

TECHNICAL NOTES

U.S. DEPARTMENT OF AGRICULTURE

NEVADA

SOIL CONSERVATION SERVICE

TN AGRONOMY-NV-15 (Revised)

December 1976

SOIL CONDITIONING RATINGS

This Soil Conditioning Rating Index covers the major crops grown in Nevada under irrigation. It is an excerpt from WTSC, Conservation Agronomy TN No. 27, 1974. The values are relative one to another and can be adjusted to fit local conditions based on the best available research information, supplemented by local observations and farmer experience. Locally adjusted figures should be entered in the column which is left blank on the right hand side of the table.

Soil conditioning ratings are comparative plus (+) or minus (-) values assigned to crops and soil treatments which will give their relative soil-improving (+) or soil-deteriorating (-) effect for any specific crop combination (rotation) in a specific conservation cropping system. Index ratings assigned plus (+) or minus (-) values should reflect the degree to which each crop and soil treatment used in producing the crop affects soil tilth and organic matter, either favorably or adversely, in a particular conservation cropping system.

In arriving at a rating for any given crop combination (rotation) in a conservation cropping system, the algebraic sum of the values assigned to each crop including the residues returned from the crop, along with the animal manure and/or other applied organic material and fertilizer, will give the relative soil-improving (+) or soil-deteriorating (-) effect on a particular soil. The allowable amount of commercial or mineral plant food applied should be calculated separately. (See attached example).

Also attached are examples of how to evaluate a specific crop combination (rotation) for crops grown under irrigation.

This system does not rate the erosion effectiveness for any crop combination. This must be determined by field evaluations which are made locally.

The system described above is a modification of a similar system developed first by the research work of R. M. Salter and T. C. Green in Ohio (1). From this basic research, Salter, Lewis, and Slipper (2) prepared a "Productivity Index" for the important crops in Ohio. It was published in 1936 and later in 1941. Klemme and Coleman (3), working in Missouri, published a similar productivity rating for individual crops grown in Missouri. The first of these ratings was published in 1939 and revised and published again in 1949. For a brief summary of this work, see Agronomy Technical Note No. 13, prepared by Wayne W. Austin, Washington-Field Agronomist (Western), Berkeley, California, April 15, 1960.

REFERENCES

- (1) AUSTIN, WAYNE W. SOIL PRODUCTIVITY INDEX. Soil Conservation Service, U. S. Department of Agriculture, Technical Note Agronomy No. 13 (Western States), April 15, 1960.
- (2) BEAR, FIRMAN E. SOILS AND FERTILIZERS. 4th Edition, 1953. John Wiley and Sons. New York, N. Y. Pages 192, 193 and 194.
- (3) COOK, R. L. SOIL MANAGEMENT FOR CONSERVATION AND PRODUCTION. John Wiley and Sons. New York, N. Y. 1962.
- (4) KLEMME, A. E., and COLEMAN, O. T. EVALUATING ANNUAL CHANGES IN SOIL PRODUCTIVITY. Missouri Agricultural Experiment Station Bulletin No. 405, 1939, and Bulletin No. 522, 1949.
- (5) SALTER, R. M.; LEWIS, R. D.; and SLIPHER, J. A. OUR HERITAGE - THE SOIL. Ohio State University, Agricultural Extension Service Bulletin No. 175, 1936, 3rd Edition, 1941.
- (6) SALTER, R. M. and GREEN, T. C. FACTORS AFFECTING THE ACCUMULATION AND LOSS OF NITROGEN AND ORGANIC CARBON ON CROPPED SOILS. Journal of The American Society of Agronomy 25: 622-630, 1933.

SOIL CONDITIONING RATING INDICES
FOR
MAJOR IRRIGATED CROPS IN THE WESTERN STATES

<u>A. Crop and Residue Use</u>	<u>Rating*</u>	<u>Adjusted Local Rating*</u>
1. <u>ALFALFA-GRASS</u> (hay, silage or green chop)		
Establishment period <u>1/</u>		
(a) New seeding without companion crop	0.00	
(b) Grain, new seeding, straw removed	-1.00	
(c) Alfalfa-grass w/companion crop, latter removed	-0.50	

1st year forage production	+1.50	<u>2/</u>
2nd year forage production	+3.00	<u>2/</u>
3rd year forage production	+4.00	<u>2/</u>
4th year forage production	+4.50	<u>2/</u>
5th year forage production	+4.75	<u>2/</u>
6th year forage production	+5.00	<u>2/</u>
7th year forage production	+5.25	<u>2/</u>
8th year forage production	+5.50	<u>2/</u>

For additional years in sod, add 0 0.20 for each year.
Rating index figure is accumulative.

2. <u>ALFALFA</u> - (alone) (hay, silage or green chop)		
Establishment period <u>1/</u>		
(a) New seeding without companion crop	0.00	
(b) Grain, new seeding, straw removed	-1.00	
(c) Alfalfa-grass w/companion crop, latter removed	-0.50	

1st year forage production	+1.00	<u>2/</u>
2nd year forage production	+2.50	<u>2/</u>
3rd year forage production	+3.00	<u>2/</u>
4th year forage production	+3.50	<u>2/</u>
5th year forage production	+3.75	<u>2/</u>
6th year forage production	+4.00	<u>2/</u>
7th year forage production	+3.80	<u>2/</u>
8th year forage production	+3.50	<u>2/</u>

For each additional year in alfalfa beyond 8 years, subtract 2/10 for each year. Rating index figure is accumulative.

Last crop plowed under.

1/ The value for the Establishment period is in addition to the value for the years in forage production.

2/ These are accumulative to-date values and not including the establishment periods.

*Includes the minimum number of cultural operations required in growing the crop.

A. Crop and Residue Use (continued)

	<u>Rating*</u>	<u>Adjusted Local Rating*</u>
3. <u>PASTURE</u> (perennial grass-legume)		
Establishment period 1/		
(a) New seeding without companion crop	0.00	
(b) Small grain, new seeding, straw removed	-1.00	
(c) Grass-legume w/companion crop, latter removed	-0.50	

1st year forage production	+1.50	2/
2nd year forage production	+3.00	2/
3rd year forage production	+4.00	2/
4th year forage production	+4.75	2/
5th year forage production	+5.25	2/
6th year forage production	+5.50	2/
7th year forage production	+5.75	2/
8th year forage production	+6.00	2/

For each additional year, add 1/10 of a point. Rating index figure is accumulative.

- 1/ The value for the Establishment period is in addition to the value for the years in forage production.
- 2/ These are accumulative to-date values and not included in the establishment year or years.

4. <u>PASTURE</u> (annual or biennial)	
(a) <u>Grass-legume</u> (rye grass and vetch)	+1.50
(b) <u>Small grain</u>	+0.50
(c) <u>Sudan grass</u>	+0.50
(d) <u>Sweet clover and grass</u> (2 years)	+2.00

5. <u>GRASS FOR SEED PRODUCTION</u>	
1st year of establishment	-1.00

1st seed year, residues removed	+1.00
2nd seed year, residues removed	+2.50
3rd seed year, residues removed	+3.00
4th seed year, residues removed	+3.25

Last seed year, add +0.60 per ton residues returned.

- 1/ The value for the Establishment period is in addition to the value for the years in forage production.

*Includes the minimum number of cultural operations required in growing the crop.

A. Crop and Residue Use (continued)

	<u>Rating*</u>	<u>Adjusted Local Rating*</u>
6. <u>LEGUME</u> (perennial, for seed production), in rows		
Period of establishment 1/	-1.00	

1st year seed production, residue removed	+1.00	
2nd year seed production, residue removed	+2.00	
3rd year seed production, residue removed	+2.50	
4th year seed production, residue removed	+2.75	
5th year seed production, residue removed	+3.00	

7. <u>LEGUME</u> (biennial for seed production), solid seeding		
Period of establishment, with small grain, companion crop, residue removed	-1.00	

1st year seed production, residues removed 2/	+1.00	
2nd year volunteer seed production, residues removed	+1.50	

8. <u>COVER CROP</u> - later used as a green manure crop		
(a) Small grain 2/ seedbed preparation	-1.00	
(b) Legumes 2/ (annual) seedbed preparation	-0.50	
(c) Grass-legume 2/ (annual) seedbed preparation	-0.50	
(d) Grass (annual) 2/ seedbed preparation	-0.50	
(e) Volunteer (annual) 2/ no seedbed preparation.	+0.00	
9. <u>A. FORAGE CROPS</u> (annual) all tops removed		
(a) <u>Small Grain</u> - (cut for hay or silage)	-1.00	
(b) <u>Small Grain</u> and <u>annual legume</u> (cut for hay or silage)	-1.00	
(c) <u>Sudan grass</u> drilled (cut for hay or silage)	-1.00	
(d) <u>Annual grass-legume</u> (cut for hay or silage)	-0.50	
(e) <u>Sorghum</u> , sweet stalk-cultivated rows (silage)	-1.50	
<u>B. FORAGE CROPS</u> (Biennial Legumes)		
Establishment period 1/		
(a) New seeding w/companion crop, latter removed	-1.00	
(b) New seeding without a companion crop	+0.00	
(c) Production year for silage, green chop	+1.00	

1/ The value for the Establishment period is in addition to the value for the years in forage production.

2/ Add +0.60 for each ton of crop residue returned to the soil.

*Includes the minimum number of cultural operations required in growing the crop.

A. Crop and Residue Use (continued)

	<u>Rating*</u>	<u>Adjusted Local Rating*</u>
9. <u>C. FORAGE CROPS</u> (perennial legumes except alfalfa for use as hay, silage or green chop)		
Establishment period ^{1/}		
(a) New seeding without companion crop	+0.00	
(b) New seeding, w/companion crop, latter removed	-0.50	
(c) Preparatory crop only such as small grain and Sudan grass, residue removed	-1.00	

1st year forage production	+0.50 ^{2/}	
2nd year forage production	+1.25 ^{2/}	
3rd year forage production	+2.25 ^{2/}	
4th year forage production	+3.00 ^{2/}	
5th year forage production	+3.50 ^{2/}	
6th year forage production	+3.25 ^{2/}	
7th year forage production	+2.75 ^{2/}	

9. <u>D. FORAGE CROPS</u> (Perennial grasses and legumes except alfalfa for use as hay, silage or green chop)		
Establishment period ^{1/}		
(a) New seeding without companion crop	0.00	
(b) New seeding w/companion crop, latter removed	-0.50	
(c) Preparatory crop only such as small grain and Sudan grass, residue removed	-1.00	

1st year forage production	+1.00 ^{2/}	
2nd year forage production	+2.25 ^{2/}	
3rd year forage production	+3.25 ^{2/}	
4th year forage production	+4.00 ^{2/}	
5th year forage production	+4.50 ^{2/}	
6th year forage production	+4.75 ^{2/}	
7th year forage production	+5.00 ^{2/}	

10. <u>GREEN MANURE CROP</u>		
(a) <u>Biennial sweetclover</u> (second year crop ret'd) or second year alfalfa ^{2/}	+1.00	
(b) <u>Annual legumes</u> ^{2/} (such as peas, vetch, Sesbania, horsebeans, hubam sweetclover)	+0.50	
(c) <u>Sorghum</u> or <u>corn</u> ^{2/}	-1.50	
(d) <u>Small grain</u> ^{2/}	-1.00	
(e) <u>Volunteer annuals</u> (all of the plants returned to the soil) ^{2/}	+0.00	
(f) <u>Sudan grass</u> , drilled	-1.00	

^{1/} The value for the Establishment period is in addition to the value for the years in forage production.

^{2/} Add +0.60 for each ton of crop residue returned to the soil.

*Includes the minimum number of cultural operations required in growing the crop.

A. Crop and Residue Use (continued)

	<u>Rating*</u>	<u>Adjusted Local Rating*</u>
11. <u>ARTICHOKES</u> (in rows, cultivated) all residues removed <u>2/</u>	-1.50	
12. <u>BEANS AND PEAS</u> (dry, planted in rows and cultivated) all tops removed <u>2/</u>	-1.50	
13. <u>CASTOR BEANS</u> (planted in rows and cultivated) all tops removed <u>2/</u>	-1.50	
14. <u>CORN</u> (cultivated, in rows)		
(a) <u>Grain</u> (stalks removed) <u>2/</u>	-1.50	
(b) <u>Grain</u> (stalks grazed) Take 80% of value of residue produced <u>2/</u>	-1.50	
(c) <u>Silage</u> (all stalks removed)	-1.50	
(d) <u>Sweet corn</u> (all stalks removed)	-1.50	
(e) <u>Sweet corn</u> (stalks grazed) Take 80% of value of residue produced	-1.50	
15. <u>COTTON</u> (rows cultivated) all residues removed) <u>2/</u>	-2.00	
16. <u>FLAX</u> (drilled) all residues removed <u>2/</u>	-1.00	
17. <u>LENTILS</u> - dry, (drilled) all residues removed <u>2/</u>	-1.25	
18. <u>PEAS</u> - dry, (drilled) all residues removed <u>2/</u>	-1.25	
19. <u>PEAS</u> - green (drilled) all residues removed <u>2/</u>	-1.25	
20. <u>POTATOES</u> (rows cultivated) all residues removed <u>2/</u>	-2.50	
21. <u>SMALL GRAIN FOR GRAIN</u> (drilled) Small grain, all straw removed <u>2/</u>	-1.00	

2/ Add +0.60 for each ton of crop residue returned to the soil.

*Includes the minimum number of cultural operations required in growing the crop.

A. Crop and Residue Use (continued)

	<u>Rating*</u>	<u>Adjusted Local Rating*</u>
22. <u>SUGAR BEETS</u> (rows cultivated)		
(a) Tops removed 2/	-2.00	
(b) Tops grazed when field is dry (Take 80% of the total residues produced)	-2.25	
(c) Tops grazed when field is wet (Take 80% of the total residues produced)	-2.50	
23. <u>SAFFLOWER</u>		
(a) Planted in rows and cultivated, all residues removed 2/	-1.50	
(b) Solid planted, all residues removed 2/	-1.00	
24. <u>SORGHUM</u> for grain		
(a) Planted in rows, cultivated, all residues removed 2/	-1.50	
(b) Solid seeded, not cultivated, all residues removed 2/	-1.00	
25. <u>VEGETABLE CROPS</u> , cultivated in rows		
(a) <u>Non-root</u> crops such as broccoli, cabbage, lettuce, melons, celery, tomatoes, cauliflower planted in rows, cultivated, (all residues removed) 2/	-1.50	
(b) <u>Root crops</u> such as table beets, radishes, carrots, (all residues removed) 2/	-2.00	
26. <u>ASPARAGUS</u> , planted in rows, cultivated, all tops removed 2/	-1.50	
27. <u>STRAWBERRIES</u> , planted in rows, cultivated 2/		
(a) First year of establishment	-1.50	
(b) Established stand	-1.00	
28. <u>SUGAR BEETS</u> for seed, in rows, cultivated, all residues removed 2/	-1.50	
29. <u>VEGETABLE AND FLOWER SEED PRODUCTION</u> , in rows, cultivated, all residues removed. 2/	-1.50	

2/ Add +0.60 for each ton of crop residue returned to the soil.

* Includes the minimum number of cultural operations required in growing the crop.

A. Crop and Residue Use (continued)

	<u>Rating*</u>	<u>Adjusted Local Rating*</u>
30. <u>ORCHARD CROPS</u> , clean cultivated, minimum tilled, all prunings removed. 2/ When volunteer annuals are allowed to grow this rating value becomes 0.00	-1.50	
31. <u>ORCHARD CROPS</u> , weed free non-tillage (chemical weed control, all prunings removed.) When additional mulch is applied, see C1 for additional credit.	0.00	
32. <u>ORCHARD CROPS</u> , seeded annual green manure crop. Rotary mowed and minimum tilled, all prunings removed. 2/ When volunteer annuals are allowed to grow, this becomes 0.00 When mulch is added, refer to C1 for additional credit.	+0.50	
33. <u>ORCHARD CROPS</u> , well established perennial sod crop, mowed, all prunings removed.	+6.00	
34. <u>VINE AND BERRY CROPS</u> (bramble or cane,) clean cultivated, all prunings removed, minimum tilled. 2/ When volunteer annuals are allowed to grow, this becomes 0.00 When mulch is added, refer to C1 for additional credit.	-1.50	
35. <u>VINE AND BERRY CROPS</u> (bramble or cane,) seeded annual cover-green manure crop. Rotary mowed and minimum tilled, all prunings removed. 2/	+0.50	
36. <u>VINE AND BERRY CROPS</u> (bramble or cane,) all prunings removed. Weed free non-tillage (chemical weed control.) When organic materials are applied as mulch, see C1 for additional credit.	+0.00	
37. <u>VINE AND BERRY CROPS</u> , well established, all prunings removed. Perennial sod mowed.	+6.00	
2/ Add +0.60 for each ton of crop residue returned to the soil.		

*Includes the minimum number of cultural operations required in growing the crop.

B. Animal Manures

	<u>Rating*</u>	<u>Adjusted Local Rating*</u>
1. <u>MANURE</u>		
(a) For each 1 ton of air dry cow manure, well cared for	+0.70	
(b) For each 1 ton of air dry sheep manure, well cared for	+0.80	
(c) For each 1 ton of air dry poultry manure, well cared for	+1.00	
Air dry weight calculated at a moisture content of not more than 10%.		

C. Organic Materials

1. <u>MULCH</u> (applied)		
For each <u>ton</u> of air dry organic mulch material applied, such as wood chips, sawdust, straw or other plant residues properly balanced with Nitrogen. (Not to exceed a total of more than +2.00 may be credited annually but can be credited as long as it is effective.) Air dry weight calculated at an average moisture content of not more than 10%.	+0.60	
Example: 2 tons of wood chips + 40 lbs of actual N = +1.20 (Note the Nitrogen is not creditable in this case.)	+1.20	

D. Plant Food Elements

1. <u>FERTILIZER</u> (commercial) - only needed elements will qualify. Ratings are based on actual pounds of plant food elements applied. <u>Up to 200 pounds of elemental plant nutrients can be credited annually.</u>		
(a) Nitrogen per pound of elemental N.	+0.005	
(b) Phosphorus per pound of elemental P. <u>5/</u>	+0.005	
(c) Potassium per pound of elemental K. <u>6/</u>	+0.005	
(d) Sulphur per pound of elemental S.	+0.008	
(e) Other minor elements per pound of each mineral element in pure form, such as Zn, Cu, and mg.	0.010	

5/ Conversion P_2O_5 to P, ($P_2O_5 \times 0.44 =$ amount of elemental P)

6/ Conversion K_2O to K, ($K_2O \times 0.83 =$ amount of elemental K)

*Includes the minimum number of cultural operations required in growing the crop.

E. Soil Treatments

1. TILLAGE (Fallow or clean cultivation in orchard and vineyards.)

Where irrigated land is not cropped for some reason such as lack of irrigation water or to control undesirable weeds, or insect pests, and is fallowed for a season or crop year, use the table below to calculate the minus (-) rating for each year of fallow as it may occur in the cropping sequence.

(a) Tillage Operations

1. Moldboard plowing	-0.50
2. Disc plowing	-0.60
3. Heavy tandem disc, offset (Goble or Towner)	-0.70
4. Sweeping (heavy sweep, 8-12 in. deep)	-0.40
5. Chiseling up to 16 inches deep	-0.45
6. Light tandem discing	-0.50
7. Heavy duty springtoothing	-0.33
8. Duckfoot cultivating 4-8 in. deep	-0.33
9. Cultivating for weed control, 3-4 in. deep.	-0.25
10. Spiketooth harrow	-0.25
11. Packing (land roller, cultipacker or or till and pack)	-0.10
12. Subsoiling deep - 16 inches and deeper - 3 to 6 ft. apart	-0.75

WORK SHEET FOR ESTIMATING
SOIL CONDITIONING RATINGS ON IRRIGATED LAND

Crop Rotation (Crop combination or Sequence) (Irrigated)	Crop Residues Returned and Fertilizers	Rating Index	Calculations	Rating Value
Alfalfa: 3 years forage production Last crop Green manure	2000 lbs.	+0.60	3 yrs. (accumulative) = +3.00 1 X +0.60 = +0.60	+3.60
Cotton: 3 years 2.5 bales each year	4000 lbs. each year	-2.00 +0.60	3 X -2.00 = -6.00 3 X +1.2 = +3.60	-2.40
Barley 1 year grain (Straw baled off) Alfalfa drilled in stubble		-1.00	1 X -1.00 = -1.00	-1.00
Fertilizer Applied	Amount of Fertilizer Applied			
1st year alfalfa	90# P ₂ O ₅ X .44 = 39.6	+0.005	39.6 X +0.005 = +0.20	+0.20
1st year cotton	75# N	+0.005	75 X +0.005 = +0.38	+0.38
2nd & 3rd year cotton	115# N X 2 = 230#	+0.005	230 X +0.005 = 1.15	+1.15
Barley	75# N	+0.005	75 X +0.005 = +0.38	+0.48
	50# P ₂ O ₅ X .44 = 22	+0.005	22 X +0.005 = +0.10	+0.48
			Total for the 7-year rotation	+2.41

WORK SHEET FOR ESTIMATING
SOIL CONDITIONING RATINGS ON IRRIGATED LAND

Crop Rotation (Crop combination or Sequence (Irrigated)	Crop Residues Returned and Fertilizers	Rating Index	Calculations	Rating Value
Alfalfa-grass 4 years (Hay) production	None	+4.50	4 years accumulated = +4.50	+4.50
Corn for grain 1 year (8000 lbs stalks returned)	4 tons	-1.50 +0.60	1 X -1.50 = -1.50 4 X +0.60 = +2.40	+0.90
Potatoes 2 years (1000 lbs tops returned each year)	1 ton for 2 yrs	-2.50 +0.60	2 X -2.50 = -5.00 1 X +0.60 = +0.60 +4.40	+4.40
Sugar Beets 2 years (6000 lbs of tops returned each year)	6 tons of tops for two years	-2.00 +0.60	2 X -2.00 = -4.00 6 X +0.60 = +3.60	-0.40
Alfalfa-grass 1 year, seeded in spring without companion crop.	None	0.00		0.00
Barnyard Manure (cow)	4 tons air dry	+0.70	4 X +0.70 = +2.80	+2.80
Fertilizer Applied (mineral)	Amount applied			
1st year alfalfa-grass	90# P ₂ O ₅ X .44 = 39.6	+0.005	39.6 X +0.005 = +0.20	+0.20
3rd year alfalfa-grass	90# P ₂ O ₅ X .44 = 39.6	+0.005	39.6 X +0.005 = +0.20	+0.20
Corn 1 year	150 # N	+0.005	150 X +0.005 = +0.75	+0.75
Potatoes 2 years for N 1 year for P	150# X 2 = 300 45# P O X .44 = 19.8	+0.005 +0.005	300 X +0.005 = +1.50 19.8 X +0.005 = +0.10	+1.60
Sugar Beets 2 years for N 1 year for P	150# N X 2 = 300 90# P O X .44 = 39.6	+0.005 +0.005	300 X +0.005 = +1.50 39.6 X +0.005 = +0.20	+1.70
			Total for the 10- year Rotation	+7.85

WORK SHEET FOR ESTIMATING
SOIL CONDITIONING RATINGS ON IRRIGATED LAND

Crop Rotation (Crop combination or Sequence (Irrigated))	Crop Residues Returned and Fertilizers	Rating Index	Calculations	Rating Value
Barley companion crop Red clover drilled with barley. (Straw removed)	None	-1.00	$1 \times -1.00 = 1.00$	-1.00
Red Clover 1st seed year	2 tons	+1.00	$1 \times +1.00 = +1.00$	+1.00
Red Clover 2nd seed year-volunteer (all residues returned)		+1.50	$1 \times +1.50 = +1.50$	+2.70
Potatoes: 2 years ($\frac{1}{2}$ ton of tops plowed under per year)	1 ton for 2 years	+0.60	$2 \times +0.60 = +1.20$	+2.70
		-2.50	$2 \times -2.50 = -5.00$	-4.30
		+0.60	$1 \times +0.60 = +0.60$	-2.40
<u>Fertilizer Applied</u>	<u>Amount Applied</u>			
Red Clover 1st seed year.	90# P ₂ O ₅ X .44 = 39.6 40# Sulphur	+0.005	$39.6 \times +0.005 = +0.20$	+0.52
		+0.008	$40 \times +0.008 = +0.32$	
Potatoes 1st year	150# N 90# P ₂ O ₅ X .44 = 39.6	+0.005	$150 \times +0.005 = +0.75$	+0.95
		+0.005	$39.6 \times +0.005 = +0.20$	
Potatoes 2nd year	150#N 45# P ₂ O ₅ X .44 = 19.8	+0.005	$150 \times +0.005 = +0.75$	+0.85
		+0.005	$19.8 \times +0.005 = +0.10$	
			Total for the 5-year Rotation	+0.62