



Figure 1. Studentized residual plot of predicted Kp for dry forage without outliers. Studentized residuals were calculated by subtracting predicted Kp by fixed effects from observed Kp adjusted for study effect and then dividing by square root of mean squared error (MSE).

content in dietary DM in the equation to estimate Kp of dry forage was found to be a plus and not a minus (+0.007 instead of -0.007). This typographical error may cause a 15% lower prediction of Kp for dry forage. However, its effect on model prediction of MP supply and MP allowable milk was less than 1% (data not shown). The corrected passage rate equation for dry forages and the other 2 equations to estimate rate of passage of undigested feed out of the rumen are shown below. The parameter estimates are the solution for each fixed effect:

$$\begin{aligned} \text{Kp for dry forage} &= 3.362 (\pm 0.263) + 0.479 (\pm 0.052) \\ &\text{DMIpBW} - 0.017 (\pm 0.004) \text{NDF} \\ &+ 0.007 (\pm 0.002) \text{ConcpDM}; \end{aligned}$$

$$\begin{aligned} \text{Kp for wet forage} &= 3.054 (\pm 0.393) \\ &+ 0.614 (\pm 0.126) \text{DMIpBW}; \end{aligned}$$

$$\begin{aligned} \text{Kp for concentrate} &= 2.904 (\pm 0.516) + 1.375 (\pm 0.177) \\ &\text{DMIpBW} - 0.020 (\pm 0.006) \text{ConcpDM}; \end{aligned}$$

where DMIpBW = DMI as a percentage of BW, ConcpDM = concentrate content of the diet, % DM, and NDF = NDF of forage feedstuff, % DM.

As shown in Table 1, the database used to develop the equations had wide ranges in DMI, BW, and DMIpBW. Therefore, these equations are expected to cover a wide range of production situations. The passage rate equa-

tions for dry forages (corrected equation), wet forages and concentrates explain 87, 86, and 91%, respectively of the variation in measured passage rates in the database used in equation development, when the observations were adjusted for random study effect. Figures 1, 3, and 5 show the studentized residual plots of the observed and predicted Kp by fixed effects of the equations. The plots indicated there was no apparent bias and the regression models seemed to be appropriate.

To evaluate the effect of omitting outliers, the data that were originally treated as outliers and removed in the development of equations (25, 5, and 1 observations in dry forage, wet forage, and concentrates, respectively) were added back to the database and the parameters for the variables were reestimated. The equations are shown below, and the residual plots of the observed and predicted Kp by fixed effects of the equations are shown in Figures 2, 4, and 6.

$$\begin{aligned} \text{Kp for dry forage} &= 4.542 (\pm 0.321) + 0.485 (\pm 0.064) \\ &\text{DMIpBW} - 0.035 (\pm 0.004) \text{NDF} \\ &+ 0.006 (\pm 0.002) \text{ConcpDM} (n = 344); \end{aligned}$$

$$\begin{aligned} \text{Kp for wet forage} &= 2.948 (\pm 0.418) \\ &+ 0.655 (\pm 0.134) \text{DMIpBW} (n = 68); \end{aligned}$$

$$\begin{aligned} \text{Kp for concentrate} &= 3.205 (\pm 0.567) + 1.325 (\pm 0.178) \\ &\text{DMIpBW} - 0.023 (\pm 0.006) \text{ConcpDM} (n = 140); \end{aligned}$$