

Effect of concentrate levels on the production performance of Angora rabbits

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ABSTRACT

Experiment was conducted on adult male German Angora rabbits (54) with 18 rabbits in each group. Rabbits in T₁ were given 140 g pellet feed whereas in T₂ group 110 and in T₃ 80 g pellet per day was given. The grass in all the groups was given *ad lib*. Other management practices were kept common in all the groups. Feed intake and body weight was monitored fortnightly. Rabbits were weighed and sheared after 75 days interval and the experiment was conducted for 375 days up to four consecutive shearing. Wool production of five consecutive shearing was recorded. Initial body weights of rabbits were 3.13, 3.12 and 3.04 kg in T₁, T₂ and T₃ groups, which were 3.28, 3.03 and 3.07 kg, respectively, in these groups by the end of fifth shearing. Concentrate level did not reveal any marked effect on the body weight. The annual wool yield was 803 g, 772.4 g and 767.4 g in T₁, T₂ and T₃ groups with significant differences among treatments, although there were no differences between T₂ and T₃ groups. The significant differences were recorded for daily dry matter intake between groups with the respective value of 157.5 g, 133.1 g and 115.1 g in T₁, T₂ and T₃ groups. Significant differences were recorded for digestibility of dry matter, crude fibre and ether extract digestibility. The crude fibre digestibility decreased whereas ether extract digestibility increased with the lowering of concentrate feeding. Total mortality was two rabbit each in T₁ and T₂ and five in T₃ groups. Dry matter required for producing 100 g wool was 7.35 kg in T₁, 6.46 kg in T₂ and 5.62 kg in T₃ group. From this experiment it is concluded that feeding of 140 g of pellet feed per day is higher and 110 g of pellet per day by virtue of almost similar wool production and mortality is appropriate in adult rabbit for economical Angora rabbit production.

Key words: Angora rabbit, Balance, Digestibility, Pellet, Wool production

Fulfilling the nutritional needs is a prerequisite for harnessing the full genetic potential of the Angora rabbits. Hence both feed quantity and quality has importance in feed management techniques for achieving higher wool yield. As feed cost accounts for more than 60 per cent of total recurring cost a small saving may make the Angora farming more successful. The disadvantage with *ad lib* feeding as compared to rationed feeding is that it not only increases the feeding cost but also causes unnecessary fattening which hamper reproduction. The aim of developing feeding schedule is to meet the nutrient requirement of different physiological processes without significantly altering the body composition. Maertens (1992) optimized the restricted quantity of concentrate to the adult males and non breeding females as 35 g/day/kg live weight. However for Angora rabbit such information is not available. With this aim the present experiment was planned on adult Angora rabbits to optimize the concentrate feeding.

MATERIALS AND METHODS

Adult Angora male rabbits of German Angora breeds (54) were divided into 3 equal groups with 18 animals in each group. They were offered 140 g (T₁), 110 g (T₂) or 80 g (T₃) concentrate pellet feed along with *ad lib*. green grass/day. Green grass fed was a mixture of all the seasonal grasses and consisted of mixture of *Festuca arundinacea*, *Lolium perene*, *Trofolium repens*, *Paspalum* sp., *Puereria thunbergiana*, *Panicum* sp. *Themeda* sp. and *Setaria* sp mainly. The ingredient composition of pelleted concentrate of mixture was groundnut cake 15, mustard cake 5, sunflower cake 5, soyaflakes 5, maize 25, wheat bran 15, deoiled rice bran 15, fish meal 1.5 and common salt 0.5 parts. Rabbits were offered concentrate with a standardized scoop daily and their dry matter intake was recorded once per week. The experiment was conducted for 375 days. The animals were weighed and sheared before start of experiment. Thereafter the animals were weighed and sheared at the interval of 75 days. The wool samples were taken from the dorsal surface of each rabbit for quality evaluation. After second shearing a digestibility trial of 5 days duration was conducted on four representative rabbits from each group. During the trial the

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total concentrate and grass intake were recorded, faeces voided out were collected and weighed daily. Urine samples were collected, measured and samples were taken for nitrogen estimation. Fresh faecal samples were collected for crude protein and dry matter estimation. The feed, grass and faeces were analyzed for proximate principles (AOAC 1990) and fibre fractions (Goering and Van Soest 1984). Wool samples collected were studied for staple length (cm) with scale after fixing sample on the board. The dry matter required for producing 100 g wool was calculated for studying comparative economics in two regimes. The purchased cost of concentrate and the prevalent cost of roughage and fodder were used for calculating feed cost. The data were analyzed statistically (Snedecor and Cochran 1994).

RESULTS AND DISCUSSION

Composition of experimental diets (Table 1) revealed 22.92% crude protein, 7.05% crude fibre, 3.37% ether extract, 7.93% total ash, 58.73% nitrogen free extract, 18.40% acid detergent fibre and 13.20% cellulose. Roughage fed was a mixture of cultivated and seasonal grasses and consisted of 10.50% crude protein, 21.05% crude fibre, 2.40% ether extract, 10.30% total ash, 55.75% nitrogen free extract, 36.06% acid detergent fibre and 31.93% cellulose. The higher content of protein and lower content of crude fibre in concentrate was kept to compensate the low value of protein and higher of crude fibre in roughage so that the rabbit as a whole get the nutrient as per NRC (1977) in the complete ration. The composition of concentrate and roughage is as per Bhatt *et al.* (2005) with slight variations which were due to compositional variations of feed ingredients.

The initial body weight of rabbits in different groups were 3.06, 3.05 and 3.08 kg in T₁, T₂ and T₃ groups, respectively, and the differences between groups were statistically nonsignificant (Table 2). Body weight decreased in all the groups during first shearing and was due to summer stress. Similar summer stress was also reported earlier in Angora (Bhatt *et al.* 1999) and broiler rabbits (Stephen *et al.* 1979) stating that higher environmental temperature resulted in lower wool yield in Angora rabbits and is related to higher fibre density and longer fibre in colder compared to warmer

Table 1. Chemical composition of concentrate and roughage (% on dry matter basis)

Nutrients	Concentrate	Roughage
Dry matter	87.59	90.57
Crude protein	22.92	10.50
Crude fibre	7.05	21.05
Ether extract	3.37	2.40
Total ash	7.93	10.30
Nitrogen free extract	58.73	55.75
Acid detergent fibre	18.40	36.06
Cellulose	13.20	31.93

climates. The extent to which this effect is dependent on temperature alone or on other environmental components, such as day length is unknown. The body weight of rabbits during second, third, fourth, and fifth shearing did not change much within the group and remained statistically similar among groups. Increased amount of nutrients in terms of higher concentrate in T₁ and T₂ as compared to T₃ did not result higher body weight in adult Angora rabbits. These results are in contrast to grower broiler rabbits where *ad lib.* concentrate fed rabbits yielded significantly ($P < 0.05$) higher body weight than 80 and 50 g concentrate fed groups (Bhatt *et al.* 2005). In growing Angora rabbits the higher concentrate feeding was reported good for growth as compared to restricted feeding (Singh *et al.* 2004).

There was no treatment difference in wool yield in rabbits during first, second, third, fourth, and fifth shearing between different groups. However, the wool yield in T₁ was higher than T₂ which was higher than T₃ during all the five shearings. When the wool yield of all the shearings was added together to calculate the annual yield the differences between groups widened and as a result the differences in annual yield were statistically significant ($P < 0.05$). The wool yield during second shearing was reduced in all the treatments which also correlated well with the reduced body weight of group during this period. This is due to the summer stress due to higher temperature during this period. Seasonal influences have been

Table 2. Body weight, wool yield and plane of nutrition in rabbits

Parameters	T ₁	T ₂	T ₃	Standard Error
Body weight (kg)				
Initial	3.06	3.05	3.08	0.05
1st Shearing	2.98	2.91	2.84	0.06
2nd Shearing	3.04	3.08	3.19	0.26
3rd Shearing	3.07	3.00	3.09	0.18
4th Shearing	3.37	3.13	3.15	0.27
5th Shearing	3.28	3.03	3.07	0.29
Wool yield (g)				
1st Shearing	161.4	159.2	154.6	6.7
2nd Shearing	136.6	141.3	129.3	5.0
3rd Shearing	155.3	146.9	145.3	4.8
4th Shearing	187.7	165.0	177.4	7.2
5th Shearing	162.0	160.0	160.8	5.9
Av. wool yield/shearing	160.6	154.5	153.5	4.8
Annual wool yield (g)	803.0 ^a	772.4 ^b	767.4 ^b	6.4
Wool yield/kgW ^{0.75}	68.2	67.3	66.2	3.2
Mortality (No.)	2	2	5	
Staple length (cm)	5.40 ^a	5.20 ^b	5.09 ^b	0.07
Plane of nutrition (g dry matter intake/d)				
Concentrate intake	118.1	94.9	70.3	1.4
Roughage intake	39.4	38.2	44.8	3.6
Total	157.5	133.1	115.1	2.5

Values with different superscripts in a row differ significantly ($P < 0.05$).

Table 3. Digestibility of nutrients, nitrogen balance and dry matter intake in different treatments

Parameters	T ₁	T ₂	T ₃	Standard Error
Digestibility coefficient (%)				
DM	64.8 ^a	69.8 ^b	66.4 ^{ab}	1.5
CP	73.6	78.3	77.1	1.5
CF	25.1 ^a	39.7 ^b	44.0 ^b	4.4
EE	68.9 ^a	85.6 ^b	85.4 ^b	3.2
NFE	73.1	75.0	70.2	1.3
ADF	39.0	40.8	43.5	1.7
Cellulose	45.0	46.3	50.7	2.7
Balance of nitrogen				
Daily intake (g)	5.03 ^a	4.13 ^b	3.42 ^c	0.10
Daily outgo				
Through faeces (g)	1.32 ^a	0.89 ^b	0.78 ^c	0.05
Through urine (g)	2.19	2.31	2.24	0.22
Balance (g)	1.52 ^a	0.92 ^b	0.59 ^c	0.12
Balance (% of intake)	30.7 ^a	22.0 ^b	14.3 ^c	1.86
Dry matter consumed/ 100g wool produced				
Concentrate	5.51	4.61	3.43	
Roughage	1.84	1.85	2.19	
Total	7.35	6.46	5.62	

Values with different superscripts in a row differ significantly ($P < 0.05$).

recorded to be significant for wool production in Angora rabbits. Winter harvests are reported to be more productive than spring which were higher than summer (Charlet-Lery *et al.* 1985). Similar results were reported by Bhatt *et al.* (1999) in Angora rabbits. Annual wool yield of rabbits in T₁, T₂ and T₃ groups was 803.0 g, 772.4 g and 767.4 g respectively. The wool yield in T₁ group was significantly ($P < 0.05$) higher than T₂ and T₃ groups. Wool yield in T₂ and T₃ groups was almost similar indicating no effect of nutrition on wool yield in these two feeding regimes. In contrast Bhatt *et al.* (2005) reported nonsignificant differences in weight gain in broiler rabbits at 80 g and *ad lib.* (113.3±11.3 g) concentrate level and significant differences ($P < 0.05$) at 50 and 80 g of concentrate level. In agreement to our observations Singh *et al.* (2004) reported significant effect of concentrate level on wool yield at second shearing in Angora weaners. Among wool attributes staple length in T₁ group was significantly ($P < 0.05$) higher than T₂ and T₃ groups. The differences between T₂ and T₃ were non significant which correlated well with the wool yield in these respective groups. From these findings it is revealed that higher nutrients in the form of concentrate stimulated the staple length which increased the wool yield in the respective groups.

Plane of nutrition revealed higher concentrate in T₁, followed by T₂ which was followed by T₃ group as the rabbits were offered variable amounts of concentrate. The non significant differences were observed in the roughage intake

in different groups indicating that different amount of concentrate did not affect the roughage intake. Similar results were reported by Bhatt *et al.* (2005) in broiler weaners. Significant ($P < 0.05$) differences were observed in total dry matter intake of rabbits in different groups with highest value (157.5 g) in T₁, followed by (133.1 g) T₂ and T₃ (115.1 g) groups. The notable difference in total dry matter intake in different groups is due to the variable levels of concentrate offered in different groups. As per Shemin *et al.* (1991) the daily crude protein requirement for Angora with this production potential is between 25 and 26 g /day. In T₁ regime the daily total (concentrate+ roughage) supplied is 31.20 g whereas in T₂ it is 25.8 g which is well within the requirement. In T₃ the total daily protein supplied is 20.8 g which is below the requirement.

Digestibility coefficient data (Table 3) revealed nonsignificant differences for dry matter, crude protein, nitrogen free extract, acid detergent fibre and cellulose digestibility. Significant differences exist for crude fibre and ether extract digestibility. Crude fibre digestibility was highest (44.0%) in T₃ group, followed by T₂ (39.7%) and T₁ (25.1%) group. Xiccato and Cinetto (1988) also reported low fibre digestibility at high nutritive level and *vice-versa*. In agreement to these observations Bhatt *et al.* (2004) also reported increased fibre and ether extract digestibility with low concentrate level as compared to *ad lib* concentrate fed group. Low crude fibre digestibility at high concentrate feeding is due to the fact that when available rabbits derive most of its energy from non-fibre carbohydrates and pass the fibre as unutilized from the gastro intestinal tract. EE digestibility was 68.9% in T₁ which significantly ($P < 0.05$) increased to 85.6% in T₂ and 85.4% in T₃ group. The digestibility of EE is related to digestibility of CF in the diet, and is due to the fact that the major part of the plant lipid is always associated with cell walls in non-added fat diets (Xiccato, 1998). Significant ($P < 0.05$) differences were observed for the nitrogen balance in different groups. The daily nitrogen balance was 1.52 g in T₁, which decreased to 0.92 g in T₂ and 0.59 g in T₃. Similar values were reported by Singh *et al.* (1985) and Lall *et al.* (1984) for Angora rabbits fed pellets plus roughage and different protein levels respectively.

Calculated dry matter used for producing 100 g wool was 7.35 kg in T₁, 6.46 kg in T₂ and 5.62 kg in T₃ group with the respective concentrate intake value of 5.51 kg in T₃, 4.61 kg in T₂ and 3.43 kg in T₁ group indicating the T₃ group as most economical. But higher mortality in this group is most important factor to be considered before concluding. In agreement to our observations Schlolaut and Lange (1983) reported lower wool yield (188 g) and feed/kg of wool produced (60.9 kg feed) in rationed rabbit as compared to (203 g wool and 80.9 kg feed) *ad lib.* fed rabbits. In another experiment Schlolaut and Lange (1983) reported 79% wool production in 80 g concentrate+ *ad lib* roughage as compared

to *ad lib.* concentrate+ roughage feeding regime. He further documented that exclusive feeding of pelleted concentrates risks a shortening of lifespan due to the development of hair balls in the stomach, adiposis and dysentery. Therefore from this experiment it is concluded by virtue of almost similar wool production and mortality by feeding 110 and 140 g concentrate level per day and fulfilling the daily protein requirement that the feeding of 110 g of concentrate has been appropriate in adult rabbit for economical Angora rabbit production.

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