For3456/3457, Lecture 4: Regression Analysis, Soil Moisture Relationships

Using the lab data produced the following best-fitted least-squares regression results for estimating gravimetric soil field capacity (FCg) from

(i) soil texture and organic matter (OM), and
(ii) sand and gravimetric saturation point (SATg)

As shown, knowing SATg provides better predictions for FCg than what can be obtained from OM and Sand specifications. This is because FCg and SATg relate more closely to each other than to Sand and OM matter content.

Still, the results show that FCg should increase with increasing OM, but decrease with increasing Sand content. Hence, sandy soils have low water retention capacity, but adding organic matter helps in this regard.

Note that the t-values (= Coefficient/Std. error) assess the signal-to-noise ratio for the intercept and the regression variables. The higher this ratio, the stronger is the potential of the independent variable to predict the dependent variable.

The p-value estimates the probabilities that the intercept or the regression coefficient between the dependent and independent variables are **not zero,** and are therefore "significant".

The R square value (R^2) is a measure of the goodness of fit between the best-fitted regression line (based on the best-fitted regression model), and the actual data for the dependent variable. $R^2 = 1$ implies a perfect fit. $R^2 = 0$ implies that no relationship between the selected dependent and independent variables could be found.

RMS Residual is the root mean square value between the actual and predicted values.

The reporting of significant digits for the best-fitted models should reflect the extent of the standard error uncertainties associated with the intercept and regression coefficients. For example, quoting the result of 38.755 ± 1.037 as 38.8 ± 1.0 implies that this best-fitted value could vary between 37.7 and 39.7. Hence, adding further digits does not improve the prediction.

Alternative best-fitted examples for gravimetric field capacity (FCg)

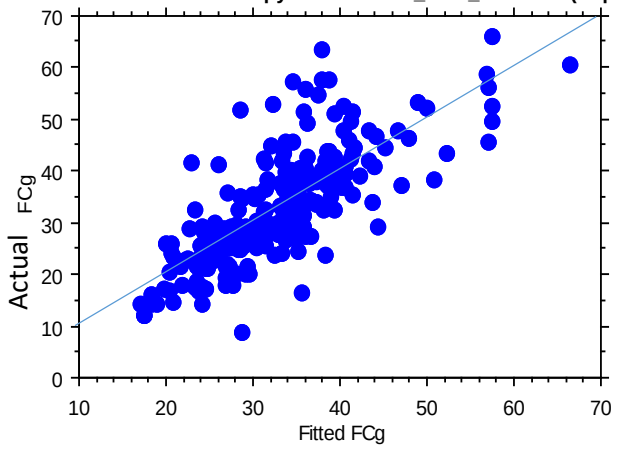
Regression Summary
FCg vs. 2 Independents
Row exclusion: Copy of Permdata_2017_email.txt (imported)

Count	440
Num. Missing	0
R	.753
R Squared	.566
Adjusted R Squared	.564
RMS Residual	7.289

Regression Coefficients
FCg vs. 2 Independents
Row exclusion: Copy of Permdata_2017_email.txt (imported)

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	38.755	1.037	38.755	37.369	<.0001
Sand	-.232	.017	-.436	-13.784	<.0001
OM	2.267	.125	.575	18.177	<.0001

Dependent vs. Fitted
Row exclusion: Copy of Permdata_2017_email.txt (imported)



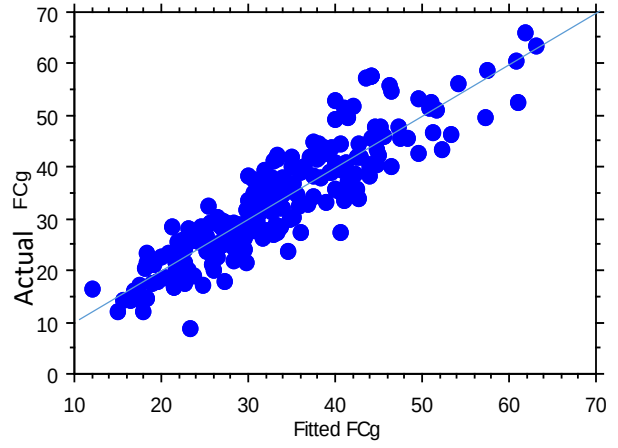
Regression Summary
FCg vs. 2 Independents
Row exclusion: Copy of Permdata_2017_email.txt (imported)

Count	440
Num. Missing	0
R	.900
R Squared	.810
Adjusted R Squared	.809
RMS Residual	4.825

Regression Coefficients
FCg vs. 2 Independents
Row exclusion: Copy of Permdata_2017_email.txt (imported)

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	11.118	1.163	11.118	9.563	<.0001
Sand	-.097	.012	-.182	-8.110	<.0001
SATg	.576	.016	.816	36.253	<.0001

Dependent vs. Fitted
Row exclusion: Copy of Permdata_2017_email.txt (imported)



Best-fitted models

FCg = (38.8 ± 1.0) – (0.23 ± 0.02) Sand + (2.27 ± 0.13) OM

FCg = (11.1 ± 1.2) – (0.097± 0.012) Sand + (0.58 ± 0.02) SATg