4. MODEL VALIDATION

In RWEQ soil loss is defined as soil removed from a field. The relationship between transport mass, field length, and soil loss is basic to a clear understanding of this definition. Using this definition, the transport mass continues to increase as the field length increases. When transport mass at a point within a field is divided by the upwind field length along the path of the wind, the result is the average soil loss for the upwind field. Appendix I-1 illustrates the relationship between transport mass, field length, and soil loss. As the field length increases to the critical field length (*s*), the transport rate and average soil loss (*ASL*) both increase (APPENDIX I-1). However, once the field length exceeds the critical field length, the capacity of the wind to detach and transport particles approaches Q_{max} and *ASL* begins to decrease. The transport mass approaches the capacity of the wind and essentially remains constant. The average soil loss must decline as field length continues to increase.

4.1 MEASURED SOIL EROSION

The most accurate method of measuring soil loss is to collect all of the eroded material leaving a field boundary. To collect all eroded material may be possible in a laboratory wind tunnel but is not possible for field erosion conditions. An alternative is to sample the entire vertical profile of the dust cloud. Again for small plots this may be feasible, but for the 2.5 ha standard circles or larger fields this is not feasible.

Vertical mass samples were collected to a height of 1 meter. Vertical distribution was projected to a height of 2 meters for integration purposes. This technique works for sandy textured soils (Fryrear and Saleh, 1993). Data from Nickling (1978) supports this technique. In RWEQ the average soil loss is based on the computed total transport mass from the soil surface to a height of 2 meters.

To calculate transport mass for a circular instrumented site, the circle is divided into 20 equal width strips. The average length of each strip and maximum transport capacity are used in equation **[6]** to compute transport mass in kg/m-width. Transport mass for average field length of each segment is computed. See APPENDIX L-1 for a detailed explanation. Since there are 2-10 m wide strips with this length, the transport mass in kg/unit-width is multiplied times 20 meters to yield the total kg of soil lost from the 2 strips. The kg loss for all strips are added and the total mass is divided by the area of the circle to give average soil erosion in kg/m^2 from the entire circle. Soil loss from a field can be determined by dividing transport mass at the downwind edge of the field by the upwind field length parallel to the prevailing wind direction.

For many eroding fields the depth of the suspension cloud continues to increase as field length increases. The suspension component represents much less mass than the saltation/creep component even though the clouds of dust are readily visible. The lack of data to develop and verify routines to estimate the total suspension component for various soil textures, field length, and surface conditions prohibits the inclusion of a suspension component in RWEQ97.

Fryrear, D.W., Ali Saleh, J.D. Bilbro, H.M. Schomberg, J.E. Stout, and T.M. Zobeck. 1998. Revised Wind Erosion Equation (RWEQ). Wind Erosion and Water Conservation Research Unit, USDA-ARS, Southern Plains Area Cropping Systems Research Laboratory. Technical Bulletin No. 1. Internet address: http://www.csrl.ars.usda.gov/wewc/rweq.htm

4.2 ESTIMATED SOIL EROSION

When mass transport is estimated every 15 days or less for the entire erosion or management period, routines for soil wetness from rainfall or irrigation, degradation of tillage roughness, decay of crop residues, and growth of crop canopy must be included. The single event coefficients from equations **[32]** and **[33]** are used in equation **[10]** for the entire erosion season. *SW* and *SD* may be less than 1 for portions of the erosion season.

The residue level, tillage roughness value, and/or crop canopy at the end of each period are used to compute erosion for that period. The weather factor, tillage roughness, SLR_f , SLR_s , and SLR_c coefficients are output in the tabular output. They can also be viewed graphically.

RWEQ divides the field into 200 equal width strips and the field length of each strip is computed for four wind directions according to the preponderance and positive parallel ratio values. The *Q(x)* for the average field length is divided by average field length to estimate average soil loss for the field. Erosion estimates for each wind direction are based on the transport for the average field length of the 200 strips in each of four directions.

4.2.1 Weather

At each of the instrumented validation sites, wind speeds and wind direction were recorded every minute. Solar radiation, air temperatures, and rainfall were recorded every 10 minutes. Average daily maximum and minimum temperatures, % calm, and the wind Weibull coefficients, total precipitation, number of rainfall events, *EI* and total solar radiation were determined for each month.

Monthly weather data files were created for each instrumented location. The WERIS data file closest to the instrumented location was used for weather data not measured at the instrumented site. The Weibull coefficients (*c* and *k*), % calm, the average maximum and minimum temperatures, solar radiation, precipitation, days with rain and the *EI* in the WERIS file were replaced with data from the instrumented site.

4.2.2 Management

To organize the input data for the validation sites, the original RWEQ INPUT FORM (APPENDIX A-2) was modified to create APPENDIX A-4. The headings SOIL and CROP show *measured* values for *EF, K*, silhouette, and canopy cover. These measured values were included for comparison with values computed by RWEQ.

Modified RWEQ INPUT FORMs (APPENDIX A-4) for each site-year are listed in APPENDIX K1-51. The first entry line provides crop and tillage input data to describe field conditions at the beginning of the management period. Operations listed on the RWEQ INPUT FORM are entered by dates in the DOABLE screen.

4.2.3 **Output**

RWEQ model estimates were compared to *measured* soil loss values from instrumented sites. RWEQ estimates were made using weather data files that had been customized for the validation site and time period. The management files describe the soil, field, crops and tillage operations for the validation site.

The agreement between measured and estimated erosion values for 51 site/years from 11 states is shown in Figure 4.2.3 and Table 4.2.3. There is no adjustment for freeze-thaw effects. Freeze/ thaw is a major factor at Montana, Nebraska, Colorado, Indiana, Minnesota, and Washington. The effect of freeze-thaw may increase or decrease erosion and would depend on soil texture.

Considering the variety of erosion and surface measurements required to quantify the soil, crop, and surface conditions, the agreement in Figure 4.2.3 and Table 4.2.3 is good ($R^2 = 0.805$).

Figure 4.2.3 Measured soil losses plotted against estimated soil losses with RWEQ97.

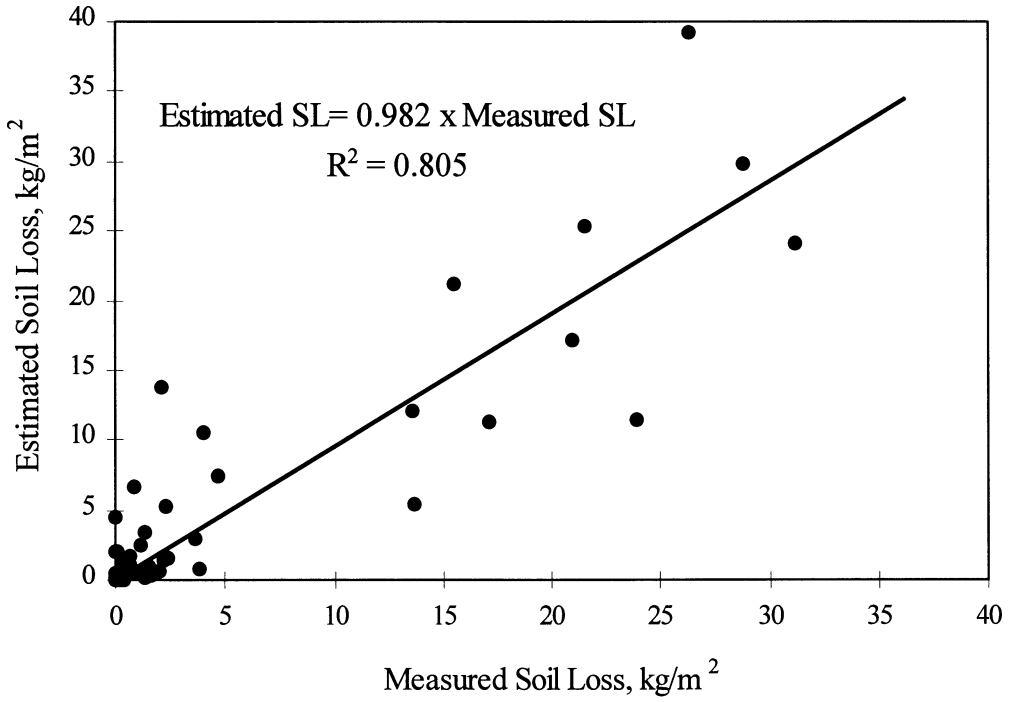

Table 4.2.3 Comparison of measured and estimated soil erosion from instrumented sites for various time periods. The * indicates those sites with erosion events included in the development of "Q_{max}" and "s" coefficients Table 3.8.1.

CLIENT	SITE	TIME		SOIL LOSS	
				----------*kg/m²*----------	
		Start	Stop	Measured	Estimated
AC89	Akron, CO	10/27/88	05/26/89	0.83	6.70
AC90	Akron, CO	10/20/89	04/26/90	1.10	0.38
EC91*	Eads, CO	10/30/90	05/07/91	2.43	1.57
EC92	Eads, CO	09/15/91	04/15/92	0.67	0.81
CPI90	Crown Point, IN	01/10/90	12/31/90	31.21	23.42
CPI91	Crown Point, IN	01/01/91	12/31/91	23.95	11.23
CPI92	Crown Point, IN	01/01/92	06/04/92	0.42	0.67
EKS90	Elkhart, KS	02/27/90	12/30/90	0.29	0.63
EKS91	Elkhart, KS	01/01/91	12/30/91	1.32	3.41
EKS92*	Elkhart, KS	01/01/92	10/15/92	15.50	20.73
EKS93	Elkhart, KS	01/01/93	05/25/93	2.06	13.72
CM89	Crookston, MN	11/07/88	12/31/89	0.21	0.00
CM90	Crookston, MN	11/27/89	05/06/90	0.32	0.00
SLM91	Swan Lake, MN	04/11/91	12/31/91	1.14	2.51
SLM92	Swan Lake, MN	01/01/92	12/31/92	0.13	0.04
SLM93	Swan Lake, MN	01/01/93	12/31/93	0.00	0.00
KM93*	Kennett, MO	12/02/92	06/17/93	13.73	5.42
KM94	Kennett, MO	11/18/93	05/05/94	0.64	1.75
HM93	Havre, MT	10/28/92	05/05/93	0.01	4.44
HM94	Havre, MT	10/19/93	03/30/94	0.01	0.52
LM91	Lindsey, MT	10/18/90	05/21/91	0.03	1.97
LM92	Lindsey, MT	10/08/91	04/08/92	0.09	2.02
SM89	Scobey, MT	10/03/88	05/10/89	4.68	7.37
SM90F	Scobey MT Fallow	10/04/89	04/21/90	1.34	0.07
SM90S	Scobey, MT Stubble	10/04/89	04/21/90	0.39	0.00
SN89	Sidney, NE	10/25/88	05/24/89	0.52	0.52
SN90	Sidney, NE	10/24/89	04/24/90	0.38	0.04
SIDNEYB	Sidney, NE	10/31/90	05/07/91	2.29	4.44
PORTALES	Portales, NM	11/24/94	04/06/95	0.01	0.09
FND95	Fargo, ND	12/06/94	05/07/95	0.00	0.00
FND96	Fargo, ND	10/24/95	05/07/96	0.00	0.00
FND97	Fargo, ND	10/29/96	05/15/97	0.00	0.00
BST89	Big Spring, TX	01/12/89	05/03/89	21.54	25.26
BST90*	Big Spring, TX	01/05/90	05/04/90	20.96	17.06
BST91	Big Spring, TX	01/25/91	05/15/91	0.10	0.11
BST93*	Big Spring, TX	03/16/93	06/01/93	28.78	29.85
BST94	Big Spring, TX	01/06/94	05/18/94	17.16	11.23
BST95	Big Spring, TX	01/11/95	05/15/95	26.29	39.15
BST96	Big Spring, TX	01/12/96	05/16/96	3.99	10.51
BST97	Big Spring, TX	01/23/97	05/23/97	13.63	11.99
TEXAS2	Martin-C, TX #2	01/24/95	06/06/95	0.30	0.20
TEXAS3	Martin-C, TX #3	01/11/95	05/23/95	0.80	0.52
TEXAS4	Martin-C, TX #4	02/11/95	05/11/95	0.30	0.43
PLAINSE	Plains E, TX	11/15/94	06/03/95	2.20	1.82
PLAINSB	Plains B, TX	12/13/94	05/24/95	1.60	0.36
PTE96	Plains, TX E	12/12/95	06/04/96	3.83	0.61
PTX96B8	Plains, TX B (800m)	12/13/95	05/29/96	2.02	0.22
PTX96B16	Plains, TX B (1600m)	12/13/95	05/29/96	1.55	0.54
MABTON*	Mabton, WA	12/13/90	04/28/91	3.68	2.98
PROSSER1	Prosser, WA #1	12/03/91	03/25/92	0.17	0.13
PROSSER2	Prosser, WA #2	06/10/92	06/15/93	0.32	1.05

4.3 **EXAMPLES OF FIELD MANAGEMENT SYSTEMS**

To test RWEQ in different regions of the country the following management systems were evaluated. A brief description and discussion of the the estimated erosion are included. The weather files used with these systems are from the closest WERIS site. Weather data files were not modified except for the sites in Washington. The weather file, the RWEQ Input Form, and the DOABLE screen showing the estimated erosion are included with each example.

These systems are not intended to reflect all possible cropping systems used in the country. These systems do provide examples of typical systems and the potential wind erosion from these systems for each region. In most cases, the generic soil, crop, and tillage coefficients are used. When input deviates from the generic values the new input value is used, not the generic value. These client, weather, and management files are included in the F2 choice lists.

4.3.1 **Dryland winter wheat**

This example is a typical dryland winter wheat-fallow system at Akron, Colorado. Between harvest and planting, 6 tillage operations are performed. The initial tillage operation after harvest is chemical weed control. This operation does not modify soil roughness. Some farmers observe that chemical herbicides promote residue decomposition, but this is not a factor in the current decomposition parameters.

In the DOABLE SCREEN the total soil loss for this two-year rotation is 1.7 t/ac or an annual average of 0.85 t/ac/yr. The majority of the erosion occurs after wheat planting or just prior to planting in September. For more detailed information on erosion by periods, view the tabular output.

With this system, wind erosion is not a problem unless soil moisture is not sufficient for good canopy cover after wheat planting. When dry fall conditions limit crop canopy development, the wind erosion problem can intensify in the winter and result in considerable erosion in the late winter/early spring. The *V* coefficient, reflecting residue levels on 9/20/1992, is 0.76 at wheat planting which is not sufficient to provide protection without the crop canopy.

Weather File: **CO24015.DAT**

```
# 24015 USA CO AKRON
  40 07 N 103 10 W 1399 19480101 19541231 ARF  60 64
   6.98  7.11 7.97  7.74  7.23  6.69  6.61 6.38  6.78   6.61  7.41  7.31
   2.56  2.44  2.32  2.36  2.40  2.37  2.43  2.41  2.34  2.44  2.49  2.51
   1.11  1.10  1.09  1.06  1.05  1.02  1.01  1.02  1.03  1.06  1.09  1.10
    315   338   315   338   338   338   158   158   158   338   337   315
    2.9   3.4   3.8   4.1   3.7   2.6   1.9   1.7   2.6   3.1   5.8   3.1
   0.95  0.93  0.93  0.63  0.50  0.60  0.71  0.59  0.69  0.63  0.95  0.96
    3.1   3.1   2.7   2.5   3.7   3.9   3.5   4.1   4.3   4.6   3.0   2.9
    3.7   6.3   9.5  15.8  21.1  27.2  31.4  30.5  25.5  19.0   9.9   5.3
  -10.6  -8.3  -5.4   0.1   5.7  11.0  14.7  13.8   8.5   2.2  -5.0  -8.9
  -10.9  -8.4  -7.5  -3.1   3.0   7.5  10.1   9.4   4.2  -1.4  -6.6  -9.2
    261   315   509   568   612   671   696   589   517   402   393   234
      9     7    25    33    78    67    70    46    32    21    14    10
    4.5   4.1   7.5   7.3  10.9   9.7   9.6   7.8   5.5   4.6   4.3   3.8
   31.3  24.2  10.5   0.0   0.0   0.0   0.0   0.0   0.0   0.0   3.8  18.6
      0     7    68    71    29    37   115   297   209    83    81    19
    0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
  40 6 N 103 9 W 2.3 CO AKRON CAA AP
```

RWEQ INPUT FORM

CLIENT: AKCOLD WEATHER FILE: W\CO24015.DAT MANAGEMENT FILE: AKCOLD.MAN

Soil Properties:
soil texture Sandy loam OR sand 64 %
silt 26 %
organic matter 0.5 %
calcium carbonate 3 %
rock cover 0 %

Field Geometry: shape circular or (rectangular)
area 160, acres
orientation 0, ° from north
length_N 2640, feet
slope gradient —
slope length —, feet

Longitude_____ Latitude_____ Elevation_____ Annual Rainfall_____

DATE	VEGETATION					OPERATION / EVENT								IRRIGATION			BARRIERS			
	Residue	Yield	% Cov.	# Stems	Growing Crop	Implement	Mod. Rough.	RR	Ridge Spac.	Ridge Ht.	Ridge Orient.	Kill Crop	% Flat	% Stand.	Amt.	Rate	# Days	Ht.	DI	Spac.	Orient.
4/20/90	NONE	0		0	WWHEAT	DRILL-HO	Y	0.8	12	2	0	N	50	40							
7/1/91	WWHEAT	2000		100	NONE	HARVEST	N	0	0	0	0	Y	100	100							
8/15/91	WWHEAT	0		0	NONE	CHEM WEED	N	0	0	0	0	N	100	100							
5/1/92	WWHEAT	0		0	NONE	CHISEL STR	Y	1.5	12	2	0	N	70	70							
6/1/92	WWHEAT	0		0	NONE	SWEEP-3	Y	0.5	36	2	0	N	90	45							
7/1/92	WWHEAT	0		0	NONE	CULT-30"	Y	0.7	24	1	0	N	70	90							
8/1/92	WWHEAT	0		0	NONE	CULT-30"	Y	0.7	24	1	0	N	70	90							
9/1/92	WWHEAT	0		0	NONE	CULT-30"	Y	0.7	24	1	0	N	70	90							
9/20/92	WWHEAT	0		0	WWHEAT	DRILL-HO	Y	0.8	12	2	0	N	50	40							

REVISED WIND EROSION EQUATION

Client: AKCOLO Weather File: w/CO24015.DAT
Man. File:AKCOLO.MAN

Soil Field EF: 0.51 SCF: 0.6024
DOABLE SCREEN

Date Start	Vegetation	Operation/Event	Barrier	K'	K''	V	Period Erosion
09/20/1990	G_WWheat	DRILL_HO	No	0.18	0.14	0.95	0.0
07/01/1991	R_WWheat	HARVEST	No	0.38	0.36	0.00	0.9
08/15/1991	R_WWheat	CHEMWEED	No	0.49	0.48	0.00	0.0
05/01/1992	R_WWheat	CHI_STR	No	0.05	0.04	0.03	0.0
06/01/1992	R_WWheat	SWEEPS_3	No	0.26	0.22	0.05	0.0
07/01/1992	R_WWheat	CULT_30	No	0.20	0.19	0.11	0.0
08/01/1992	R_WWheat	CULT_30	No	0.21	0.20	0.28	0.0
09/01/1992	R_WWheat	CULT_30	No	0.20	0.19	0.51	0.3
09/20/1992	G_WWheat	DRILL_HO	No	0.14	0.10	0.76	0.5

Total Erosion (t/ac): 1.7

RWEQ 97

Press F1 Key Twice to View HELP on SPECIAL FUNCTION KEYS

Accept or enter the operation date (MM/DD/YEAR)

4.3.2 **Dryland cotton**

Dryland cotton at Big Spring, Texas is the major cash crop for about 4 million acres. The traditional system consists of tilling the soil as soon as possible after each major rainfall. However, it is difficult to illustrate this timing in a period erosion model.

This example is a typical dryland cotton system. It consists of 10 operations between harvests. Some years it is not unusual for the farmer to till 6 to 8 additional times to control wind erosion, but these are not included in this example. There is some erosion between harvest and the first operation, but most of the erosion occurs in the months of February, March, April, and May. Based on field observations and measurements the estimated erosion of 8.0 t/ac/yr is excessive. For more detailed information on erosion by periods, view the tabular output.

Another concern is the weather file TX23005.DAT. When the management file in this example is used with *measured* weather data for the years of 1989, 1990, 1991, 1993, 1994, 1995, 1996, and 1997, the estimated erosion is 8.4, 6.2, 6.1, 10.0, 5.7, 8.0, 7.2, and 8.0 t/ac/yr. Only one of these years had as much erosion as the WERIS file for Big Spring, Texas.

The vegetative levels look about right for this type of system. The soil roughness values look good except for the fact that the timing of the tillage operations in the real world immediately follows a rain event.

Weather file: **TX23005.DAT**

```
# 23005 USA TX BIG_SPRING
  32 14 N 101 30 W 784 19590507 19701231 AGA  95 91
   5.91  6.50  7.30  7.25  7.05  6.80  5.97  5.52  5.68  5.93  5.83  5.70
   2.13  2.15  2.35  2.47  2.65  2.68  2.82  2.61  2.47  2.26  2.15  2.12
   1.17  1.15  1.13  1.10  1.09  1.08  1.07  1.08  1.09  1.11  1.14  1.16
    247    45   247   225   180   180   180   180   180   180   180   225
    1.3   1.5   1.2   1.0   2.1   5.1   3.7   1.6   3.5   3.6   2.1   1.5
   0.70  0.56  0.71  0.79  0.86  0.93  0.96  0.85  0.75  0.80  0.64  0.60
    8.0   6.6   3.3   3.6   3.2   3.8   4.0   4.7   6.1   7.2   7.8   9.5
   13.6  16.3  20.8  25.9  29.8  33.7  34.7  34.2  30.6  25.7  19.0  15.3
   -1.3   1.1   4.8  10.3  15.2  19.5  21.6  20.9  17.3  11.4   4.5   0.4
   -3.1  -1.3  -1.0   4.0  10.5  14.9  16.0  15.2  13.7   8.5   1.9  -1.6
    378   442   612   699   810   844   845   766   668   527   411   357
     17    15    17    35    76    49    47    45    67    42    16    14
    3.5   3.2   2.7   3.8   6.2   4.6   4.8   5.0   5.5   4.5   2.9   2.7
    0.7   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   2.5
      0     0    16    16   226   371   226   226   226   226    64    16
    0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
  32 13 N 101 30 W 1.9 TX BIG SPRING WB AP
```

RWEQ INPUT FORM

CLIENT: BIGTEX WEATHER FILE: W\TX23005.DAT MANAGEMENT FILE: BIGTEX.MAN

Soil Properties:
soil texture SANDY LOAM OR sand 64 %
silt 26 %
organic matter 0.5 %
calcium carbonate 3 %
rock cover 0 %

Field Geometry: shape circular or (rectangular)
area 320, acres
orientation 0, ° from north
length_N 2640, feet
slope gradient 0
slope length 0, feet

Longitude_____ Latitude_____ Elevation_____ Annual Rainfall_____

DATE	VEGETATION					OPERATION / EVENT								IRRIGATION			BARRIERS			
	Residue	Yield	% Cov.	# Stems	Growing Crop	Implement	Mod. Rough.	RR	Ridge Spac.	Ridge Ht.	Ridge Orient.	Kill Crop	% Flat	% Stand.	Amt.	Rate	# Days	Ht.	DI	Spac.	Orient.
11/15/91	COTTON	400		10	NONE	HARVEST	N	0	0	0	0	Y	100	100							
1/1/92	COTTON	0		0	NONE	CHISEL-STR	Y	0.4	12	3	0	N	70	70							
2/1/92	COTTON	0		0	NONE	MOLDB-8*	Y	1.9	10	3	0	N	5	0							
3/1/92	COTTON	0		0	NONE	FERT-L (Herb-Inc)	Y	0.8	12	3	0	N	80	50							
3/15/92	COTTON	0		0	NONE	LISTER	Y	1.0	40	10	0	N	20	0							
4/15/92	COTTON	0		0	NONE	KNIFE	Y	0.6	40	7	0	N	20	0							
5/10/92	COTTON	0		0	NONE	KNIFE	Y	0.5	40	6	0	N	20	0							
5/30/92	COTTON	0		0	COTTON	PLAN_ROW	Y	0.4	40	4	0	N	20	0							
6/25/92	COTTON	0		0	COTTON	CULT-6	Y	0.3	40	2	0	N	20	0							
7/20/92	COTTON	0		0	COTTON	CULT-6	Y	0.2	40	1.5	0	N	20	0							
8/15/92	COTTON	0		0	COTTON	CULT-6	Y	0.2	40	1	0	N	20	0							
11/15/92	COTTON	400		10	NONE	HARVEST	N	0.0	40	0	0	Y	100	100							

REVISED WIND EROSION EQUATION

Client: BIGTEX Weather File: W\TX23005.DAT
Man. File:BIGTEX.MAN

Soil Field EF: 0.51 SCF: 0.6024
DOABLE SCREEN

Date Start	Vegetation	Operation/Event	Barrier	K'	K''	V	Period Erosion
11/15/1991	R_Cotton	HARVEST	No	1.00	1.00	0.21	0.0
01/01/1992	R_Cotton	CHI_STR	No	0.07	0.19	0.18	1.5
02/01/1992	R_Cotton	MOLDB8	No	0.01	0.01	0.90	0.0
03/01/1992	R_Cotton	FERT_L	No	0.05	0.11	0.92	0.4
03/15/1992	R_Cotton	LISTER	No	0.02	0.05	0.98	0.0
04/15/1992	R_Cotton	KNIFE	No	0.08	0.08	1.00	0.5
05/10/1992	R_Cotton	KNIFE	No	0.26	0.09	1.00	0.9
05/30/1992	G_Cotton	PLAN_ROW	No	0.38	0.27	1.00	2.6
06/25/1992	G_Cotton	CULT_6	No	0.41	0.32	0.63	1.1
07/20/1992	G_Cotton	CULT_6	No	0.53	0.47	0.01	0.0
08/15/1992	G_Cotton	CULT_6	No	0.54	0.52		0.0

Total Erosion (t/ac): 8.0

RWEQ 97

Press F1 Key Twice to View HELP on SPECIAL FUNCTION KEYS

Accept or enter the operation date (MM/DD/YEAR)

4.3.3 **Corn-soybeans**

A typical corn-soybean system for the Midwest was supplied by Niki McClain, NRCS at Lake County, Indiana.

Excluding harvesting and planting, there are 2 tillage operations. With the high rainfall at Crown Point, the residue levels from these two crops are sufficient to protect the land from wind erosion. The total erosion is 1.9 t/ac for two years or an average of 0.95 t/ac/yr. The erosion that does occur is immediately after corn planting. This is when vegetative cover from the decaying soybeans is at a minimum. Soil roughening is not a major factor in protecting the soils because the high rainfall degrades soil roughness.

In this region, wind erosion should not be a problem unless dry weather or other unusual phenomena destroy the crop. If for some reason, the residue is removed after harvest (for fuel, feed, or building material), the wind erosion problem will be considerably different. Tillage would not be a recommended procedure because of the high rainfall. Cover crops or windbarriers might be options to minimize wind erosion under adverse conditions.

Weather file: **IL14834.DAT**

```
# 14834 USA IL JOLIET
  41 30 N 88 10 W 181 19460101 19521231 ARW  150 101
   6.46  6.18  6.49  6.38  5.54  5.04  4.16  3.88  4.50  4.95  6.13  5.82
   2.25  2.09  2.09  2.11  2.22  2.06  2.13  2.15  2.13  2.16  2.18  2.15
   1.29  1.29  1.26  1.23  1.20  1.18  1.17  1.18  1.20  1.22  1.25  1.28
    225   247   203   203   203   203   225   225   203   203   203   225
    1.9   1.7   1.8   1.6   2.0   2.5   3.5   2.1   2.0   6.7   1.7   2.3
   0.91  0.93  0.84  0.89  0.87  0.95  0.96  0.92  0.97  0.96  0.90  0.97
    1.8   2.3   3.6   2.1   2.1   3.4   5.3   6.4   4.7   5.2   2.5   4.0
   -0.7   1.1   7.7  15.3  21.7  26.9  29.5  28.3  24.2  17.8   9.0   1.3
  -10.4  -8.7  -2.9   2.8   8.4  13.7  16.3  15.4  11.2   5.0  -1.3  -7.6
   -8.8  -7.1  -3.5   2.2   8.4  13.6  16.4  16.3  11.9   6.2  -0.6  -5.5
    151   205   332   442   574   608   615   550   419   298   175   123
     44    36    64    85    95   108    88    89    92    63    57    50
    8.3   7.0   9.3   9.9  10.7  10.1   8.1   8.3   8.2   7.6   7.8   8.1
   45.0  14.6   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  22.5  32.5
      0    25    51    76   204   357   612   510   382   178   102    51
    0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
  41 45 N 88 19 W 30.5 IL AURORA COLLEGE
```

RWEQ INPUT FORM

CLIENT: CROWNPIN WEATHER FILE: W\IL14834.DAT MANAGEMENT FILE: CROWNPIN.MAN

Soil Properties:
soil texture SANDY LOAM OR sand 64 %
silt 26 %
organic matter 0.5 %
calcium carbonate 3 %
rock cover 0 %

Field Geometry: shape circular or (rectangular)
area 80, acres
orientation 90, ° from north
length_N 2640, feet
slope gradient 0
slope length 0, feet

Longitude_____ Latitude_____ Elevation_____ Annual Rainfall_____

DATE	VEGETATION					OPERATION / EVENT								IRRIGATION			BARRIERS			
	Residue	Yield	% Cov.	# Stems	Growing Crop	Implement	Mod. Rough.	RR	Ridge Spac.	Ridge Ht.	Ridge Orient.	Kill Crop	% Flat	% Stand.	Amt.	Rate	# Days	Ht.	DI	Spac.	Orient.
4/20/92	NONE	0		0	NONE	DISK_TAN	Y	0.8	12	1	0	N	50	20							
5/1/92	NONE	0		0	CORN	PLANT_ROW	Y	0.4	30	3	0	N	90	50							
10/20/92	CORN	9000		15	NONE	HARVEST	N	0	0	0	0	Y	100	100							
5/1/92	CORN	0		0	NONE	DISK_TAN	Y	0.8	12	1	0	N	50	20							
5/10/92	CORN	0		0	SOYBEAN	DRILL_NOH	Y	0.3	12	1	0	N	90	40							
10/1/93	SOYBEAN	3000		100	NONE	HARVEST	N	0	0	0	0	Y	100	100							
4/20/94	SOYBEAN	0		0	NONE	DISK_TAN	Y	0.8	12	1	0	N	50	20							

REVISED WIND EROSION EQUATION

Client: CROWNPIN Weather File: w/IL14834.DAT
Man. File:CROWNPIN.MAN

Soil Field EF: 0.51 SCF: 0.6024
DOABLE SCREEN

Date Start	Vegetation	Operation/Event	Barrier	K'	K''	V	Period Erosion
04/20/1992	R_Soybea	DISK_TAN	No	0.17	0.15	1.00	0.0
05/01/1992	G_Corn	PLAN_ROW	No	0.30	0.22	1.00	1.0
10/20/1992	R_Corn	HARVEST	No	0.90	0.90	0.00	0.8
05/01/1993	R_Corn	DISK_TAN	No	0.18	0.16	0.01	0.0
05/10/1993	G_Soybea	DRIL_NOH	No	0.41	0.36	0.02	0.0
10/01/1993	R_Soybea	HARVEST	No	0.91	0.91	0.00	0.0
04/20/1994	R_Soybea	DISK_TAN	No	0.16	0.14	0.01	0.0
/ /			No	0.00	0.00	0.00	0.0

Total Erosion (t/ac): 1.9

RWEQ 97

Press F1 Key Twice to View HELP on SPECIAL FUNCTION KEYS

Accept or enter the operation date (MM/DD/YEAR)

4.3.4 **Winter wheat**

Horse Heaven Hills is that region of south central Washington State west of the Yakima River and north of the Columbia River. It is characterized by dry weather with infrequent but very strong winds. This dryland winter wheat-fallow management system has 6 tillage operations and one application of herbicide.

With this system the total wind erosion is 0.0 t/ac. From the 0.88 *V* value at planting (8-30-93) there is insufficient residue on the land to protect the soil if high winds should occur. Measurements and observation agree that this is a critical erosion period. The total erosion is relatively small, but this volcanic ash soil is subject to long distance transport. Any soil eroded is transported hundreds of miles before being deposited.

Cover crops are not an option because of the lack of rainfall. Windbarriers are of limited value because of the undulating topography. The soil texture is not conducive to roughening, but the potential may warrant additional research. Other options would include soil amendments for critical problem areas, or acceptance that this level of erosion will not degrade the soil resources over extended periods of time. This is probably true except during those exceptional events when high speed winds blow through the region.

HOWEVER, during extended droughts, the residue levels will be even lower and erosion can be considerably greater. Because of the impact on air quality, alternative systems and techniques may deserve additional research.

Weather file: **P2WA9293.W1**

```
# 24243 USA WA YAKIMA    modified for PROSSER2    JUN 92 to MAR 93
  46 34 N 120 32 W 326 19620119 19781231 AGW  5 10
   3.50  3.95  4.19  4.89  4.82  4.78  4.38  4.26  4.82  3.45  3.06  5.28
   1.47  1.32  1.97  2.03  2.18  2.25  2.55  2.56  1.60  1.69  1.78  1.92
   1.26  1.24  1.22  1.20  1.18  1.16  1.15  1.16  1.18  1.21  1.23  1.25
    270   247   292   292   315   293   315   292   292   270   225   180
    1.9   1.6   1.1   2.0   1.9   3.2   2.3   1.3   2.1   1.4   1.2   2.3
   0.96  0.93  0.94  0.99  0.91  1.00  0.97  1.00  0.99  1.00  1.00  0.95
   18.3  12.7  13.2   2.9   2.0   1.9   2.3   2.5   8.4  10.4  24.4   8.9
   -2.1   2.0   9.4  17.5  22.7  30.6  30.4  33.8  10.5  18.3   7.2   2.0
   -8.3  -4.5   0.4   1.4   5.8  15.3  14.3  15.2   0.1   5.2   0.9  -3.3
   -7.1  -2.6  -1.1   0.7   4.4   7.1   8.1   8.5   6.8   4.3   0.6  -2.2
    132   228   319   532   671   694   662   611   222   282   131   106
     16     7    27    11    12    29    37     8     6    22    29     6
      6     8    13   4.3   4.9     6    10   2.8     5     7    11     5
   44.3   0.1   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   6.1  25.2
     29     3    20     7     8    16    53     7     2     7    10    .2
    0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
  46 33 N 120 31 W 2.2 WA YAKIMA WB AP D
```

RWEQ INPUT FORM

CLIENT: HORSEHH-WA WEATHER FILE: P2WA9293.W1 MANAGEMENT FILE: HORSEHH.MAN

Soil Properties:
soil texture SANDY LOAM OR sand 64 %
silt 26 %
organic matter 0.5 %
calcium carbonate 3 %
rock cover 0 %

Field Geometry: shape circular or ~~rectangular~~
area 160, acres
orientation 0, ° from north
length_N 3640, feet
slope gradient 0
slope length 0, feet

Longitude_____ Latitude_____ Elevation_____ Annual Rainfall_____

DATE	VEGETATION					OPERATION / EVENT									IRRIGATION			BARRIERS			
	Residue	Yield	% Cov.	# Stems	Growing Crop	Implement	Mod. Rough.	RR	Ridge Spac.	Ridge Ht.	Ridge Orient.	Kill Crop	% Flat	% Stand.	Amt.	Rate	# Days	Ht.	DI	Spac.	Orient.
7/15/92	WWHEAT	1800		70	NONE	HARVEST	N	0	0	0	0	Y	100	100							
9/1/92	WWHEAT	0		0	NONE	SWEEP-2	Y	0.6	36	2	0	N	15	55							
4/10/93	WWHEAT	0		0	NONE	FERT_L (HERBICIDE)	Y	0.4	0	0	0	N	80	50							
5/21/93	WWHEAT	0		0	NONE	CULT-30	Y	0.7	24	1	0	N	70	90							
5/22/93	WWHEAT	0		0	NONE	ROD-PLA	Y	0.4	0	0	0	N	70	50							
6/1/93	WWHEAT	0		0	NONE	FERT-L	Y	0.4	0	0	0	N	80	50							
6/15/93	WWHEAT	0		0	NONE	ROD-PLA	Y	0.4	0	0	0	N	90	50							
8/1/93	WWHEAT	0		0	NONE	ROD-PLA	Y	0.4	0	0	0	N	90	50							
8/30/93	WWHEAT	0		0	WWHEAT	DRILL-HO	Y	0.8	16	3	0	N	50	40							
7/15/94	WWHEAT	1800		70	NONE	HARVEST	N	0	0	0	0	Y	100	100							

REVISED WIND EROSION EQUATION

Client: HORSEHH Weather File: P2WA9293.W1
Man. File:HORSEHH.MAN

Soil Field EF: 0.51 SCF: 0.6024
DOABLE SCREEN

Date Start	Vegetation	Operation/Event	Barrier	K'	K''	V	Period Erosion
07/15/1992	R_WWheat	HARVEST	No	1.00	1.00		0.0
09/01/1992	R_WWheat	SWEEPS_2	No	0.15	0.21	0.06	0.0
04/10/1993	R_WWheat	FERT_L	No	0.33	0.33	0.13	0.0
05/21/1993	R_WWheat	CULT_30	No	0.16	0.17	0.17	0.0
05/22/1993	R_WWheat	ROD_PLA	No	0.33	0.33	0.27	0.0
06/01/1993	R_WWheat	FERT_L	No	0.34	0.34	0.43	0.0
06/15/1993	R_WWheat	ROD_PLA	No	0.34	0.34	0.61	0.0
08/01/1993	R_WWheat	ROD_PLA	No	0.33	0.33	0.70	0.0
08/30/1993	G_WWheat	DRILL_HO	No	0.05	0.11	0.88	0.0
07/15/1994	R_WWheat	HARVEST	No	0.20	0.21	0.00	0.0

Total Erosion (t/ac): 0.0

RWEQ 97

Press F1 Key Twice to View HELP on SPECIAL FUNCTION KEYS

Accept or enter the operation date (MM/DD/YEAR)

4.3.5 **Cotton**

This system of cotton at Kennett, Missouri was provided by Phil Gurley, NRCS, Kennett, Missouri. This is the "Boot Heel" region of extreme Southeast Missouri. The fields are relatively flat but may have trees on the boundaries. In this system, the winter wheat is used as a cover crop and is not harvested. Tillage terminology (hipped and doall) are not common to West Texas; therefore, values for soil ridges and random roughness have been assumed.

Most of the erosion occurs at cotton planting. Experience and measurements agree that February, March and April are the critical months. The total erosion is 0.6 t/ac/yr. This is minimal, but if excessive winds occur during the critical period, such as the period immediately before cotton planting, erosion can be much greater. While infrequent, severe dust storms do occur filling road ditches and closing highways.

This region is ideally suited for windbarriers or cover crops. Soil roughening is not effective because of the numerous rainfall events. Residue management is possible, but high residue crops would need to be a part of the system. From these data, wind erosion is not a problem except in those years with a unique combination of high winds at cotton planting time.

Weather file: **KM93.W1**

```
# 13814 USA AR BLYTHEVILLE MODIFIED FOR KENNETT DEC 92 THRU JUN 93
  35 58 N 89 57 W 80 19600501 19701231 AGA  280 106
   5.24  4.22  5.63  6.15  4.31  3.54  3.45  1.72  3.14  3.90  4.49  4.90
   2.59  2.35  1.98  1.95  1.87  1.56  1.60  1.14  1.64  2.00  2.11  1.88
   1.28  1.27  1.24  1.21  1.19  1.18  1.17  1.18  1.19  1.22  1.25  1.27
    180   180   202   202   180   180     0    45     0   180   180   180
    5.9   3.4   2.2   2.7   3.3   3.3   8.5   5.9   6.7   5.5   4.2   2.9
   0.54  0.57  0.73  0.95  0.83  0.89  0.79  0.79  0.79  0.77  0.84  0.71
   13.8  15.7   7.9  13.9  10.7  16.5  15.6  44.1  24.4  20.3  21.2  10.6
    5.8  10.1  13.2  18.9  26.3  31.2  35.5  33.9  26.8  21.0  13.4  10.5
   -0.3  -1.5   3.8   8.0  14.1  19.2  22.6  20.3  14.1   7.8   2.5   0.1
   -0.0   1.0   3.1   8.7  14.7  18.8  20.5  19.9  16.4   9.6   3.3   0.3
    102   261   300   359   471   492   600   476   386   296   198   204
    135   111   138 128.8  65.3 110.2  45.5  82.3    90    71  38.1   122
   10.2   9.1  10.5  16.0  18.0  13.0   4.0   6.0   7.1   6.5   3.0   9.3
    8.2   4.7   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   7.0
    143   285   381   225    97   709   368   667    50   285   100   333
    0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
  35 32 N 89 39 W 55.3 TN COVINGTON
```

RWEQ INPUT FORM

CLIENT: KENNMO WEATHER FILE: KM93.W1 MANAGEMENT FILE: KENNMO.MAN

Soil Properties:
soil texture _____ OR
sand 87.3 %
silt 9.7 %
organic matter 0.4 %
calcium carbonate 0.2 %
rock cover 0 %

Field Geometry:
shape circular or (rectangular)
area 80, acres
orientation 90, ° from north
length_N 1300, feet
slope gradient 0
slope length 0, feet

Longitude _____ Latitude _____ Elevation _____ Annual Rainfall _____

DATE	VEGETATION					OPERATION / EVENT								IRRIGATION			BARRIERS			
	Residue	Yield	% Cov.	# Stems	Growing Crop	Implement	Mod. Rough.	RR	Ridge Spac.	Ridge Ht.	Ridge Orient.	Kill Crop	% Flat	% Stand.	Amt.	Rate	# Days	Ht.	DI	Spac.	Orient.
10/15/91	COTTON	1250		0	NONE	HARVEST	N	0	0	0	0	Y	100	100							
11/1/91	COTTON	0		0	NONE	LISTER (HIPPED)	Y	1.0	38	10	0	N	20	0							
11/5/91	COTTON	0		0	WWHEAT	DRILL-DD (OVERSEEDED)	N	0	0	0	0	N	100	100							
4/1/92	COTTON	0		0	NONE	LISTER (DOALL)	Y	0.8	38	6	0	N	20	0							
4/30/92	COTTON	0		0	COTTON	PLAN_ROW	Y	0.2	38	4	0	N	90	50							
5/20/92	COTTON	0		0	COTTON	CULT-12	Y	0.3	38	3	0	N	75	50							
6/20/92	COTTON	0		0	COTTON	CULT-12	Y	0.3	38	1	0	N	75	50							
7/30/92	COTTON	0		0	COTTON	CULT-12	Y	0.3	38	1	0	N	75	50							
10/15/92	COTTON	0		0	NONE	HARVEST	N	0	0	0	0	Y	100	100							

REVISED WIND EROSION EQUATION

Client: KENNMO Weather File: KM93.W1
Man. File:KENNMO.MAN

Soil Field EF: 0.66 SCF: 0.9439
DOABLE SCREEN

Date Start	Vegetation	Operation/Event	Barrier	K'	K''	V	Period Erosion
10/15/1991	R_Cotton	HARVEST	No	1.00	1.00	0.09	0.0
11/01/1991	R_Cotton	LISTER	No	0.13	0.06	0.24	0.0
11/15/1991	G_WWheat	DRILL_DD	No	0.17	0.11	0.27	0.0
04/01/1992	R_Cotton	LISTER	No	0.21	0.19	0.24	0.2
04/30/1992	G_Cotton	PLAN_ROW	No	0.55	0.45	0.27	0.4
05/20/1992	G_Cotton	CULT_12	No	0.43	0.36	0.25	0.0
06/20/1992	G_Cotton	CULT_12	No	0.51	0.50	0.01	0.0
07/30/1992	G_Cotton	CULT_12	No	0.57	0.57		0.0
10/15/1992	R_Cotton	HARVEST	No	0.88	0.88	0.02	0.0

Total Erosion (t/ac): 0.6

RWEQ 97

Press F1 Key Twice to View HELP on SPECIAL FUNCTION KEYS

Accept or enter the operation date (MM/DD/YEAR)

4.3.6 **Winter wheat-sorghum-fallow**

This example is a winter wheat-sorghum-fallow system at Scott County, Kansas. This system is the same as used by NRCS in their training material for WEQ.

The critical period is between sorghum harvest and wheat planting. Total erosion from this three year rotation is 14.4 t/ac or an annual average of 4.8 t/ac/yr. The greatest opportunity to reduce erosion is between sorghum harvest and the first tillage operation the following April. Options may include chemical weed control, soil roughening with chiseling in March, using tillage that produces larger ridges and furrows, or possibly using windbarriers. The dominate wind direction during the erosion problem periods will determine if ridge tillage or barriers are an effective option. Only 9 tillage operations are performed in this three-year rotation. Planting and harvesting operations are not counted.

Weather file: **KS23065.DAT**

```
# 23065 USA KS GOODLAND
  39 22 N 101 42 W 1112 19500609 19640322 ARW  70 88
   6.15  6.43  7.35  7.34  6.93  6.88  6.17  6.02  6.34  6.17  6.40  6.24
   2.60  2.45  2.34  2.44  2.50  2.54  2.59  2.56  2.55  2.56  2.49  2.57
   1.15  1.13  1.12  1.10  1.07  1.05  1.04  1.05  1.07  1.09  1.12  1.14
    338   338   338   338   158   180   158   158   180   338   337   337
    3.3   3.8   3.4   3.6   2.3   2.4   2.1   2.9   3.2   3.6   3.6   4.4
   0.94  0.88  0.87  0.66  0.63  0.83  0.79  0.85  0.69  0.52  0.83  0.92
    2.4   2.8   2.6   2.2   2.5   2.4   3.7   3.5   3.3   2.9   3.1   3.1
    4.5   7.6  11.6  18.1  23.4  29.3  33.2  32.2  27.0  20.8  11.4   6.6
   -9.9  -7.3  -3.5   2.2   8.1  13.5  16.9  15.7  10.4   3.9  -3.4  -7.7
   -9.5  -6.3  -5.7  -0.4   6.3  11.9  14.1  13.5   8.1   1.9  -4.4  -7.6
    256   313   478   544   637   684   728   620   510   394   359   221
     12    14    37    43    87    89    71    49    39    30    19    12
    3.9   4.7   7.2   7.4   9.5   9.5   7.8   6.9   5.5   4.4   4.2   3.7
   22.9  26.2  10.4   0.0   0.0   0.0   0.0   0.0   0.0   0.0   6.7  17.6
      0     0    11    23   119   285   285   202   154    59    35    11
    0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
  39 46 N 101 22 W 52.9 KS MC DONALD C
```

RWEQ INPUT FORM

CLIENT: SCOTKS WEATHER FILE: W\KS23065.DAT MANAGEMENT FILE: SCOTKS.MAN

Soil Properties:
soil texture FINE SANDY LOAM OR
sand 64 %
silt 26 %
organic matter 0.5 %
calcium carbonate 3 %
rock cover 1 %

Field Geometry: shape circular or (rectangular)
area 160, acres
orientation 0, ° from north
length_N 2640, feet
slope gradient 0
slope length 0, feet

Longitude_____ Latitude_____ Elevation_____ Annual Rainfall_____

DATE	VEGETATION					OPERATION / EVENT								IRRIGATION			BARRIERS			
	Residue	Yield	% Cov.	# Stems	Growing Crop	Implement	Mod. Rough.	RR	Ridge Spac.	Ridge Ht.	Ridge Orient.	Kill Crop	% Flat	% Stand.	Amt.	Rate	# Days	Ht.	DI	Spac.	Orient.
6/15/91	WWHEAT	1800		100	NONE	HARVEST	N	0	0	0	0	Y	100	100							
4/1/92	WWHEAT	0		0	NONE	DISK-TAN	Y	0.8	12	1	0	N	50	70							
5/1/92	WWHEAT	0		0	NONE	CULT-30	Y	0.7	24	1	0	N	70	90							
5/14/92	WWHEAT	0		0	NONE	CULT-30	Y	0.7	24	1	0	N	70	90							
5/15/92	WWHEAT	0		0	SORGHUM	PLAN-ROW	Y	0.2	36	2	0	N	90	50							
10/15/92	SORGHUM	3900		10	NONE	HARVEST	N	0	0	0	0	Y	100	100							
4/1/93	SORGHUM	0		0	NONE	SWEEP-2	Y	0.6	36	2	0	N	85	45							
5/15/93	SORGHUM	0		0	NONE	SWEEP-2	Y	0.6	36	2	0	N	85	45							
7/15/93	SORGHUM	0		0	NONE	SWEEP-2	Y	0.6	36	2	0	N	85	45							
8/15/93	SORGHUM	0		0	NONE	SWEEP-2	Y	0.6	36	2	0	N	85	45							
9/10/93	SORGHUM	0		0	NONE	ROD-PLA	Y	0.4	0	0	0	N	90	50							
9/15/93	SORGHUM	0		0	WWHEAT	DRILL-HO	Y	0.8	14	2	0	N	50	40							
6/15/94	WWHEAT	1800		100	NONE	HARVEST	N	0	0	0	0	Y	100	100							

REVISED WIND EROSION EQUATION

Client: SCOTKS Weather File: w/KS23065.DAT
Man. File:SCOTKS.MAN

Soil Field EF: 0.51 SCF: 0.6024
DOABLE SCREEN

Date Start	Vegetation	Operation/Event	Barrier	K'	K''	V	Period Erosion
06/15/1991	R_WWheat	HARVEST	No	1.00	1.00		0.0
04/01/1992	R_WWheat	DISK_TAN	No	0.15	0.13	0.07	0.0
05/01/1992	R_WWheat	CULT_30	No	0.20	0.19	0.15	0.0
05/14/1992	R_WWheat	CULT_30	No	0.18	0.16	0.27	0.0
05/15/1992	G_Sorghu	PLAN_ROW	No	0.51	0.45	0.38	0.6
10/15/1992	R_Sorghu	HARVEST	No	0.83	0.82	0.22	0.5
04/01/1993	R_Sorghu	SWEEPS_2	No	0.21	0.16	0.34	7.0
05/15/1993	R_Sorghu	SWEEPS_2	No	0.22	0.19	0.49	1.6
07/15/1993	R_Sorghu	SWEEPS_2	No	0.23	0.20	0.70	2.5
08/15/1993	R_Sorghu	SWEEPS_2	No	0.22	0.18	0.90	0.8
09/10/1993	R_Sorghu	ROD_PLA	No	0.34	0.34	1.00	1.1
09/15/1993	G_WWheat	DRILL_HO	No	0.16	0.08	1.00	0.0
06/15/1994	R_WWheat	HARVEST	No	0.44	0.43	0.00	0.4

Total Erosion (t/ac): 14.4

RWEQ 97

Press F1 Key Twice to View HELP on SPECIAL FUNCTION KEYS

Accept or enter the operation date (MM/DD/YEAR)

4.3.7 **Winter wheat-fallow**

This dryland winter wheat-fallow system at Moses Lake, Washington was provided by Mike Klugland, NRCS, Washington. Using the WERIS weather file, there is no estimated erosion with this system. The crop yields are sufficient to produce excellent ground cover and standing silhouette. The very small *V* values are evidence that for normal conditions, wind erosion is not a problem in this region with this weather file.

Observations have shown that very fine dust is generated from some fields without any saltating movement (personal communication with Dr. Keith Saxton). The problem is modeling the infrequent but intense winds that are responsible for erosion in this region. From the three erosion measurement sites instrumented, there is good agreement between measured and estimated erosion. However, these estimates are made using measured wind and weather conditions. The weather conditions in the WERIS files may not include these infrequent but severe wind conditions.

Weather file: **WA24110.DAT**

```
# 24110 USA WA MOSES LAKE
  47 11 N 119 20 W 361 19570501 19660530 AGA  5 10
   3.78  4.02  4.64  4.97  4.58  4.50  4.24  4.16  4.14  3.73  3.82  3.70
   1.89  1.89  1.92  2.07  2.21  2.24  2.29  2.32  2.00  1.86  1.81  1.91
   1.25  1.23  1.21  1.19  1.17  1.15  1.14  1.15  1.17  1.20  1.23  1.24
      0     0   247   270   270   247   247   270     0   203   203   180
    6.4   1.8   1.3   2.3   3.3   1.7   1.9   3.3   2.6   4.9   1.9   2.9
   0.85  0.63  0.67  0.99  0.99  0.90  0.94  1.00  0.90  0.97  0.90  0.55
   31.8  28.6  17.8  14.5  18.0  17.3  20.7  23.2  27.3  31.9  32.5  35.5
    0.2   5.3  11.2  16.8  22.5  26.9  31.4  30.5  25.4  17.0   7.1   1.9
   -6.8  -2.9   0.0   3.8   8.8  13.0  16.5  15.8  11.0   4.6  -1.0  -4.7
   -8.6  -4.3  -3.0  -0.9   2.7   5.7   6.9   7.4   5.4   2.7  -1.0  -3.8
    132   210   382   556   698   727   825   671   470   280   157   100
     23    18    17    13    13    14     6     7     8    13    26    30
    8.9   7.1   6.0   4.7   5.1   4.2   2.0   2.7   3.4   5.2   8.6   9.9
   57.3   8.4   0.2   0.0   0.0   0.0   0.0   0.0   0.0   0.0  11.7  34.6
      0     0     2     7     8    14     7     7     8     8    13     5
    0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
  47 17 N 119 31 W 17.8 WA EPHRATA CAA AP P
```

RWEQ INPUT FORM

CLIENT: WASHWHEAT WEATHER FILE: W\WA24110.DAT MANAGEMENT FILE: WASHWHEA.MAN

Soil Properties:
soil texture SANDY LOAM OR sand 64 %; silt 26 %; organic matter 0.5 %; calcium carbonate 1 %; rock cover 0 %

Field Geometry: shape circular or (rectangular); area 160, acres; orientation 0, ° from north; length_N 2640, feet; slope gradient 0; slope length 0, feet

Longitude_____ Latitude_____ Elevation_____ Annual Rainfall_____

DATE	VEGETATION					OPERATION / EVENT								IRRIGATION			BARRIERS			
	Residue	Yield	% Cov.	# Stems	Growing Crop	Implement	Mod. Rough.	RR	Ridge Spac.	Ridge Ht.	Ridge Orient.	Kill Crop	% Flat	% Stand.	Amt.	Rate	# Days	Ht.	DI	Spac.	Orient.
8/1/91	WWHEAT	2500		100	NONE	HARVEST	N	0	0	0	0	Y	100	100							
9/1/91	WWHEAT	0		0	NONE	CHISEL-STR	Y	1.0	12	2	0	N	70	70							
3/1/92	WWHEAT	0		0	NONE	SWEEP-3	Y	0.5	36	2	0	N	90	45							
4/1/92	WWHEAT	0		0	NONE	ROD-PLA	Y	0.4	0	0	0	N	90	50							
5/20/92	WWHEAT	0		0	NONE	ROD-PLA	Y	0.4	0	0	0	N	90	50							
6/15/92	WWHEAT	0		0	NONE	ROD-PLA	Y	0.4	0	0	0	N	90	50							
7/30/92	WWHEAT	0		0	NONE	ROD-PLA	Y	0.4	0	0	0	N	90	50							
7/1/92	WWHEAT	0		0	WWHEAT	DRILL-HO	Y	0.8	16	4	0	N	50	40							
8/1/93	WWHEAT	2500		100	NONE	HARVEST	N	0	0	0	0	Y	100	100							

REVISED WIND EROSION EQUATION

Client: WASHWHEAT Weather File: W\WA24110.DAT
Man. File:WASHWHEA.MAN

Soil Field EF: 0.53 SCF: 0.6024
DOABLE SCREEN

Date Start	Vegetation	Operation/Event	Barrier	K'	K''	V	Period Erosion
08/01/1991	R_WWheat	HARVEST	No	1.00	1.00		0.0
09/01/1991	R_WWheat	CHI_STR	No	0.11	0.05		0.0
03/01/1992	R_WWheat	SWEEPS_3	No	0.19	0.25	0.01	0.0
04/01/1992	R_WWheat	ROD_PLA	No	0.33	0.33	0.01	0.0
05/01/1992	R_WWheat	ROD_PLA	No	0.33	0.33	0.02	0.0
06/15/1992	R_WWheat	ROD_PLA	No	0.34	0.34	0.03	0.0
07/30/1992	R_WWheat	ROD_PLA	No	0.33	0.33	0.04	0.0
09/01/1992	G_WWheat	DRILL_HO	No	0.14	0.03	0.17	0.0
08/01/1993	R_WWheat	HARVEST	No	0.14	0.22	0.00	0.0

Total Erosion (t/ac): 0.0

RWEQ 97

Press F1 Key Twice to View HELP on SPECIAL FUNCTION KEYS

Accept or enter the operation date (MM/DD/YEAR)

4.3.8 **Winter wheat-sunflower-fallow**

A three year rotation of winter wheat-sunflowers-fallow in Northeast Colorado was provided by Richard Fryrear, a farmer (B.Sci., Chemical Engineering, Colorado School of Mines) from Haxtun, Colorado. With this system the total erosion is 1.5 t/ac, and the average erosion is 0.5 t/ac/yr. This is little erosion for the sandy loam soils of this region.

Farmers comment that they see some erosion in the spring after the sunflowers are harvested. With this system there is considerable carry over of the flat wheat residue. When supplemented with the sunflower stalks, the *V* value is 0.13 which is very effective in controlling wind erosion.

This system would be very effective in controlling wind erosion unless there is a crop failure due to drought, a severe hail that destroys the surface residue, or winter temperatures that damage the winter wheat.

NOTE: There are no plant canopy coefficients for sunflowers; therefore, cotton is used for the planted crop in June, 1992 in this example.

Weather file: **CO24015.DAT**

```
# 24015 USA CO AKRON
  40 07 N 103 10 W 1399 19480101 19541231 ARF  60 64
   6.98  7.11  7.97  7.74  7.23  6.69  6.61  6.38  6.78  6.61  7.41  7.31
   2.56  2.44  2.32  2.36  2.40  2.37  2.43  2.41  2.34  2.44  2.49  2.51
   1.11  1.10  1.09  1.06  1.05  1.02  1.01  1.02  1.03  1.06  1.09  1.10
    315   338   315   338   338   338   158   158   158   338   337   315
    2.9   3.4   3.8   4.1   3.7   2.6   1.9   1.7   2.6   3.1   5.8   3.1
   0.95  0.93  0.93  0.63  0.50  0.60  0.71  0.59  0.69  0.63  0.95  0.96
    3.1   3.1   2.7   2.5   3.7   3.9   3.5   4.1   4.3   4.6   3.0   2.9
    3.7   6.3   9.5  15.8  21.1  27.2  31.4  30.5  25.5  19.0   9.9   5.3
  -10.6  -8.3  -5.4   0.1   5.7  11.0  14.7  13.8   8.5   2.2  -5.0  -8.9
  -10.9  -8.4  -7.5  -3.1   3.0   7.5  10.1   9.4   4.2  -1.4  -6.6  -9.2
    261   315   509   568   612   671   696   589   517   402   393   234
      9     7    25    33    78    67    70    46    32    21    14    10
    4.5   4.1   7.5   7.3  10.9   9.7   9.6   7.8   5.5   4.6   4.3   3.8
   31.3  24.2  10.5   0.0   0.0   0.0   0.0   0.0   0.0   0.0   3.8  18.6
      0     7    68    71    29    37   115   297   209    83    81    19
    0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
  40 6 N 103 9 W 2.3 CO AKRON CAA AP
```

RWEQ INPUT FORM

CLIENT: WHSUNFAL WEATHER FILE: W\CO24015.DAT MANAGEMENT FILE: WHSUNFAL.MAN

Soil Properties:
soil texture SANDY LOAM OR sand 64 %
silt 26 %
organic matter 0.5 %
calcium carbonate 3 %
rock cover 0 %

Field Geometry: shape circular or (rectangular)
area 160, acres
orientation 0, ° from north
length_N 2640, feet
slope gradient 0
slope length 0, feet

Longitude_____ Latitude_____ Elevation_____ Annual Rainfall_____

DATE	VEGETATION					OPERATION / EVENT									IRRIGATION			BARRIERS			
	Residue	Yield	% Cov.	# Stems	Growing Crop	Implement	Mod. Rough.	RR	Ridge Spac.	Ridge Ht.	Ridge Orient.	Kill Crop	% Flat	% Stand.	Amt.	Rate	# Days	Ht.	DI	Spac.	Orient.
9/10/90	NONE	0		0	WWHEAT	DRILL-HO	Y	0.8	14	2	0	N	50	40							
7/1/91	WWHEAT	2640		150	NONE	HARVEST	N	0	0	0	0	Y	100	90							
4/15/92	WWHEAT	0		0	NONE	DISK-OS	Y	1.9	0	0	0	N	50	15							
5/1/92	WWHEAT	0		0	NONE	CHISEL-STR	Y	1.2	12	2	0	N	70	70							
6/1/92	WWHEAT	0		0	SUNFLOW	PLAN-ROW	Y	0.2	36	2	0	N	90	50							
10/1/92	SUNFLOWER	800		6	NONE	HARVEST	N	0	0	0	0	Y	100	100							
5/15/93	SUNFLOWER	0		0	NONE	DISK-OS	Y	1.9	0	0	0	N	50	15							
6/15/93	SUNFLOWER	0		0	NONE	CHISEL-STR	Y	1.2	12	2	0	N	70	70							
9/10/93	SUNFLOWER	0		0	WWHEAT	DRILL-HO	Y	0.8	14	2	0	N	50	40							

REVISED WIND EROSION EQUATION

Client: WHSUNFAL Weather File: W/CO24015.DAT
Man. File:WHSUNFAL.MAN

Soil Field EF: 0.51 SCF: 0.6024
DOABLE SCREEN

Date Start	Vegetation	Operation/Event	Barrier	K'	K''	V	Period Erosion
09/10/1990	G_WWheat	DRILL_HO	No	0.18	0.14	0.95	0.0
07/01/1991	R_WWheat	HARVEST	No	0.40	0.38	0.00	0.9
04/15/1992	R_WWheat	DISK_OS	No	0.03	0.03	0.04	0.0
05/01/1992	R_WWheat	CHI_STR	No	0.06	0.04	0.09	0.0
06/01/1992	G_Cotton	PLAN_ROW	No	0.50	0.43	0.15	0.3
10/01/1992	R_Sunflower	HARVEST	No	0.74	0.72	0.00	0.0
05/15/1993	R_Sunflower	DISK_OS	No	0.03	0.03	0.05	0.0
06/15/1993	R_Sunflower	CHI_STR	No	0.08	0.05	0.09	0.0

Total Erosion (t/ac): 1.5

RWEQ 97

Press F1 Key Twice to View HELP on SPECIAL FUNCTION KEYS

Accept or enter the operation date (MM/DD/YEAR)