

**Random regression model with heterogeneous residual variance reduces polynomial order fitted for permanent environmental effect but does not affect genetic parameters for milk production in Sahiwal cattle**

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**Table S1.** Estimates of variance components ( $\text{kg}^2$ ) of test day milk yields in Sahiwal cattle

Test day	First lactation			Second lactation			Third lactation		
	V <sub>a</sub>	V <sub>pe</sub>	V <sub>p</sub>	V <sub>a</sub>	V <sub>pe</sub>	V <sub>p</sub>	V <sub>a</sub>	V <sub>pe</sub>	V <sub>p</sub>
RRM-HOM									
TD1	0.03±0.31	4.06±0.39	4.97±0.30	1.51±0.78	5.09±0.77	7.94±0.61	1.13±1.10	6.37±1.19	8.76±0.78
TD2	0.11±0.24	5.57±0.44	6.55±0.37	1.79±0.73	6.43±0.80	9.55±0.69	0.77±0.86	6.94±1.03	8.97±0.78
TD3	0.22±0.25	5.68±0.42	6.77±0.37	2.10±0.78	7.93±0.81	10.36±0.73	0.69±0.84	7.51±1.02	9.46±0.79
TD4	0.33±0.28	4.72±0.38	5.92±0.33	2.31±0.83	5.81±0.78	9.45±0.68	0.75±0.89	6.85±1.02	8.85±0.74
TD5	0.41±0.31	4.09±0.36	5.37±0.30	2.35±0.87	4.85±0.75	8.53±0.61	0.85±0.95	6.04±1.02	8.15±0.67
TD6	0.44±0.32	3.75±0.36	5.07±0.28	2.18±0.85	4.31±0.73	7.83±0.57	0.93±0.97	5.40±1.00	7.58±0.63
TD7	0.43±0.31	3.55±0.35	4.85±0.28	1.82±0.78	4.17±0.69	7.32±0.55	0.92±0.92	5.08±0.97	7.26±0.61
TD8	0.37±0.29	3.28±0.33	4.53±0.26	1.30±0.67	4.13±0.62	6.75±0.52	0.83±0.82	4.68±0.88	6.77±0.58
TD9	0.30±0.28	2.99±0.33	4.15±0.26	0.73±0.57	4.26±0.62	6.32±0.53	0.64±0.73	4.18±0.81	6.08±0.59
TD10	0.22±0.29	2.60±0.35	3.69±0.27	0.24±0.55	3.92±0.68	5.50±0.53	0.41±0.74	2.96±0.78	4.63±0.55
RRM-HET									
TD1	0.05±0.31	3.24±0.50	5.15±0.31	1.62±0.82	2.03±0.95	8.35±0.64	1.09±1.11	4.03±1.38	9.03±0.81
TD2	0.15±0.25	4.69±0.39	6.42±0.34	1.87±0.75	5.36±0.75	9.46±0.66	0.78±0.88	5.74±0.98	9.13±0.73
TD3	0.27±0.26	5.46±0.42	6.64±0.37	2.14±0.79	6.63±0.82	10.68±0.75	0.72±0.85	7.24±1.03	9.23±0.80
TD4	0.38±0.29	4.82±0.39	6.22±0.34	2.32±0.84	5.91±0.79	9.84±0.69	0.79±0.91	6.92±1.03	9.34±0.76
TD5	0.45±0.31	4.10±0.37	5.57±0.30	2.33±0.87	4.95±0.76	8.56±0.62	0.88±0.96	6.05±1.02	8.41±0.68
TD6	0.48±0.32	3.70±0.35	4.91±0.29	2.12±0.85	4.41±0.72	7.66±0.58	0.93±0.97	5.46±1.00	7.36±0.63
TD7	0.46±0.31	3.46±0.34	4.65±0.27	1.72±0.77	4.20±0.66	7.35±0.54	0.90±0.92	5.20±0.96	7.49±0.62
TD8	0.39±0.29	3.28±0.33	4.57±0.26	1.19±0.66	4.29±0.62	6.36±0.51	0.77±0.82	4.98±0.88	6.56±0.59
TD9	0.32±0.28	3.15±0.33	4.03±0.25	0.64±0.56	4.59±0.60	6.07±0.49	0.56±0.72	4.46±0.78	5.79±0.55
TD10	0.26±0.31	2.87±0.35	3.70±0.26	0.23±0.56	4.62±0.69	5.69±0.53	0.31±0.71	3.60±0.78	4.69±0.53

V<sub>a</sub>-Additive genetic variance, V<sub>pe</sub>- Permanent environment variance, V<sub>p</sub>- Phenotypic variance

**Table S2.** Genetic correlation (above diagonal) and permanent environment correlation (below diagonal) between test day milk yields in Sahiwal cattle obtained from best RRM-HOM and RRM-HET (in parenthesis)

Test Day	TD1	TD2	TD3	TD4	TD5	TD6	TD7	TD8	TD9	TD10
TD1		0.90(0.93)	0.81(0.87)	0.76(0.82)	0.71(0.77)	0.65(0.71)	0.58(0.63)	0.48(0.51)	0.33(0.31)	0.06(-0.01)
TD2	0.62(0.74)		0.99(0.99)	0.97(0.97)	0.95(0.95)	0.92(0.92)	0.88(0.87)	0.82(0.79)	0.71(0.63)	0.49(0.34)
TD3	0.48(0.59)	0.96(0.97)		0.99(0.99)	0.99(0.98)	0.97(0.96)	0.95(0.93)	0.90(0.87)	0.81(0.74)	0.62(0.48)
TD4	0.45(0.54)	0.85(0.91)	0.96(0.97)		0.99(0.99)	0.99(0.99)	0.97(0.96)	0.94(0.91)	0.86(0.80)	0.69(0.56)
TD5	0.43(0.50)	0.72(0.79)	0.86(0.88)	0.96(0.96)		0.99(0.99)	0.99(0.98)	0.96(0.94)	0.90(0.85)	0.74(0.63)
TD6	0.41(0.46)	0.64(0.66)	0.77(0.76)	0.89(0.88)	0.97(0.97)		0.99(0.99)	0.98(0.97)	0.93(0.89)	0.79(0.69)
TD7	0.38(0.42)	0.59(0.57)	0.70(0.67)	0.82(0.80)	0.92(0.92)	0.98(0.98)		0.99(0.99)	0.96(0.93)	0.84(0.76)
TD8	0.34(0.39)	0.54(0.55)	0.63(0.63)	0.75(0.74)	0.85(0.85)	0.93(0.92)	0.98(0.98)		0.98(0.98)	0.90(0.85)
TD9	0.30(0.36)	0.45(0.52)	0.54(0.58)	0.66(0.66)	0.76(0.75)	0.84(0.83)	0.90(0.90)	0.97(0.97)		0.96(0.94)
TD10	0.30(0.31)	0.39(0.38)	0.46(0.43)	0.56(0.51)	0.65(0.60)	0.73(0.69)	0.82(0.79)	0.91(0.88)	0.98(0.95)	
<b>Second lactation</b>										
TD1		0.97(0.97)	0.91(0.91)	0.86(0.87)	0.82(0.83)	0.79(0.81)	0.78(0.80)	0.77(0.82)	0.79(0.88)	0.86(0.99)
TD2	0.50(0.81)		0.99(0.99)	0.96(0.96)	0.94(0.94)	0.92(0.93)	0.91(0.92)	0.90(0.94)	0.92(0.97)	0.96(0.99)
TD3	0.36(0.71)	0.95(0.98)		0.99(0.99)	0.98(0.98)	0.97(0.98)	0.96(0.97)	0.96(0.98)	0.97(0.99)	0.99(0.96)
TD4	0.35(0.63)	0.83(0.91)	0.95(0.97)		0.99(0.99)	0.99(0.99)	0.99(0.99)	0.99(0.99)	0.99(0.99)	0.99(0.92)
TD5	0.32(0.53)	0.70(0.77)	0.85(0.87)	0.96(0.96)		0.99(0.99)	0.99(0.99)	0.99(0.99)	0.99(0.99)	0.99(0.89)
TD6	0.26(0.40)	0.60(0.60)	0.74(0.73)	0.87(0.86)	0.96(0.97)		0.99(0.99)	0.99(0.99)	0.99(0.99)	0.99(0.87)
TD7	0.18(0.30)	0.52(0.49)	0.64(0.61)	0.77(0.76)	0.88(0.89)	0.97(0.97)		0.99(0.99)	0.99(0.99)	0.99(0.87)
TD8	0.13(0.23)	0.44(0.43)	0.56(0.55)	0.69(0.68)	0.81(0.81)	0.92(0.91)	0.98(0.97)		0.99(0.99)	0.99(0.88)
TD9	0.12(0.16)	0.33(0.41)	0.48(0.51)	0.62(0.61)	0.74(0.72)	0.83(0.82)	0.89(0.91)	0.96(0.98)		0.99(0.93)
TD10	0.07(0.05)	0.32(0.33)	0.46(0.44)	0.59(0.55)	0.70(0.66)	0.79(0.77)	0.87(0.86)	0.95(0.94)	0.99(0.98)	
<b>Third lactation</b>										
TD1		0.94(0.93)	0.74(0.74)	0.51(0.53)	0.32(0.35)	0.20(0.23)	0.12(0.16)	0.08(0.12)	0.07(0.11)	0.13(0.17)
TD2	0.56(0.73)		0.93(0.93)	0.78(0.80)	0.63(0.66)	0.53(0.57)	0.46(0.50)	0.42(0.46)	0.42(0.46)	0.47(0.51)
TD3	0.39(0.56)	0.94(0.97)		0.95(0.96)	0.87(0.89)	0.80(0.82)	0.75(0.78)	0.72(0.75)	0.72(0.75)	0.76(0.79)
TD4	0.36(0.49)	0.82(0.91)	0.96(0.98)		0.98(0.98)	0.94(0.95)	0.91(0.92)	0.90(0.91)	0.90(0.90)	0.92(0.93)
TD5	0.34(0.44)	0.71(0.82)	0.87(0.91)	0.97(0.97)		0.99(0.99)	0.98(0.98)	0.97(0.97)	0.97(0.97)	0.98(0.98)
TD6	0.31(0.38)	0.64(0.68)	0.78(0.79)	0.89(0.89)	0.97(0.97)		0.99(0.99)	0.99(0.99)	0.99(0.99)	0.99(0.99)
TD7	0.25(0.31)	0.56(0.56)	0.68(0.66)	0.79(0.78)	0.89(0.89)	0.97(0.97)		0.99(0.99)	0.99(0.99)	0.99(0.99)
TD8	0.19(0.24)	0.45(0.47)	0.57(0.57)	0.70(0.68)	0.81(0.81)	0.91(0.91)	0.98(0.98)		0.99(0.99)	0.99(0.99)
TD9	0.15(0.17)	0.31(0.41)	0.46(0.51)	0.61(0.61)	0.73(0.72)	0.82(0.83)	0.88(0.91)	0.97(0.97)		0.99(0.99)
TD10	0.13(0.11)	0.33(0.34)	0.46(0.43)	0.57(0.50)	0.65(0.59)	0.72(0.67)	0.79(0.75)	0.84(0.84)	0.97(0.93)	