Original Research

Estimation of Breeding Values and Genetic Trend of Production Traits in Munjal Sheep

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Abstract

Munjal is a new promising breed of sheep and is popular among farmers for its big size and faster growth rate. The data pertaining to the production traits of 462 Munjal sheep sired of 27 rams were used to evaluate the sire by estimating the breeding value using Best Linear Unbiased Prediction (BLUP) method. The average breeding value of Munjal sires for birth weight (BW), weaning weight (WW), six month body weight (SMW), one year body weight (YW) and greasy fleece weight (GFW) were estimated as 4.15, 15.57, 21, 26.54 and 1.83 Kg, respectively. After estimation of breeding values, the sires were ranked as per their genetic merit. The product moment correlations between sire's estimated breeding values among production traits were low to high ranging from 0.01 to 0.80. The rank correlations of BW with WW, SMW, YW and GFW were low and positive. The rank correlations of WW with SMW and YW were high, positive and significant. High and positive estimates indicate that there is high degree of similarity between ranking of WW with SMW and YW. The rank correlation of SMW with YW was high, positive and significant and indicated that there is high degree of similarity between rankings of SMW with YW. Genetic trends for BW, WW, SMW, YW and GFW were estimated by regressing breeding values of traits on year of the birth of the animals and were obtained as -0.09, -0.25, -0.51, -0.67 and -0.01 kg/ year, respectively. Phenotypic trend for BW, WW, SMW, YW and GFW were estimated by phenotypic value of the traits on year of the birth of the animals were obtained as 0.08, -0.33, -0.44, -0.59 and -0.04 Kg/year, respectively. Genetic trend obtained in the present study were in negative direction which might be due to inbreeding because of small flock size.

Key words: Breeding Values, Genetic Trend, Munjal Sheep, Phenotypic Trend, Rank Correlation

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Introduction

Sheep population in India stands to be 65.06 million and the country stands at second in world sheep population (BAHS, 2016). The economy of sheep farming mainly depends on production of heavy and more lambs because lamb production contribute 85-90% of total income generation from sheep farming (Arora *et al*., 1986). Munjal sheep is large in size, tall and very popular among the farmers of Haryana, Punjab and Rajasthan for their heavy body weight. It has long head with roman nose and narrow forehead. Face is generally tan or brown in colour, which may extend up to middle of neck (Poonia, 2004). The animals of this breed are found in Muktsar, Sangrur, Bathinda, Ferozpur and Mansa districts of Punjab, Ganganagar and Hanumangarh districts of Rajasthan and Hisar, Fatehabad, Sirsa and Jind districts of Haryana.

In sheep breeding programs it is important to bring about genetic improvement in terms of growth, reproduction and production potential of a breed. An early and accurate evaluation of sires is essential for fastere genetic improvement. Effectiveness of sire evaluation is the key stone in the architecture of any breed improvement programme as the contribution of sire path is much higher than the dam path for the overall genetic improvement for a trait (Robertson and Rendel, 1954). The accurate estimates of breeding value of sires are the prerequisites to have an efficient selection and genetic improvement program. The estimations of genetic, phenotypic and environmental trends as a graphic perspective of a within-herd breeding program could convey a quick evaluation of a breeder's selection success in previous generations. These trends might be used to compare improve procedures of selection or management. They would improve selection and management aims established by a breeder. Negligible research work has been done for the genetic improvement of this promising new breed of sheep which is very popular among farmers. Hence, this study was planned to evaluate the Munjal rams based on production traits by BLUP method and to estimate year wise phenotypic and genetic trends in production traits.

Material and Methods

Data were collected on 462 Munjal sheep sired by 27 rams and maintained in the Department of Animal Genetics and Breeding, Lala Lajpat Rai University of Veterinary and Animal sciences, Hisar over a period of 16 years from 2001 to 2016. The animals were allowed to graze for about six effective hours on natural pastures. As an alternative arrangement, during the lean period of the year when natural pastures were not available, supplement feeding with concentrates and dry fodder was provided. During breeding season, the rams were supplemented with 500 gm of concentrate mixture per ram, having 70 per cent TDN and 16 per cent DCP. The pregnant ewes, one month prior to and after lambing were provided concentrate at the rate of 350 gm per ewe in addition to grazing.

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The data were collected for five production traits viz., birth weight (BW), weaning weight (WW), six month body weight (SMW), one year body weight (YW) and greasy fleece weight (GFW) to estimate sire's breeding value. Breeding values of sires having 5 or more progeny were estimated and sires were ranked according to their genetic merit. Breeding values of sires were estimated by Best Linear Unbiased Prediction (BLUP) procedure described by Henderson (1973). The breeding values were estimated by using Sex, period of birth and dam's age at lambing fixed effects. EBVs of individual sire, average breeding value and sires ranking based on EBVs for production traits were done as per their genetic merit. Product moment correlations and Spearman rank correlations between ranks were calculated by the formula of Spearman (1904) among sire's estimated breeding values for different traits. The genetic and phenotypic trends of the traits were estimated by regressing breeding values and phenotypic values of the trait on year of the birth of the animals, respectively.

Result and Discussion

Breeding Values of Sires and Their Ranks

The average breeding values of rams and their individual breeding values alongwith ranks for different traits are presented in Table 1 and 2, respectively. The average breeding values of Munjal rams for BW, WW, SMW, YW and GFW were estimated as 4.15, 15.57, 21.00, 26.54 and 1.83 Kg, respectively (Table 1).

Table 1: Average breeding value (B.V) of Munjal sire's for different production traits

Traits	No. of sires	Average B.V	Minimum B.V (% below avg.)	Maximum B.V (% Above avg.)	No. of sires above average B.V (% of sires)	No. of sires below average B.V (% of sires)
BW (Kg)	27	4.15	3.8 (15.66)	4.71 (13.49)	13 (48.14)	14 (51.86)
WW (kg)	27	15.57	13.83 (11.23)	17.23 (10.66)	17(62.96)	10 (37.04)
SMW (kg)	27	21	16.68 (20.57)	23.07 (9.8)	17(62.96)	10(37.04)
YW (kg)	27	26.54	23.60 (11.07)	28.67 (8)	16(59.25)	11(40.74)
GFW (kg)	27	1.83	1.62 (11.47)	2.01 (9.83)	11(40.74)	16(59.25)

BW- Birth weight, WW- Weaning weight, SMW- Six month body weight, YW- One year body weight, GFW- Greasy fleece weight, BV- Breeding value

It was found that out of 27 sires, the EBVs of 13 sires (48.14%) were above the average breeding value for BW, while 14 sires (51.86%) were below the average breeding value. Top ranking sire had 13.49% genetic superiority over average breeding value and bottom ranking sire 15.66% lower breeding value than average breeding value. It was found that for WW out of 27 sires, the EBVs of 17 sires (62.96%) were above the average breeding value, while 10 sires (37.04 %) were below the average breeding value. Top ranking sire 10.66% genetic superiority over average breeding value and bottom ranking sire had 11.23% lower breeding value than average breeding value. The EBVs of 17 sires (62.96%) for WW were above the

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average breeding value, while those of those of 10 sires (37.04 %) were below the average breeding value. Top ranking sire had 9.8% genetic superiority over average breeding and bottom ranking sire had 20.57 % lower breeding value than average breeding value. For YW the EBVs of 16 sires (59.25%) were above the average breeding value, while 11 sires (40.74%) were below the average breeding value. Top ranking sire had 8% genetic superiority over average breeding and bottom ranking sire had 11.07 % lower breeding value than average breeding value. The EBVs of 11 sires (40.74%) for GFW were above the average breeding value, while 16 sires (59.25%) were below the average breeding value. Top ranking sire had 9.83% genetic superiority over average breeding value and bottom ranking sire had 11.47% lower breeding value than average breeding value. The top ranking rams which are alive have been recommended for breeding.

Table 2: Estimated breeding values (EBVs) and sire's rank for different production traits

Sire Number	Number of Observation	Traits				
		BW	WW	SMW	YW	GFW
1	45	4.15 (13)	15.65 (11)	21.34 (12)	26.86 (14)	1.62 (27)
2	12	4.09 (15)	15.59 (17)	22.27 (5)	27.51 (4)	1.82 (12)
3	33	3.88 (24)	14.57 (25)	16.68 (27)	23.60 (27)	1.82 (13)
4	22	3.93 (22)	15.25 (23)	19.66 (25)	25.60 (23)	1.77 (22)
5	20	4.35 (4)	15.37 (20)	20.69 (21)	25.88 (22)	1.71 (24)
6	20	4.71 (1)	15.47(18)	20.33(22)	26.09 (20)	1.94 (3)
7	16	4.65 (2)	15.80 (9)	20.77 (19)	26.12 (19)	1.79 (15)
8	12	4.52 (3)	16.41 (3)	21.96 (6)	27.76 (2)	1.86 (8)
9	17	3.93 (23)	15.62 (14)	21.47 (10)	27.50 (6)	1.87(6)
10	15	4.00 (20)	14.26 (26)	20.01 (23)	26.63 (15)	1.87 (7)
11	13	4.16 (11)	15.26(22)	21.08 (16)	27.10(9)	1.77 (19)
12	14	4.09 (16)	15.60 (16)	21.36 (11)	26.86 (13)	1.85 (10)
13	11	4.30 (6)	15.62(13)	21.61 (7)	26.59 (16)	1.81 (14)
14	14	4.08(17)	15.70 (10)	21.30(13)	26.98 (11)	1.77 (21)
15	18	4.05(19)	15.64 (12)	20.94 (18)	26.18 (17)	2.01 (2)
16	13	4.18 (9)	15.94 (4)	21.55 (8)	27.04 (10)	1.77 (20)
17	11	3.80 (27)	15.47 (19)	21.01 (17)	27.50 (5)	1.78 (16)
18	16	3.86 (26)	16.50 (2)	22.29 (4)	27.18(8)	1.69 (25)
19	17	4.18 (10)	17.23 (1)	23.07 (1)	28.67 (1)	1.77 (18)
20	16	4.14 (14)	15.36 (21)	20.76 (20)	26.15 (18)	1.86 (9)
21	19	4.07 (18)	14.81 (24)	19.84 (24)	25.30 (25)	1.88 (5)
22	14	4.00 (21)	13.82 (27)	18.22 (26)	23.77 (26)	1.84(11)
23	20	4.32 (5)	15.88 (8)	22.30 (3)	26.94(12)	1.73 (23)
24	25	4.27 (7)	15.61 (15)	21.54 (9)	27.35 (7)	1.90 (4)
25	26	3.87 (25)	15.89 (7)	22.68 (2)	27.65 (3)	2.15 (1)
26	27	4.22 (8)	15.90 (5)	21.22 (14)	25.91 (21)	1.67 (26)
27	28	4.16 (12)	15.90 (6)	21.08 (15)	25.59 (24)	1.78 (17)

Figure with in parenthesis are the sire's rank for production traits; BW- Birth weight, WW- Weaning weight, SMW- Six month body weight, YW- One year body weight, GFW- Greasy fleece weight.

Sire no. 19 ranked first for WW, SMW and YW while Sire no. 25 ranked second for SMW, first rank for GFW and third rank for YW. Sire no. 3 ranked last for SMW and YW. Sires ranks for different production

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traits indicated that Sire no. 19 and 25 were having excellent performance for production traits. The breeding value of sires for BW and WW obtained in the present study were on higher side than those reported by Vivekanand (2013) in Magra and Singh *et al.* (2016) in Marwari sheep. The breeding value for SMW and YW obtained in the present study were on lower side than those reported by Vivekanand (2013) in Magra and Singh *et al.* (2016) in Marwari sheep. Jeichitra *et al.* (2015) estimated the breeding value of Mecheri ram for body weight by BLUP method and reported that EBVs ranged from -0.199 to 0.228 for birth weight, -1.195 to 1.133 for WW, -1.079 to 0.902 for SMW and -1.682 to 1.459 for YW. Mallick *et al.* (2016) estimated the breeding value of Bharat merino rams and reported the deviation of breeding value from population mean as 0.067 for BW, 0.008 for WW, 0.036 for SMW and -0.003 for GFW.

Product Moment and Spearman Rank Correlation

The product moment and Spearman rank correlations for BW, WW, SMW, YW and GFW are presented in Table 3.

Table 3: Estimates of Product Moment (above diagonal) and Spearman's rank correlation (below diagonal) between EBVs among production traits

Traits	BW	WW	SMW	YW	GFW
BW	-	0.03	0.01	-0.1	0.01
WW	0.29	-	0.72**	0.58**	0.21
SMW	0.12	0.70**	-	0.80**	0.19
YW	-0.06	0.48*	0.76**	-	0.34
GFW	-0.13	-0.28	-0.07	0.08	-

BW- Birth weight, WW- Weaning weight, SMW- Six month body weight, YW- One year body weight, GFW- Greasy fleece weight, EBVs- Estimated breeding values.

The product moment correlations between sire's estimated breeding values among production traits were low to high ranging from 0.01 to 0.80. The product moment correlations between sire's EBV were found high, positive and significant for WW with SMW (0.72), YW (0.58) and SMW with YW (0.80). The rank correlations between sire's EBV among production traits were also low to high (0.07 to 0.76). The rank correlations between sire's EBV were found positive and significant for WW with SMW (0.70), YW (0.48) and SMW with YW (0.76). The rank correlation of BW with WW, SMW, YW and GFW were low and positive. Similar finding were reported by Vivekanand (2013) in Magra sheep. The rank correlations of WW with SMW and YW were high, positive and significant. High and positive estimates indicate that there is high degree of similarity between ranking for WW with SMW and YW. The present findings are in close agreement with those reported by Singh (2012) in Marwari sheep. The rank correlations of SMW with YW were high, positive and significant and indicated that there is high degree of similarity between rankings of SMW with YW. Similar finding were also reported by Vivekanand (2013) in Magra sheep.

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Genetic and Phenotypic Trends

The year wise genetic, phenotypic and environmental trends in various production traits of Munjal sheep are given in Table 4.

Table 4: Estimates of genetic and phenotypic trends for production traits

Traits	Genetic Trend	Phenotypic Trend	Environmental Trend
BW	-0.09	-0.08	-0.01
WW	-0.25	-0.33	0.08
SMW	-0.51	-0.44	-0.07
YW	-0.67	-0.59	-0.08
GFW	-0.01	-0.04	0.03

Genetic trend for BW, WW, SMW, YW and GFW were negative and obtained as -0.09, -0.25, -0.51, -0.67 and -0.01 kg/ year, respectively. Phenotypic trend for BW, WW, SMW, YW and GFW were negative and obtained as -0.08, -0.33, -0.44, -0.59 and -0.04 Kg/year, respectively. However, Mokhtari and Rashidi (2010) in Kermani sheep, Balasubramanyam *et al.* (2012) in Madras red, Mohammadi and Rostam (2015) in Zandi sheep and Mallick *et al.* (2016) in Bharat merino sheep reported the positive genetic trend for BW, WW, SMW and YW. Jeichitra *et al.* (2015) estimated the genetic trends for BW, WW, SMW and YW of Mecheri lambs ranging from -0.15 to 0.23, -0.61 to 0.85, -1.12 to 0.91 and -1.50 to 4.31, respectively. Arora *et al.* (2010) found negative and significant environmental trends for BW, 3MW, 6MW, 9MW and 12MW (–0.07, –0.27, –0.24, –0.88 and –0.42 kg per year, respectively). The negative trend obtained for all body weights and GFW is due to the reason that the superior animals of heavy weight were purchased in 2001 and there was minor decline in growth performance of the flock due to inbreeding as the flock size was small.

Conclusion

Six month body weight is very important trait in sheep because of economy of sheep rearing mainly depends on six month body weight as this is also market age for meat. So, sires rank for six month body weight and rank correlation of SMW with other traits are very important selection criteria for genetic improvement in flock. Results of this study indicate that selection should be conducted using animals with high estimated breeding values through controlled breeding. So, considered an important step in the planning and implementation of any successful selection or breeding program that aims to improve the genetic gain of animals. Optimal environmental conditions should be provided to obtain more genetic progress in order to coincide the phenotypic trend with genetic one.

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