which showed significant correlations with growth and growth rate of sheep (Table 4).

The morning relative humidity accounted for 69.9 percent variation in growth. This in combination with wind velocity has accounted for 76.3 per cent variation in sheep growth. These two weather parameters coupled with maximum temperature have accounted for 86.8 percent of total variation in sheep growth under stall feeding.

In case of grazing treatment, morning relative humidity coupled with wind velocity has accounted for 76.3% of the variation in the growth of sheep ($R^2 = 0.76$) and these two parameters coupled with maximum temperature has accounted for 86.8% ($R^2 = 0.87$) of the total variation in the growth of sheep.

The variation in growth rate of sheep under stall feeding accounted to an extent of 14.4 per cent by evaporation ($R^2 = 0.14$). Morning relative humidity accounted for 44 percent of the total variation in growth rate of sheep under grazing. This in combination with wind velocity account for 49.2 per cent

Table 2 : Influence of season and method of feeding on growth of sheep

Treatment	Growth (kg sheep^{-1})	Growth rate (kg day^{-1} sheep^{-1})
Summer		
Grazing	14.22	0.093
Stall feeding	12.67	0.083
Winter		
Grazing	14.67	0.101
Stall feeding	14.83	0.102

Table 3 : Correlation coefficients between weather parameters and growth rate of sheep in sheep based farming systems

Weather parameter	Stall feeding		Grazing	
	Growth	Growth rate	Growth	Growth rate
Maximum temperature	- 0.792 **	- 0.350 **	- 0.793 **	- 0.583 **
Minimum temperature	- 0.776 **	- 0.290 **	- 0.790 **	- 0.629 **
Rainfall	- 0.131	0.005	- 0.127	- 0.212
Relative humidity I	0.836 **	0.332 **	0.837 **	0.665 **
Relative humidity II	0.669 **	0.358 **	0.672 **	0.479 **
Sunshine hours	- 0.0474	- 0.193	- 0.046	- 0.058
Wind velocity	- 0.567 **	- 0.296 *	- 0.566 **	- 0.472 **
Evaporation	- 0.805 **	- 0.380 **	- 0.804 **	- 0.617 **

* Significant at 0.05
** Significant at 0.01

($R^2 = 0.49$) of the variation in the growth rate of sheep under grazing. (Table 4.)

The results clearly indicated that the growth and growth rate of sheep decrease when maximum/minimum temperature, wind velocity and evaporation were increased. The optimum weather conditions for good growth of sheep, based on this study, were 29.6 to 33.1°C of maximum temperature 15.9 to 19.5°C of minimum temperature, morning and evening relative humidity of 80% and 37% respectively.

Table 4. : Regression equations developed between weather parameter, growth and growth rate of sheep

Parameter	Regression equation	R^2
1. Growth under stall feeding	$Y = 941.1 - 23.2\ Tmax - 8.6WS + 0.53\ RH_1$	0.87
2. Growth under garzing	$Y = 940.2 - 23.2\ Tmax - 8.7\ WS + 0.58\ RH_1$	0.87
3. Growth rate under stall feeding	$Y = 14.3 - 1.24$ x. Ep	0.14
4. Growth rate under grazing	$Y = -9.35 + 0.21\ RH_1 - 0.20\ WS$	0.49

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