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Annual replacement index of Sirohi goats in semi-arid zone

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Abstract
Data on Sirohi goats maintained at ICAR-Central Sheep and Wool Research Institute, Avikanagar for a period of 15 years (2001 to 2015) were analysed for estimation of annual replacement index. Throughout this timeframe, a total of 1,297 adult females left the flock. Of these, 43 were lost to predation, 140 due to mortality, 584 were sold, 18 were externally transferred or slaughtered, and 512 were culled for various reasons. The overall annual replacement index was calculated to be 0.68, with a range of 0.33 to 1.55 observed in different years.

Keywords: Sirohi goats, annual replacement index, culling, mortality

1. Introduction
In organized farm setups, new young animals are introduced to the flock each year. Simultaneously, some animals are taken out of the flock due to culling, mortality, sale, predation, external transfers, or slaughter. All these actions contribute to changes in the flock size, reflecting the routine management practices on the farm. The amount of animals added and lost due to voluntary culling depends on the resources available, breeding methods, and overall management. To maintain a balance and exert selection pressure on the population for achieving desired genetic improvements, there needs to be equilibrium between the incoming and outgoing animals. The stability in the number of productive females in a farm is indicated by an annual replacement index (ARI). In an ideally managed flock with an optimal and stable population size, the annual loss should be compensated by the addition of breeding females, aiming to keep the ARI close to 1.0. This study was conducted to examine the annual replacement index in Sirohi goats kept at ICAR-Central Sheep and Wool Research Institute in Avikanagar, situated in the semi-arid region of Rajasthan.

2. Material and Methods
Information for this analysis was gathered from the livestock data archives of Sirohi goats maintained at the Animal Genetics and Breeding Division of ICAR-CSWRI in Avikanagar, Rajasthan. The farm is located in the Malpura block of District Tonk in Rajasthan, India, at 75°28' E Latitude and 26°17' N Longitude, with an altitude of 320 meters above mean sea level. The climate is semi-arid and sub-tropical, with temperatures ranging from a maximum of 48 °C to a minimum of 4 °C throughout the year. The region experiences an annual rainfall of 615.93 mm. Selective breeding practices were applied, and controlled mating was employed for the does. The health management procedures adhered to the flock health calendar of the Institute. Detailed records of mortality, culling, sale, external transfers, slaughter, and predation were meticulously maintained on a day-to-day basis. The Annual Replacement Index (ARI) was calculated using the formula (Ram and Tomar, 1993) [4].

$$\text{ARI} = \frac{\text{Number of does kidding in a year}}{\text{Number of does left the herd}}$$

The total number of adult females leaving the flock was calculated, considering reductions through mortality, culling, sale, external transfers, slaughter, and predation.

3. Results and Discussion

3.1 Annual replacement index

The Annual Replacement Index (ARI) was calculated as the ratio of the number of does kidding for the first time to the number of adult goats leaving the flock, following the method described by Ram and Tomar in 1993 [4]. The total count of adult female goats leaving the flock was determined, considering reductions due to mortality, culling, sale, external transfer, slaughter, and predation. The ARI serves as an indicator of flock health, reflecting the management decisions and practices in place.

The overall ARI was calculated to be 0.68 (refer to Table 1). This suggests that for every loss of one goat, less than one replacement of primiparous does became available annually. The range of ARI fluctuated from 0.33 to 1.55 in different years. The highest ARI was recorded in the year 2012 (1.55), while the lowest occurred in the year 2013 (0.33) (refer to Table 1). The lowest ARI in 2013 was primarily due to the culling and sale of a higher number of does.

Throughout the study, the ARI values hovered around 1.0 in most years. When calculating the total females leaving the flock, considerations for culling, mortality, and other modes of disposal, such as sale, transfer/slaughter, and predation, were taken into account. This comprehensive approach resulted in lower ARI values. Additionally, the sale of breeding females for the genetic improvement of farmers' flocks played a significant role in the occurrence of low ARI values in certain years.

Comparatively, Kumar *et al*. (2000) [2] reported an overall ARI of 1.3, varying from 0.2 to 26.0 in a farm flock of Sirohi goats. In a flock of Kutchi goats under semi-arid conditions in Rajasthan, Kumar *et al*. (2002) [1] found an overall ARI of 1.3, ranging from 0.7 to 3.7. Kumar *et al*. (2010) [3] reported ARI values ranging from 0.58 to 2.14, with an overall value of 1.01 in a field flock of Sirohi goats.

Table 1: Annual replacement index in Sirohi goat in different periods

Year	Does kidding 1st time (All ages)	Adult does culled	Adult does predation	Adult does mortality	Adult does sold	Adult does ext transferred/slaughter	Total adult females leaving the flock	Annual Replacement index
	A	A	b	c	d	e	B (a to e)	A/B
2001	30	15	1	8	0	0	24	1.25
2002	60	79	2	9	19	0	109	0.55
2003	53	27	3	4	35	0	69	0.77
2004	35	24	3	5	29	0	61	0.57
2005	81	25	6	6	44	0	81	1.00
2006	47	18	4	2	84	0	108	0.44
2007	40	20	5	15	3	0	43	0.93
2008	94	50	5	11	1	0	67	1.40
2009	81	45	6	15	36	4	106	0.76
2010	65	9	2	11	77	3	102	0.64
2011	80	57	2	21	33	1	114	0.70
2012	79	17	1	9	24	0	51	1.55
2013	43	39	3	8	78	3	131	0.33
2014	45	25	0	8	72	0	105	0.43
2015	54	62	0	8	49	7	126	0.43
Overall	887	512	43	140	584	18	1297	0.68

4. Conclusion

Over the specified duration, a cumulative total of 1,297 adult females exited the flock. Within this group, 43 were attributed to predation, 140 succumbed to mortality, 584 were sold, 18 were either externally transferred or slaughtered, and 512 were culled for diverse reasons. The comprehensive annual replacement index was computed at 0.68, showcasing variability across different years with a range spanning from 0.33 to 1.55.

5. References

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