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TechLink Research Summary #3303

C Factors for Compost and Rolled Erosion Control Blankets

The C Factor or Cover Factor is one of 6 factors used in the Universal Soil Loss Equation (USLE), the Revised Universal Soil Loss Equation (RUSLE) or the latest version, RUSLE2. The C Factor indicates how an erosion control practice, erosion control product, or conservation plan will affect average annual soil loss. The Universal Soil Loss Equation was originally developed in 1965 by the USDA to help predict or estimate water soil erosion using site, soil, rainfall, and management factors. The RUSLE (currently the most widely used of the three) and RUSLE2 have revised the USLE to include water soil erosion from sites beyond agriculture, including construction activities. All equations use the same factors (it is the sub-factors and supporting database that have been revised) to predict soil loss:

$A = r\ k\ l\ s\ c\ p$

Where A equals predicted soil loss (mass/area) of interill (sheet flow) and rill (small gullies where interill deposits flow) erosion from detachment (rainfall impact) and transport (runoff flow) on hill slopes up to the point of a concentrated flow area (channels); r is the erosivity factor for a given region (range = 8 to 700), which is based on historic rainfall rate/intensity averages; k is the soil erodibility factor, which is based on soil characteristics including texture, structure, organic matter content, permeability, and runoff potential; l is the length of the slope; s is the steepness of the slope; c is the cover management factor; and p is the support practice factor, which is attributable to practices that slow runoff such as terraces and slope interruption devices or cause sediment deposition such as silt fence or FilterSoxxtm. Currently, product manufacturers have not tried to determine P Factors for their products for use with the RUSLE, however, this is not the case for C Factors.

The C Factor in the USLE only allowed for types of agricultural management practices (such as cover cropping), in RUSLE one can input a specific C Factor for a particular erosion control tool or product, such as hydraulic mulch or a single net straw mat (usually determined through product testing and reported by the manufacturer not the USDA or RUSLE modelers). In RUSLE2 one can no longer input a specific C Factor but is required to input characteristics (sub-factors for determining the C Factor) of the erosion control practice, tool, or product. This creates less potential bias from manufacturer testing and reporting, particularly since there is no standard test method for determining C Factors for erosion control products. RUSLE2 sub-factor inputs used to determine C Factors are: percent canopy coverage of soil, percent contact with soil surface, surface roughness, amount of cover applied (tons/ac) - which is used to determine thickness of blanket, decomposition rate of materials (how long will it last), and historic soil disturbance/tillage.

Although determining C Factors can be complicated, the erosion control industry (not USDA or RUSLE modelers) has greatly simplified the process to quickly and inexpensively evaluate their erosion control products so equation users (designers, engineers, architects) can readily and easily insert specific product C Factors into RUSLE. To do this, product manufacturers (and/or their third party testing labs) only determine the soil loss ratio of the specific erosion control product relative to a bare soil under the same test conditions. Therefore, the soil loss ratio is the total amount or mass of soil lost to water erosion from the erosion control product test plot area relative to a bare soil under the same soil type, rainfall, and slope conditions. The inverted soil loss ratio is the percent soil loss from the erosion control product relative to the bare soil (example: a straw blanket reduces soil loss by 80%, its soil loss ratio is 0.20, or reported as C Factor by most erosion control blanket manufacturers).

The Erosion Control Technology Council (ECTC) has approved this simplified method for determining and reporting C Factors. It includes a standard test slope of 3:1 (h:v), minimum test plot size of 8 ft w by 40 ft long, on six inches of compacted soil (testing sand, silt, and clay soils separately), with a designed storm of 2 in/hr for 20 min, 4 in/hr for 20 min, and 6 in/hr for 20 min for a total of 60 minutes or until catastrophic failure occurs (ECTC, 2003). In addition to the characteristics of the erosion control blanket that is being tested, a C Factor (or soil loss ratio) can be greatly influenced by: slope degree, slope length, rainfall intensity, duration of storm, soil texture, and soil organic content.

Product/Practice (reference)	C Factor	Influencing Factors
Hydraulic mulch + synthetic or fiber netting (ECTC, 2004)*	<0.10	5:1 slope; ECTC test method
Netless rolled erosion control blanket (bound by polymers or chemical adhesion) (ECTC, 2004)*	<0.10	4:1 slope; ECTC test method
Single net erosion control blanket (natural materials woven/mechanically bound) (ECTC, 2004)*	<0.15	3:1 slope; ECTC test method
Double net erosion control blanket (natural materials woven/mechanical bound between 2 layers) (ECTC, 2004)*	<0.20	2:1 slope; ECTC test method
Erosion control blanket/open weave textile (slow degrading, continuous weave double net ECB) (ECTC, 2004)*	<0.25	1.5:1 slope; ECTC test method
Turf reinforcement mat (permanent/nondegradable, 3- dimensional thickness, used in concentrated flows) (ECTC, 2004)*	None (usually tested for shear stress)	0.5:1 slope; ECTC test method
Straw blanket (Demars & Long, 1998) *	0.08	2:1 slope; natural rainfall (max. 1.6/24 hr); 10 ft x 35 ft test plot; on silty sand;
Straw blanket w/pam (Faucette, unpub)*	0.19	10:1 slope; 4 in/hr 1hr rainfall; 3 ft x 16 ft test plot; clay subsoil; 2 in blanket
Mulch blanket (Demars & Long, 1998)*	0.075	2:1 slope; natural rainfall (max. 1.6/24 hr); 10 ft x 35 ft test plot; on silty sand; 3 in blanket
Mulch Fines (Faucette et al, 2004)*	0.16	10:1 slope; 3.2 in/hr 1 hr rainfall; 3 ft x 3 ft test plot; clay subsoil; 1.5 in blanket
Mulch Overs (Faucette et al, 2004)*	0.11	10:1 slope; 3.2 in/hr 1 hr rainfall; 3 ft x 3 ft test plot; clay subsoil; 1.5 in blanket
Wood chips @ 7 tons/ac (GA SWCC, 2000)*	0.08	
Wood chips @ 12 tons/ac (GA SWCC, 2000)*	0.05	
Wood chips @ 25 tons/ac (GA SWCC, 2000)*	0.02	
Compost blanket (Demars, 1998)*	0.05	2:1 slope; natural rainfall (max. 1.6/24 hr); 10 ft x 35 ft test plot; on silt sand; 3 in blanket
Compost Blanket (Demars et al, 2000)*	0.02	2:1 slope; natural rainfall, 10 ft x 35 ft test plot; on silty sand; 3 in blanket
Compost Blanket (Faucette et al, 2005)*	0.01	10:1 slope; 3.2 in/hr 1 hr rainfall; 3 ft x 16 ft test plot; clay subsoil; 1.5 in blanket
Compost Overs (Faucette, unpub)*	0.01	10:1 slope; 4 in/hr 1hr rainfall; 3 ft x 16 ft test plot; clay subsoil; 1.5 in blanket
Compost Fines (Faucette, unpub)*	0.065	10:1 slope; 4 in/hr 1hr rainfall; 3 ft x 16 ft test plot; clay subsoil; 1.5 in blanket
Compost Fines w/ biopolymer (Faucette, unpub)*	0.03	10:1 slope; 4 in/hr 1hr rainfall; 3 ft x 16 ft test plot; clay subsoil; 1.5 in blanket
Forest duff layer (GA SWCC, 2000)*	0.001-0.0001	

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