AGRICULTURAL EXTENSION SERVICE
UNIVERSITY OF MINNESOTA

SOILS
FACT SHEET No. 34-1980
JAMES L. ANDERSON and LOWELL D. HANSON

Crop Equivalent Rating

Minnesota has a wide variety of soils ranging from fertile black prairie soils in the south and southwest to peat bogs and thin forest soils over bedrock in the north. There can be important soil variations within individual fields or parcels which largely determine the crop grown and the yield.

Minnesota climate exhibits a wide variety of precipitation and temperatures which means similar soils may not always have the same productivity.

Information has been compiled on the nature, suitability, and productivity of soils for crops, pasture, and timber. The Crop Equivalent Rating (CER) offers the opportunity to compare the relative productivity of soil series and tracts of land.

This ability is important when deciding what land should be cultivated, rented, or purchased. The rating is also a way to determine the management level necessary to obtain a desired yield.

Changes in farming, such as new fertilizers, pesticides, tillage methods, and crop varieties have resulted in increased crop yields. This means long term averages are not the best way to estimate current soil productivity. To be valid, yield estimates need to be reevaluated every 5 years. To constantly reevaluate yield estimates is confusing and time consuming. A desirable system is one that reflects the relative net economic return that might be expected from soils. This figure should be based on a specific management level that remains constant.

Development of the Crop Equivalent Rating

For the development of the Crop Equivalent Rating a moderate level of management was used which includes the following:

- Drainage on soils where necessary
- Strip cropping and terraces on soils where needed
- Use of limestone on acid soils
- Fertilizer application as indicated by soil tests
- Use of herbicides for weed control and insecticides as needed
- Use of adapted varieties and populations related to soil moisture and fertility supply
- Harvest procedures that minimize losses
- Timeliness of all crop production operations

CER's reflect the net economic return per acre of soil when managed for cultivated crops, permanent pasture or forest, whichever provides the highest net return. The CER's provide a relative ranking on a scale of 1 (lowest) to 100 (highest) rating.

Four steps were necessary to obtain the CER's.

- Gross productivity of the soil series is evaluated for the management level indicated.
- Prevalent crop combinations on a particular soil were derived from the Conservation Needs Inventory (1971). Where one crop clearly dominated, that crop largely determined the gross productivity. For most soils several crops were considered in calculating the income estimates.
- Gross production estimates for a specific cropping sequence multiplied by the market value of crops based on a 5 year average provides a gross value for the rotation.
- Costs of production were subtracted from the gross production figure. The soil which had the highest net total per acre was given a CER of 100. Each of the other soils is compared to this value to determine the relative ranking.

An example of the establishment of the CER for the Nicollet clay loam follows.

Table 1. Nicollet: B Slope, 1 erosion

	Corn	Soybean	Oats	Alf-mix hay	Other
% land use	39	31	15	4	11
Yield	120 bu	40 bu	80 bu	4.0 tons	
Unit price (dollars)	1.94	6.56	1.22	53.00	
Gross value	232.80	262.40	97.60	238.50	
Per distrib. (A)	90.79	81.34	14.64	9.54	
Cost of production	120.94	72.88	61.72	77.19	
Per distrib. (B)	47.17	22.59	9.26	3.09	
Net (A-B)	43.62	58.75	5.38	6.45	

Total/net acre = 114.20

Let $114.20 be equivalent to CER of 100

Assuming that the Nicollet clay loam has the highest net return per acre value the CER is 100. Other soils are then compared to the Nicollet to determine relative ranking. For example, another soil might have a net return per acre of $89.04. The CER is then calculated as a percentage of the net return per acre of the Nicollet clay loam. The calculation is:

$$\frac{89.04}{114.20} \times 100 = 78\%$$

The CER value for this soil is 78.

Since the procedure outlined provided CER values based on row crop production and row crop production is not recommended on slopes over 12 percent, soils occurring on these slopes need to be evaluated on the basis of permanent pasture and/or timber production. In addition, a method was derived to adjust CER's for differences in climate.

Climatic adjustments are made by adding 5 percent to the CER value for each additional inch of rainfall over the average for the county where the series was originally evaluated. Conversely, for each inch decrease, 5 percent is subtracted from the CER.

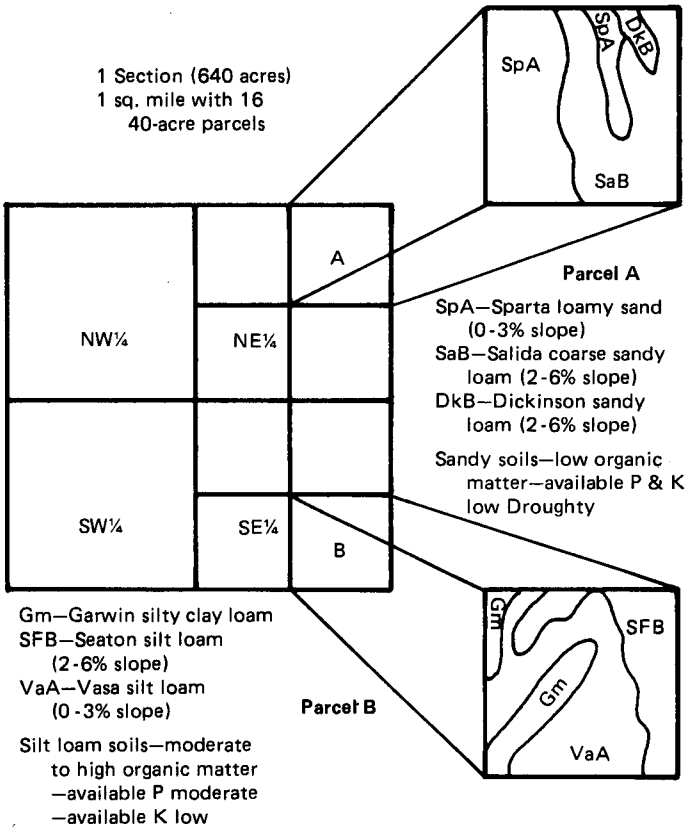
If a soil should be drained but is not, the CER is reduced by 20 percent. Where soils are used for woodland production, yet row crops are a feasible alternative, the CER can be adjusted downward. A reasonable estimate is to divide the CER in half.

Application of the Crop Equivalent Rating

CER's can be used to evaluate the relative productivity of different parcels. Decisions on whether to purchase or rent certain parcels can be based on the CER. Intensity of land management can be based on the soils' potential productivity.

For example, suppose there are two parcels and a decision is to be made which parcel to rent or purchase. The two parcels are located according to their legal description from the Public Land Survey (figure 1). The relative productivity of the two parcels can be determined based on CER's and these five steps.

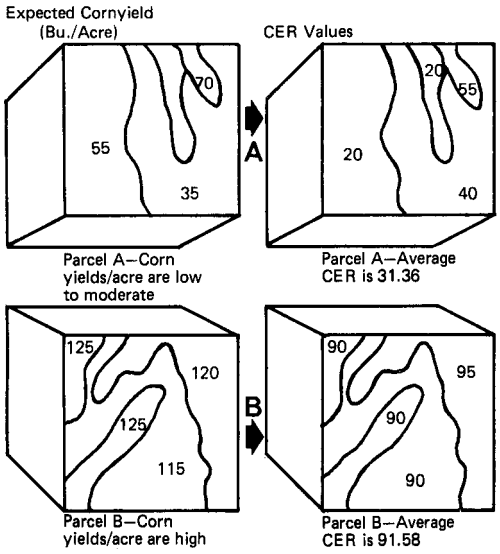
Figure 1. Public land survey indicating 40 acre parcels and soil survey information.



1. Obtain soil map and legend.
2. Determine soil use categories.
3. Obtain CER's for each mapping unit (from MR132 mentioned in last paragraph of this publication).
4. Measure and record acreage of each mapping unit for each tract of land.
5. Calculate an average CER for each 40 acre tract of land.

The soil map will give a general indication of the productivity of the soils (figure 1). From interpretative tables supplied with the soil map, average yields can be determined. By using CER's and measuring acreages, however, an indication of the relative net economic return on the parcels is determined (figure 2).

Figure 2. Comparison of corn yield data from a Soil Survey Report and CER data.



It is obvious that the 40 acre parcel (Parcel B) in the SE ¼ section is clearly the superior parcel in terms of productivity. Although the differences in this instance are so clear that a decision probably could have been made without the CER data, often this is not true. Then the CER is a useful tool to indicate differences in land productivity.

If this procedure is expanded to compare CER values with selling price, cash rent, and appraised values, a basis for land assessment is obtained. The following steps after the calculation of an average CER value are necessary to obtain an assessed evaluation.

- Obtain data on selling price, earning value, cash rent figure when available, and/or appraised value in representative soil areas.
- Determine the relationship of CER's and the dollar values for the representative tracts.
- Prepare a schedule of adjustments.

Several counties are using CER's as a basis for land evaluation.

Conclusions

CER's provide a relative ranking of soil productivity useful in comparing land parcels for purchase, rent, management or assessment.

With the current accelerated soil survey program the CER values will be refined and improved so that this method of parcel evaluation will become increasingly useful.

Additional Information

The following additional publication about CER's is available from county agricultural extension offices or the Bulletin Room, 3 Coffey Hall, 1420 Eckles Ave., University of Minnesota, St. Paul, MN 55108.

Rust, R. H. and Hanson, L. D. *Crop Equivalent Rating Guide for Soils in Minnesota.* Miscellaneous Report 132, Agricultural Experiment Station, University of Minnesota, St. Paul, MN 55108.

Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Roland H. Abraham, Director of Agricultural Extension Service, University of Minnesota, St. Paul, Minnesota 55108.

5 cents