Review of RUSLE2 Management Scenarios for the Chesapeake Bay Program's Phase 6 Watershed Model

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The following is the result of a review funded by the Scientific and Technical Advisory Committee (STAC) to support the recommendation of the STAC Nutrient Inputs review (Yagow et al. 2016)* that the RUSLE2 (Revised Universal Soil Loss Equation, Version 2) sub-factors be reviewed by an outside expert. The report was funded by STAC to facilitate a timely review and to promote further discussion on procedures that consistently and equitably evaluate RUSLE2 sub-factors among states, as used for development of the Phase 6 Watershed Model.

The enclosed material represents the professional recommendations and expert opinion of individual(s) undertaking a workshop, review, forum, conference, or other activity on a topic or theme that STAC considered an important issue to the goals of the CBP. The content therefore reflects the views of the expert(s) convened through the STAC-sponsored or co-sponsored activity. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

*Yagow, G., A. Collick, M. Ribaudo, W. Thomason, T. Veith. 2016. Scientific and Technical Advisory Committee Review of Nutrient Input Estimation for the Chesapeake Bay Watershed Model. STAC Publication Number 16-005, Edgewater, MD. 46 pp.

About the Scientific and Technical Advisory Committee

The Scientific and Technical Advisory Committee (STAC) provides scientific and technical guidance to the Chesapeake Bay Program (CBP) on measures to restore and protect the Chesapeake Bay. Since its creation in December 1984, STAC has worked to enhance scientific communication and outreach throughout the Chesapeake Bay Watershed and beyond. STAC provides scientific and technical advice in various ways, including (1) technical reports and papers, (2) discussion groups, (3) assistance in organizing merit reviews of CBP programs and projects, (4) technical workshops, and (5) interaction between STAC members and the CBP. Through professional and academic contacts and organizational networks of its members, STAC ensures close cooperation among and between the various research institutions and management agencies represented in the Watershed. For additional information about STAC, please visit the STAC website at www.chesapeake.org/stac.

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December 17, 2016

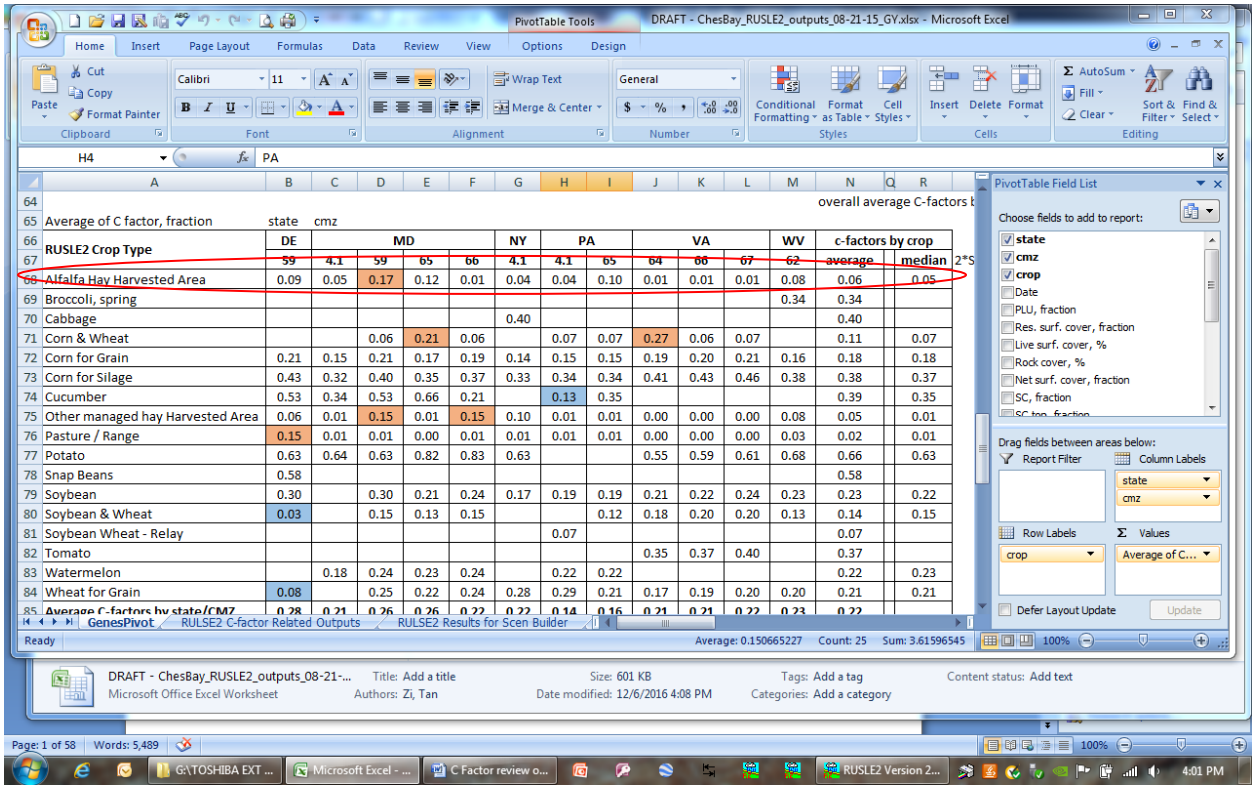
The following is a detailed discussion of my review of the RUSLE2 management scenarios and RUSLE2 runs resulting in Net C factors used in the Chesapeake Bay study.

Resources provided consisted of a limited RUSLE2 exported database containing only the management and profile files and their dependent components selected or developed for this study. The version of RUSLE2 used in making the runs was not documented in the materials provided. I utilized the latest RUSLE2 version 2.6.2.1 June 1, 2016 for this review. Net C factor and other outputs are very similar to those from other versions but may vary by a few hundredths due to bug fixes or changes in the RUSLE2 code with this version. The main focus of my review was the contents of the management files, what system they represented, whether they contained errors, and how they could be improved.

In order to create corrected examples, I imported the NRCS RUSLE2 base database containing all the additional operations, crops and etc necessary to create correct examples. In some cases I compared the official NRCS RUSLE2 managements for certain CMZ's as well, to review and compare the dates and contents of cropping and tillage systems that were previously created by NRCS experts but not included in this Chesapeake Bay database. I drew heavily on my previous 18 years of experience in building and managing the NRCS RUSLE2 database and training hundreds of RUSLE2 users in the proper construction of management files.

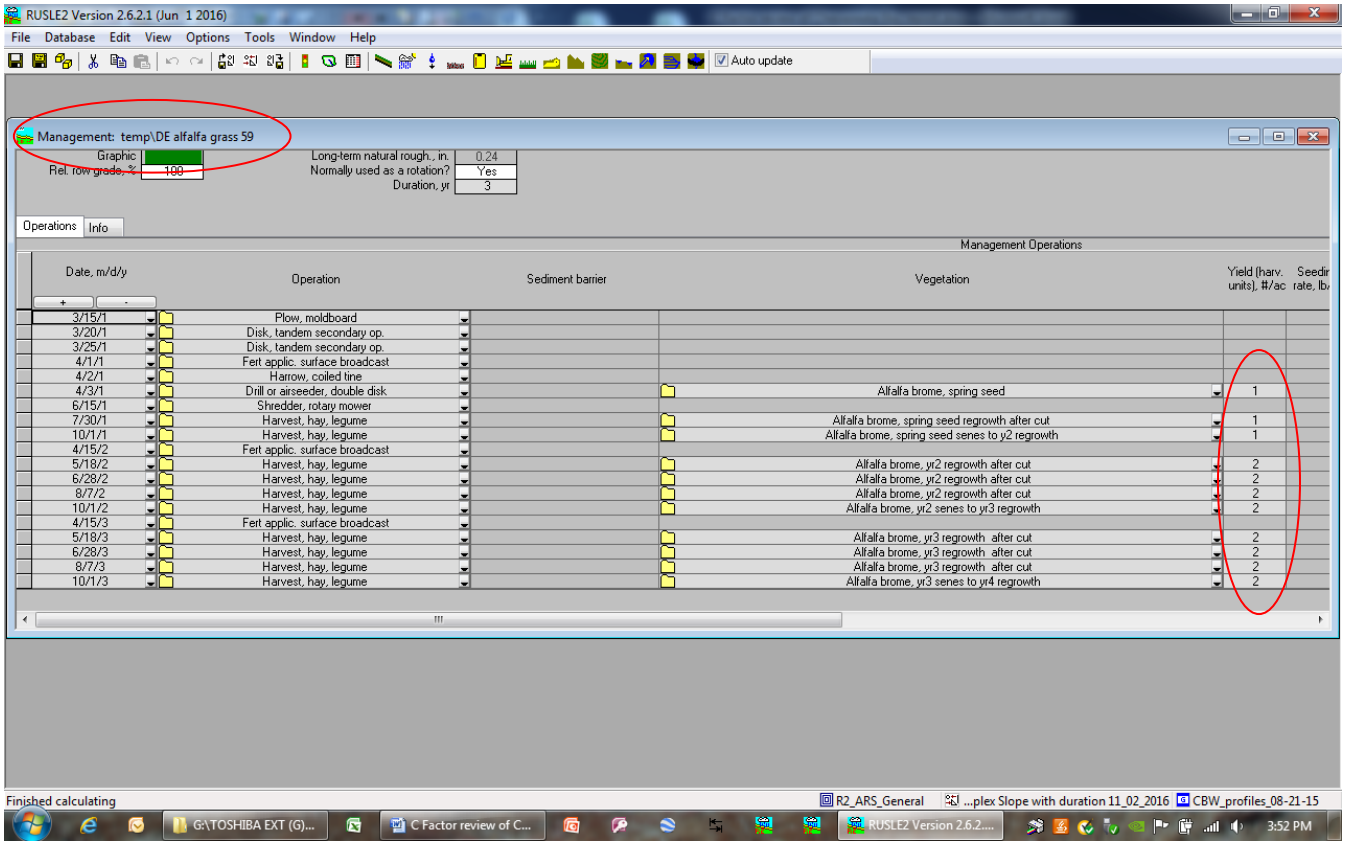
Alfalfa

The range of values is quite wide ranging from 0.01 to 0.17.



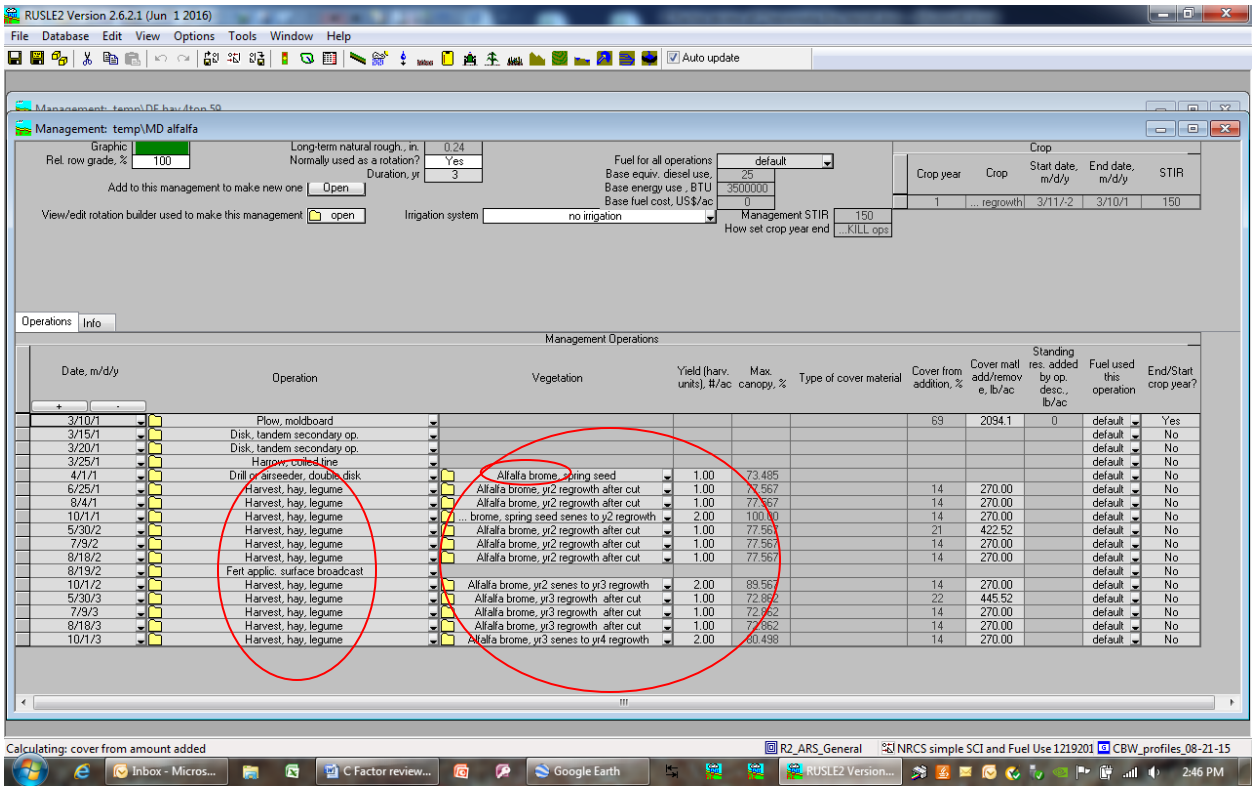
The Alfalfa hay files are reasonably well built except there are possibly some inconsistencies caused by the yield inputs for the regrowth cycles for hay crop intervals between the first cutting of the season and the later cuttings. Generally the highest yield is realized at the first cutting with decreasing yields for each successive cutting due to less desirable growing conditions during the hot summer months and shorter recovery periods between cuttings compared to the first cutting following overwintering. In RUSLE2 the forage yield is properly entered to represent the amount to be harvested at the next cut, so the senescence record spanning the fall winter and spring regrowth delivers the yield to the first cutting. Regrowth files representing later hay cuts should be lower.

Most of the Alfalfa files correctly follow this logic. However this DE Alfalfa and grass file does not.



The management file named MD Alfalfa, shown below, correctly contains the higher yield entered for the senescence and over winter periods that model the growth delivered to the next harvest, with lower yield for later cuts. However, note that both of these files represent an Alfalfa and Brome grass mixture while most of the other Alfalfa hay files are for straight Alfalfa. Note also that it uses a harvest operation intended for straight legumes so the amount of forage being cut and removed in modeling

may be off some.



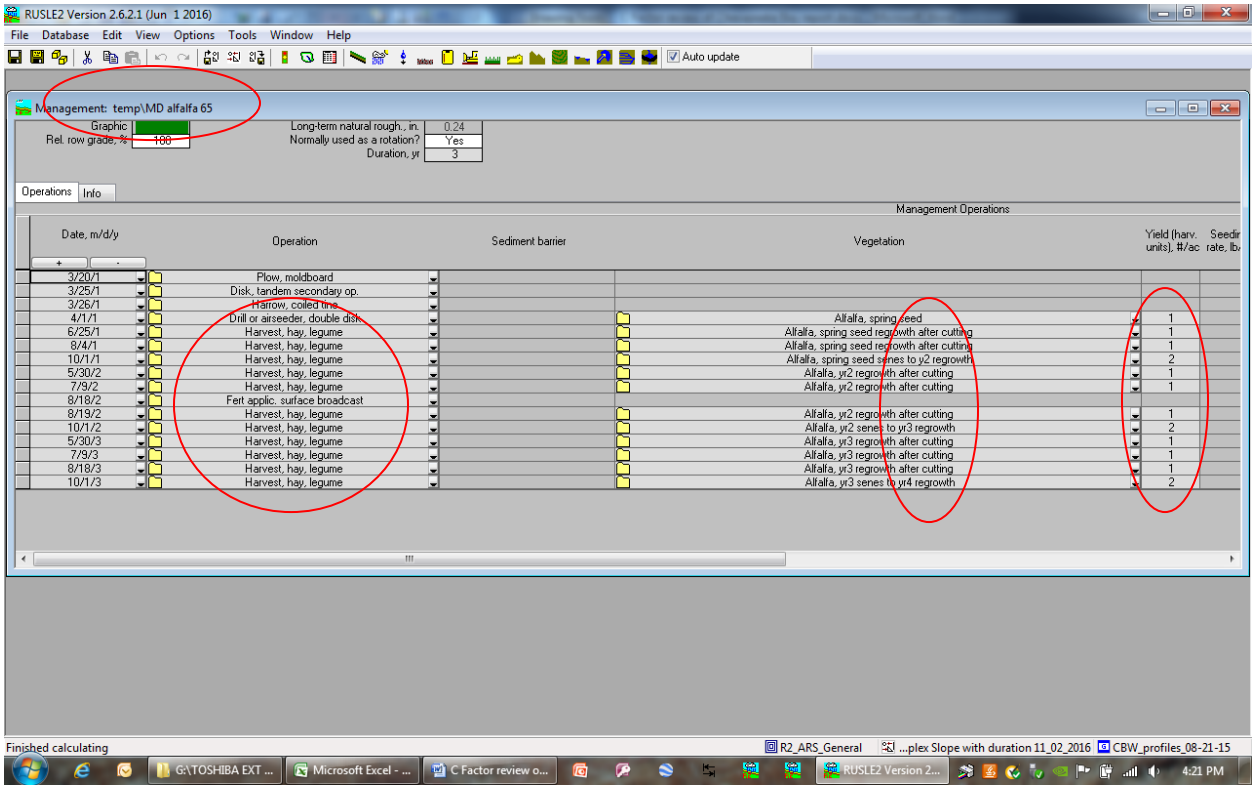
For consistency, the description of what is being modeled should be more specific and specify the length of time this perennial is to be modeled. Avoid comparing straight alfalfa to alfalfa grass mixes since canopy and ground cover are different.

The number of years that alfalfa is grown before being re-established and the planting season (spring vs. late summer) should be consistent across the states and CMZ's for this study if consistency is expected.

Typically alfalfa stands are re established every 4 to 6 years depending on yield decline and invasion of grass and weeds. On the other hand, grass hay stands typically last much longer before needing re-establishment.

Alfalfa files typically include 1 to 2 years of establishment with lower yields and fewer cuts and then 2 to 5 additional years of fully established receiving 3 or 4 cuts per year.

This Alfalfa file is more correctly built and represents straight alfalfa although the number of cuts in the seeding year seem too numerous and probably will result in a weak stand in future years.



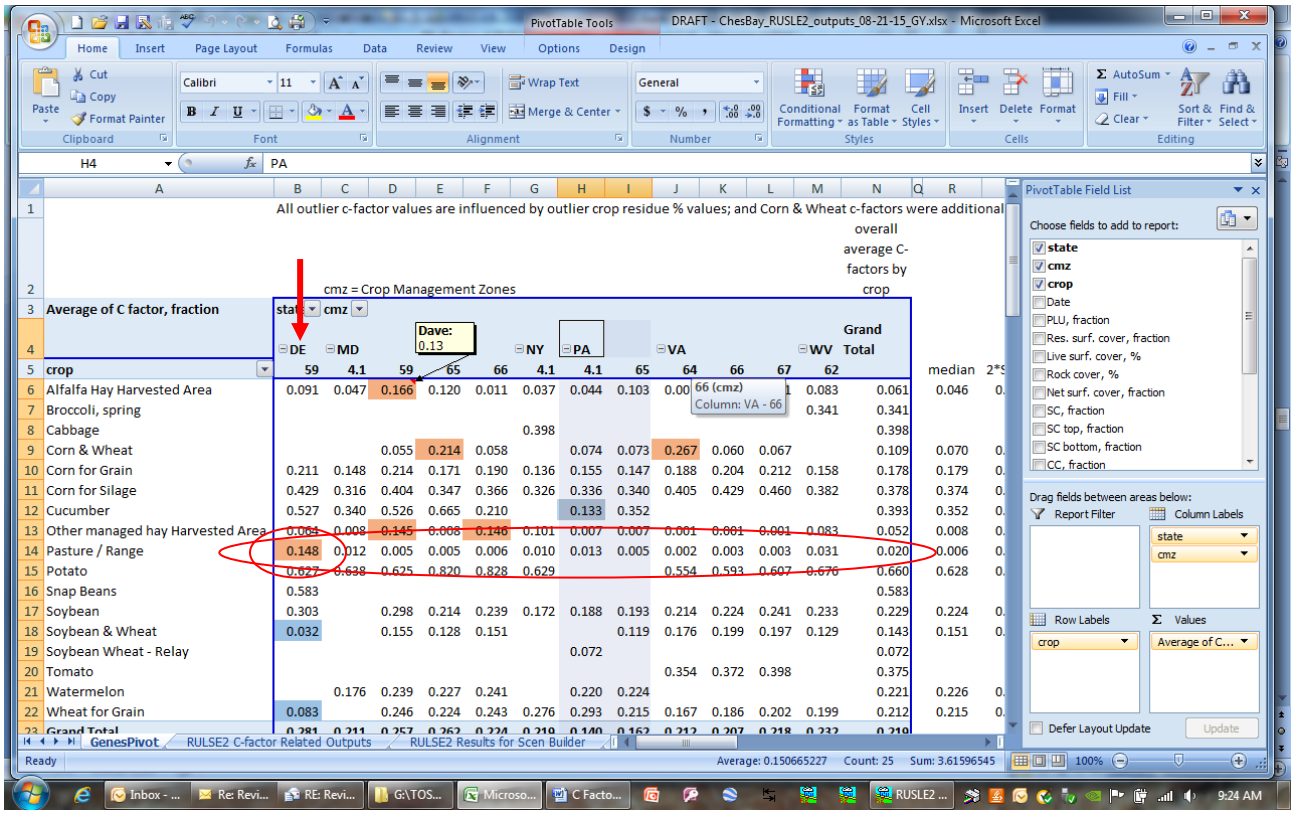
Pasture

The pasture files are a mixture of different species and grazing systems ranging from hay species with harvest cuts instead of grazing operations, to rotational grazing of nurse crops in the first year only all the way to short duration high intensity grazing systems assumed to be small paddocks with animals moved every day or two and the rest period managed according to the seasonal growth patterns.

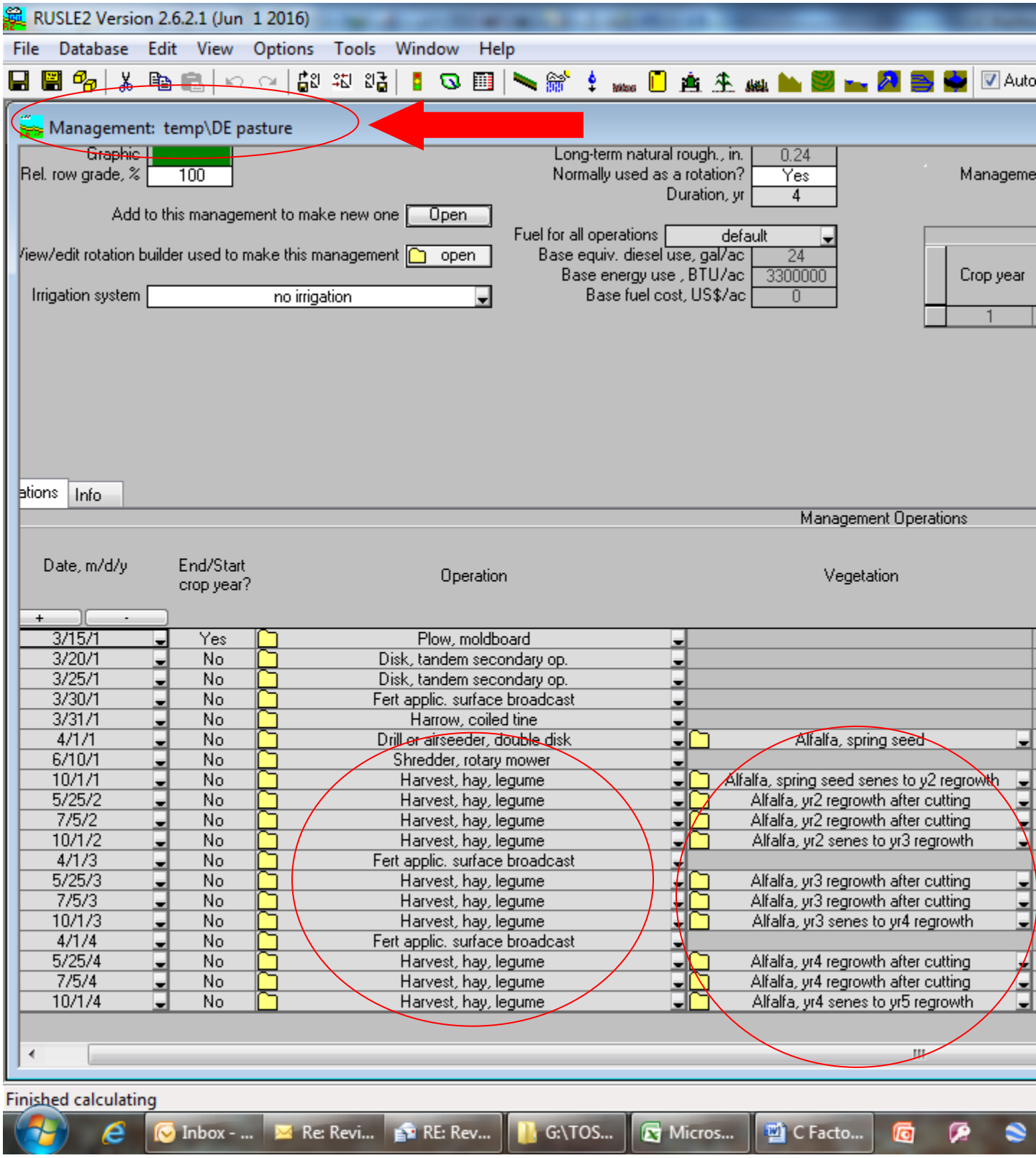
The pasture file in DE is not for pasture but is Alfalfa cut for hay. There is a wide range of different grazing and hay systems being modeled resulting in significant differences in C factors and residue, canopy outputs and erosion rates.

The USDA National Agricultural Statistics Service reported that 3899 acres of non irrigated pasture was grown in DE in 2013. I called out the pasture file in DE specifically because it exists in the USLE2 database under review and is highlighted as an outlier in the Summary table of net C factors that I was provided.

The net C factor of 0.148 is significantly higher than others across the region.



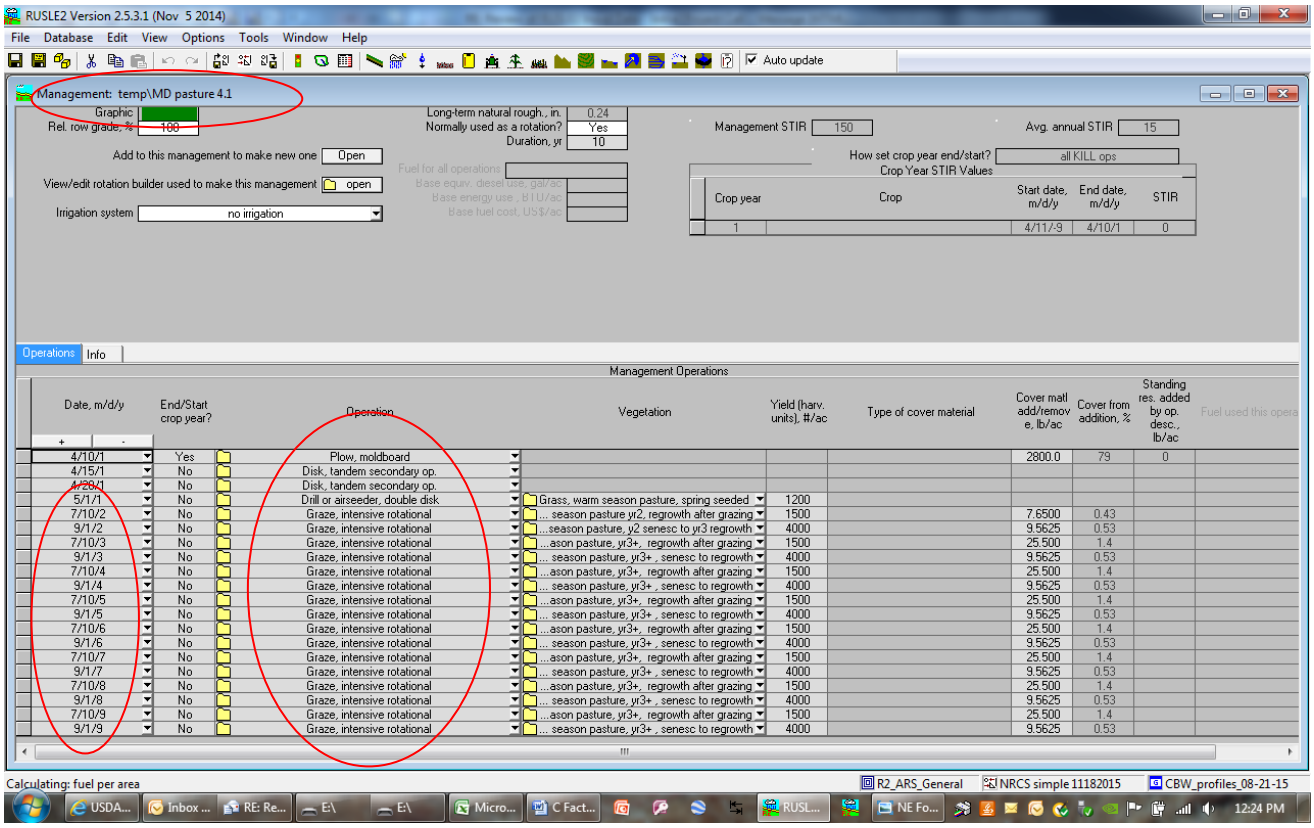
This is the DE pasture file provided. Upon review, the contents of this management file do not represent a pasture scenario. It is straight alfalfa.

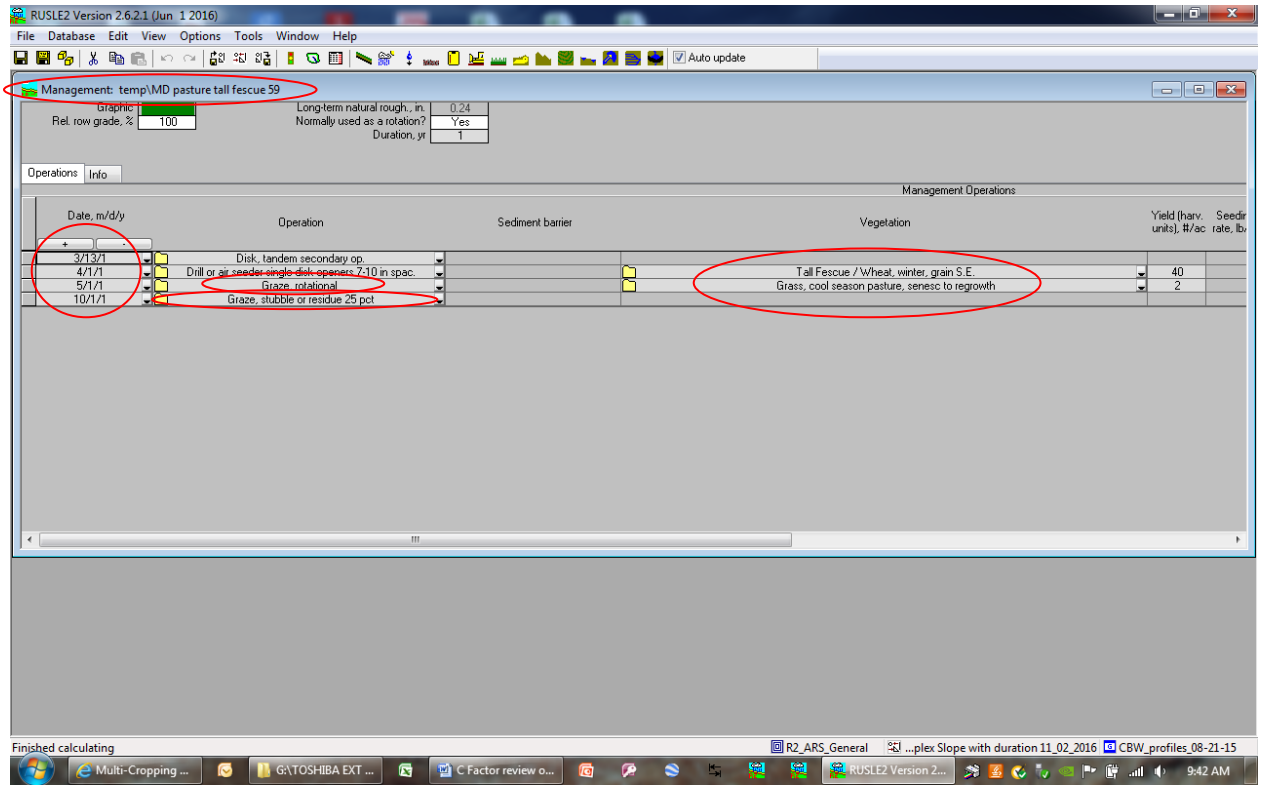


This file contains no grazing operations and no pasture species in it. It clearly does not represent a pasture scenario and should not be used in this report to represent a pasture.

Compare it to one below from MD in CMZ 4.1 illustrating the differences between a hay harvest management scenario and a pasture management scenario.

The pasture file for MD CMZ 4.1 appears to be better but it uses an intensive rotational grazing operation with only 3 grazing cycles per year which is more typical of normal rotational grazing. In typical intensive rotational grazing systems the removal is significant in a matter of hours or a day and the rest period cycles typically range between 3 weeks to 8 weeks but get longer in the late summer as production slows.





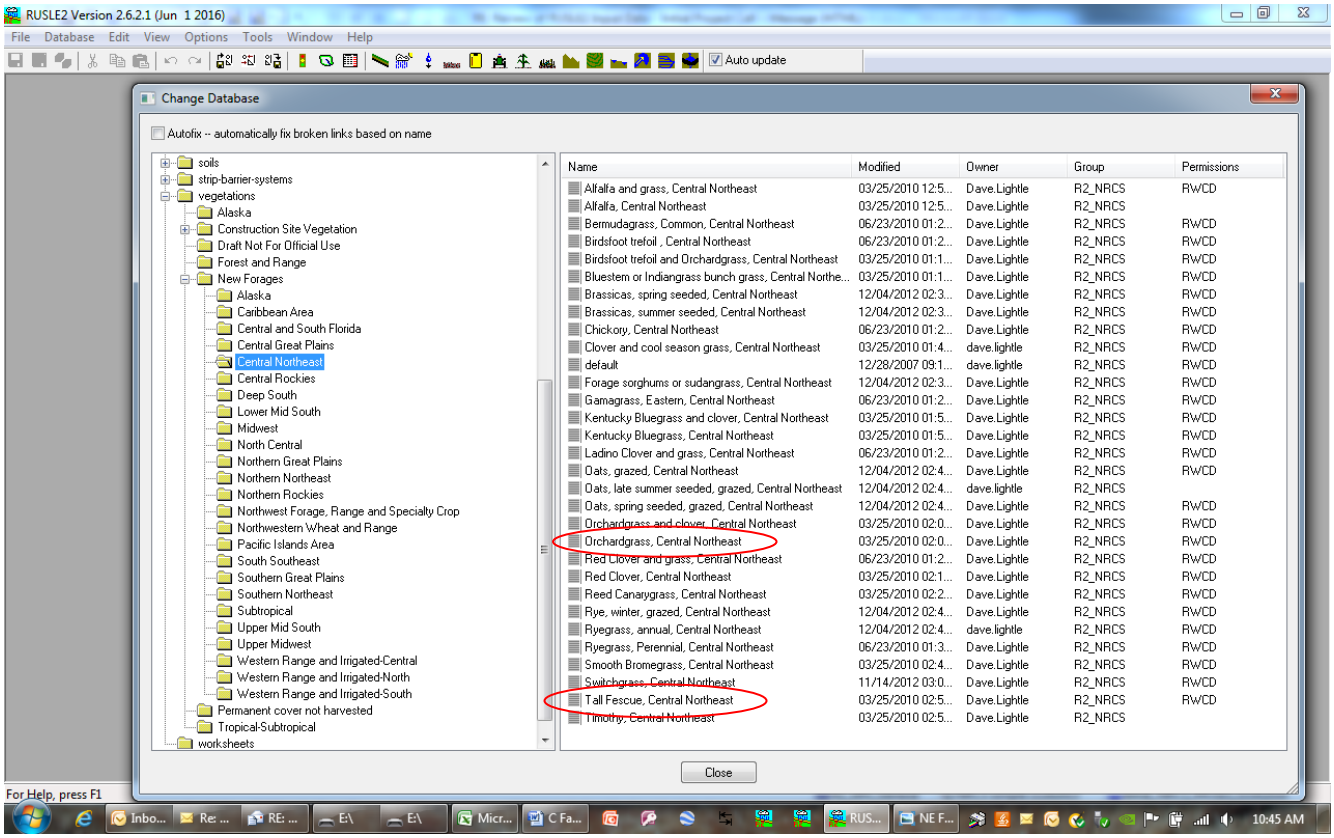
The pasture file in MD CMZ 59 shown above attempted to model the establishment period from March 13 to Oct 1 for tall fescue seeded with a wheat nurse crop grazed out 5/1. No plow was contained in the file if that was a requirement for analysis. The wheat vegetation file used at seeding in this pasture file was built for use in the Southeastern US for wheat harvested as grain and the internal growth curve contains no winter dormant period so it is probably not appropriate for MD. This vegetation also does not include tall fescue as an understory crop. The first grazing in this scenario removes wheat forage only 1 month after seeding. This is much too soon after seeding to begin grazing. This first grazing operation contains removal rates representative of a rotational grazing system but calls in an incorrect cool season grass pasture vegetation file intended for overwintering periods. Then the management shows that this is followed by a stubble grazing operation that removes no live forage only wheat stubble residue.

My conclusion on pastures is that there are significant differences in the RUSLE2 Net C factors because apparently no consistent standard format, common species or defined grazing system was specified in the instructions. Pasture files should contain species suitable for grazing not straight legumes and should contain grazing operations rather than hay cuts. Just as you specified a specific crop and tillage system or other crop groups, I recommend specifying a species or forage mixture and grazing system common to the area and allow the variability of climate and production level account for the variability across the region.

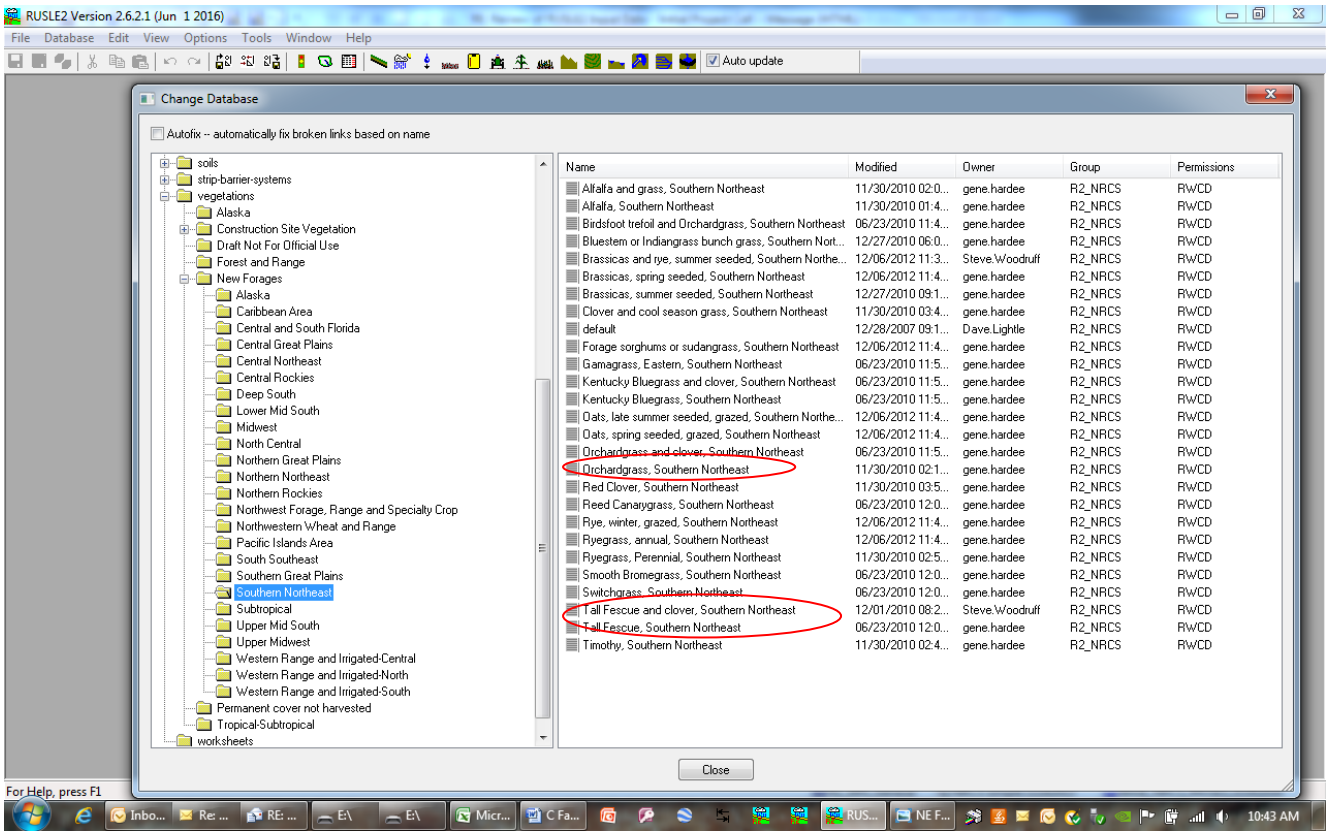
There are several common pasture species such as Tall Fescue, Orchard grass, and legume grass mixtures that contain these species that are commonly grown in the Chesapeake Bay watershed.

The following three screen prints show the forage species and mixtures common to the three Forage Production Zones that include the Chesapeake Bay watershed. There are slight differences in the monthly forage production values and slight differences in yields related to the climate files used within the vegetation files that I built for these, but not nearly the variability that exists between species grown in various parts of the watershed.

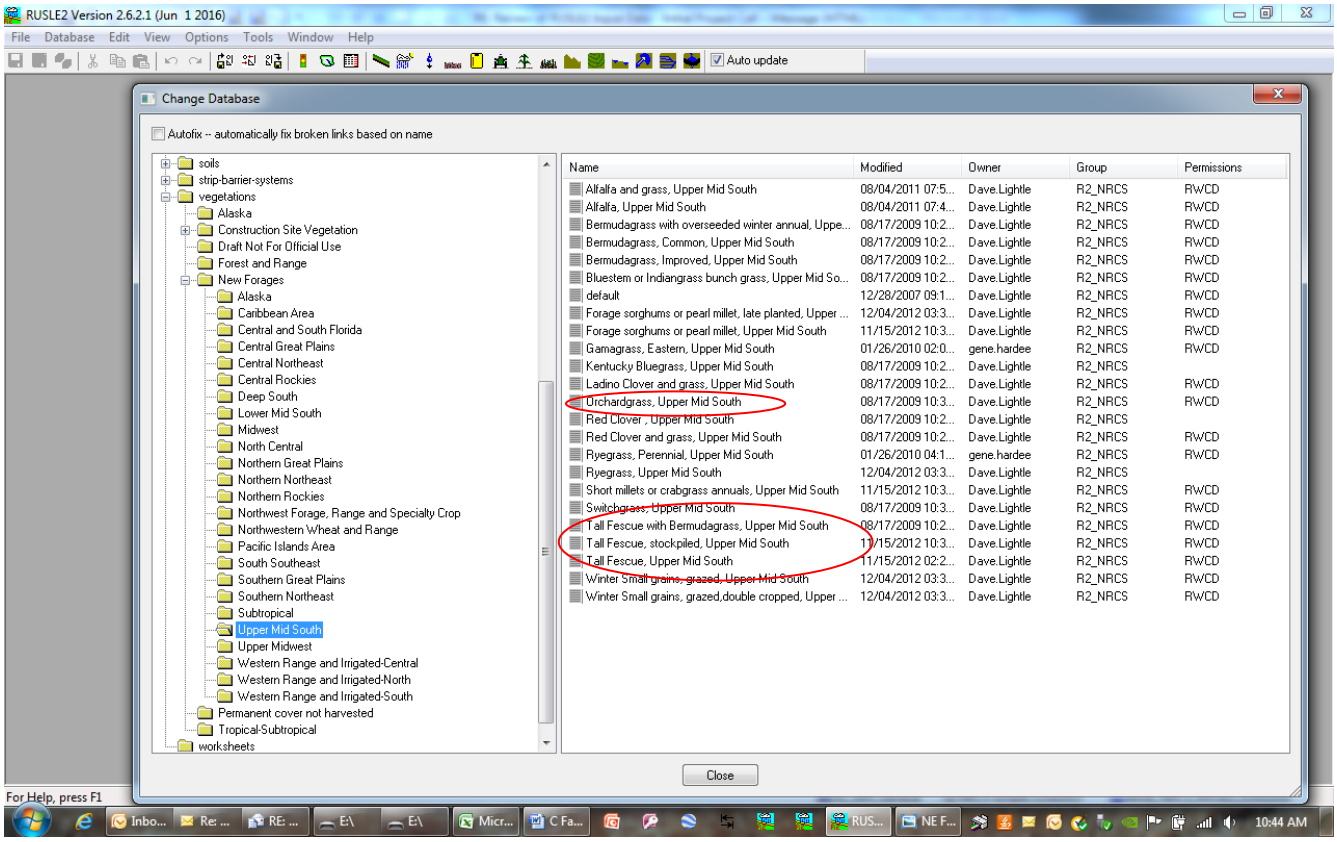
Central Northeast:



Lower (southern) Northeast:



Upper MidSouth:



Corn and Wheat

I initially had trouble determining what cropping system these files were to represent. The wheat harvest dates are more indicative of winter cover crop termination or grazing or silage or haylage harvests. These files are not labeled as double cropped scenarios and no clear description of what this crop group was intended to be was spelled out anywhere in the materials I was provided for review.

To further add to the confusion, there is a statement in Appendix D of the report on page 7 that leads me to believe that the Corn and Wheat scenarios are really intended to be a Winter Cover crop of wheat followed by corn. It reads: "*Finally, the start date of a **winter cover of wheat** (e.g., Corn & Wheat) is the essentially the same day of the summer cover crop harvest, and the winter cover's end date is the start date of the summer cover crop's date range.*"

What this doesn't say is that the wheat is to be harvested as grain.

This USDA paper provides some back ground and definitions of the common multi-cropping systems.

*"Multi-Cropping Practices: Recent Trends in Double-Cropping, EIB-125 Economic Research Service/USDA"**

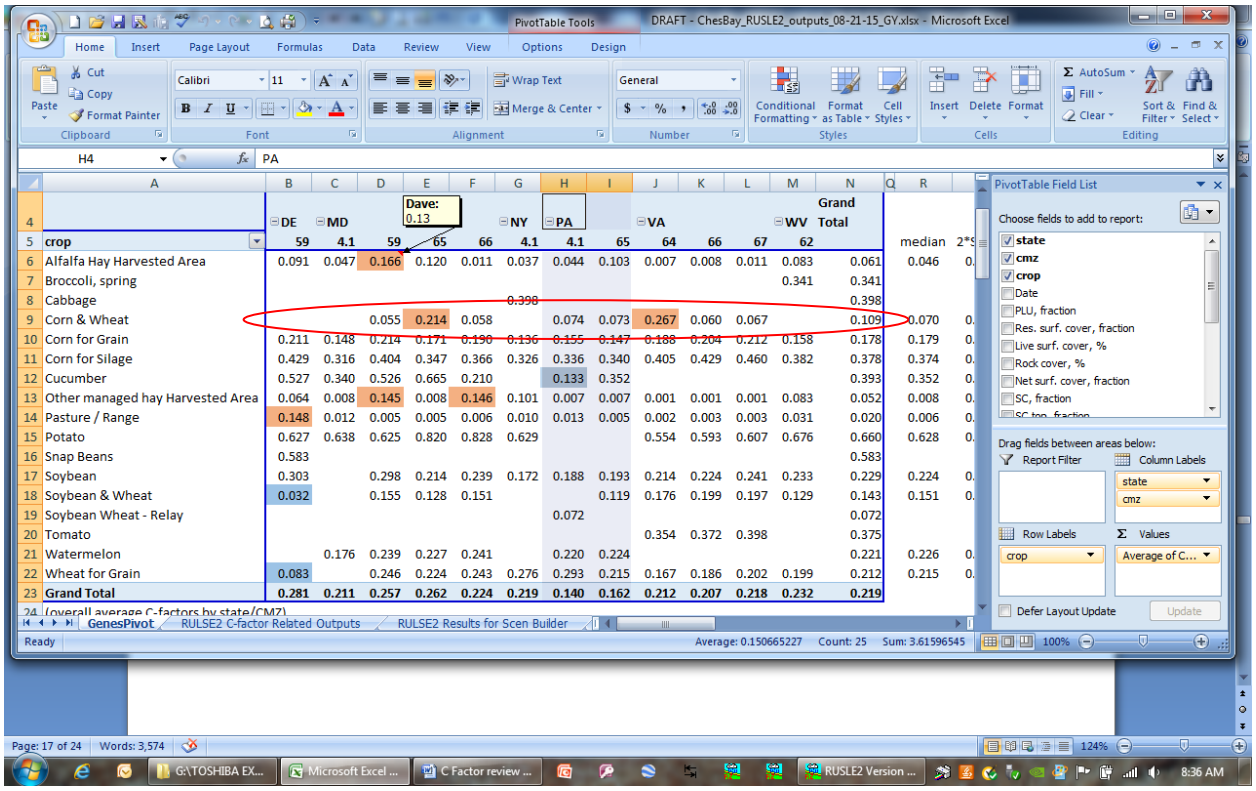
"Strictly defined, "double cropping" refers to the harvesting of two crops or commodities in a calendar year, ….. "Cover cropping" involves planting two crops but harvesting only one crop……. And "Integrated crop-livestock systems" involve harvesting one crop and then putting livestock to forage on either residue or a second crop".

"From 1999 to 2012 double cropping occurred on about 2 percent of total cropland in most years. Soybeans were, on average, the most common crop found on double-cropped acres over this time period, and, in 2012, winter wheat most commonly preceded these soybean plantings."

*Borchers, Allison, Elizabeth Truex-Powell, Steven Wallander, and Cynthia Nickerson. Multi-Cropping Practices: Recent Trends in Double Cropping, EIB -125.

After extensive discussions, apparently the Corn wheat files were supposed to represent two crops grown in the same year. I assumed that both crops were harvested as grain and reviewed the files for accuracy with that in mind. These Corn –Wheat RUSLE2 files have one common issue in that they all are harvested wheat for grain on April 30 which is much too early for the wheat to be physically mature enough for grain harvest. That would be a more typical date for terminating a cover crop or grazing the wheat as forage.

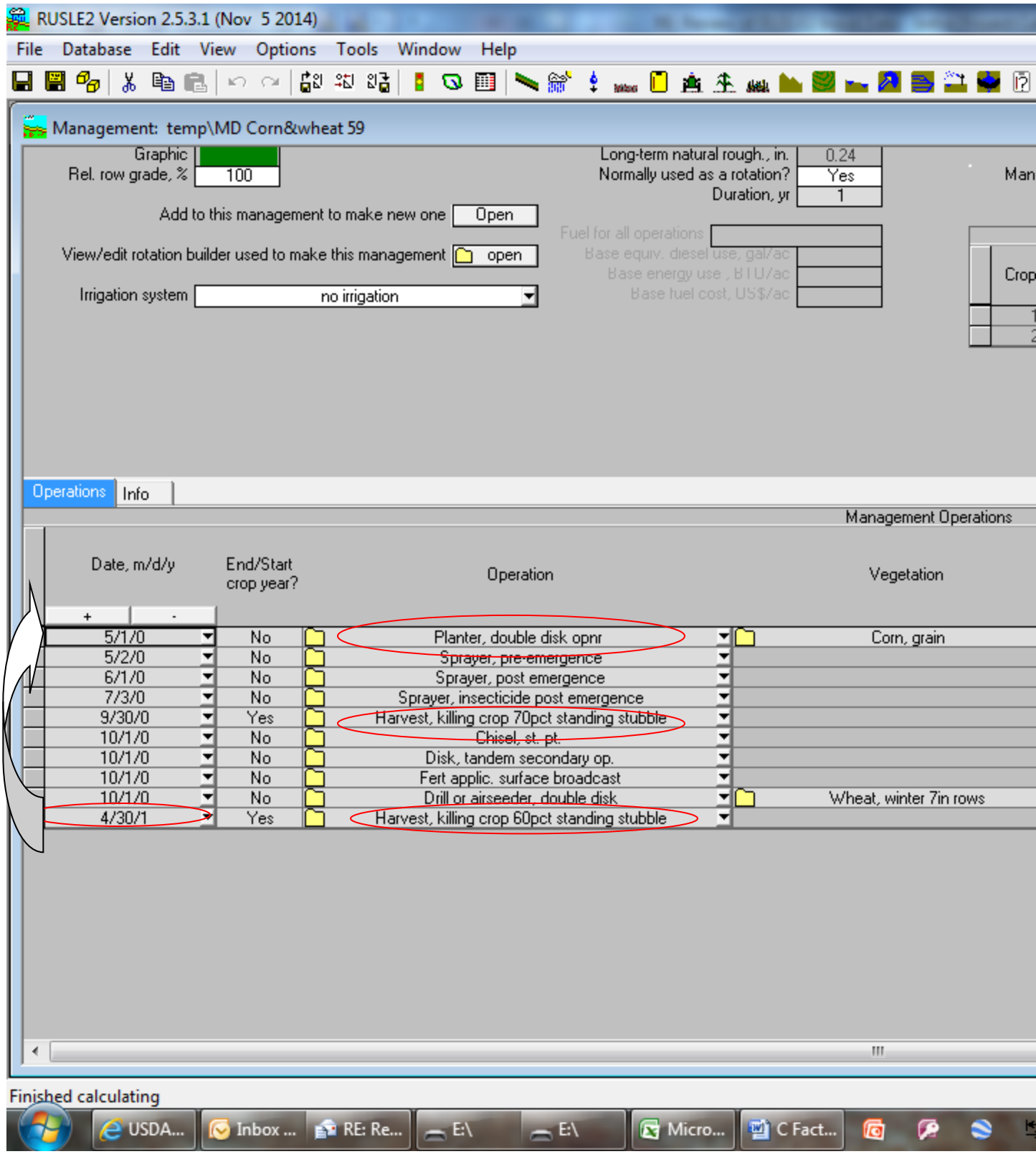
The comparison table of C factors developed for this study has highlighted several Corn wheat files as being out of range. In reality most of the corn wheat values are too low to be representative of plowed tillage systems for these crops.



crop	DE 59	MD 4.1	59	65	66	NY 4.1	PA 4.1	65	VA 64	66	67	WV 62	Grand Total	median	2*S
Alfalfa Hay Harvested Area	0.091	0.047	0.166	0.120	0.011	0.037	0.044	0.103	0.007	0.008	0.011	0.083	0.061	0.046	0.
Broccoli, spring												0.341	0.341		
Cabbage						0.398							0.398		
Corn & Wheat			0.055	0.214	0.058		0.074	0.073	0.267	0.060	0.067		0.109	0.070	0.
Corn for Grain	0.211	0.148	0.214	0.171	0.190	0.136	0.155	0.147	0.188	0.204	0.212	0.158	0.178	0.179	0.
Corn for Silage	0.429	0.316	0.404	0.347	0.366	0.326	0.336	0.340	0.405	0.429	0.460	0.382	0.378	0.374	0.
Cucumber	0.527	0.340	0.526	0.665	0.210		0.133	0.352					0.393	0.352	0.
Other managed hay Harvested Area	0.064	0.008	0.145	0.008	0.146	0.101	0.007	0.007	0.001	0.001	0.001	0.083	0.052	0.008	0.
Pasture / Range	0.148	0.012	0.005	0.005	0.006	0.010	0.013	0.005	0.002	0.003	0.003	0.031	0.020	0.006	0.
Potato	0.627	0.638	0.625	0.820	0.828	0.629			0.554	0.593	0.607	0.676	0.660	0.628	0.
Snap Beans	0.583												0.583		
Soybean	0.303		0.298	0.214	0.239	0.172	0.188	0.193	0.214	0.224	0.241	0.233	0.229	0.224	0.
Soybean & Wheat	0.032		0.155	0.128	0.151			0.119	0.176	0.199	0.197	0.129	0.143	0.151	0.
Soybean Wheat - Relay							0.072						0.072		
Tomato									0.354	0.372	0.398		0.375		
Watermelon		0.176	0.239	0.227	0.241		0.220	0.224					0.221	0.226	0.
Wheat for Grain	0.083		0.246	0.224	0.243	0.276	0.293	0.215	0.167	0.186	0.202	0.199	0.212	0.215	0.
Grand Total	0.281	0.211	0.257	0.262	0.224	0.219	0.140	0.162	0.212	0.207	0.218	0.232	0.219		

These Corn and Wheat management files are inconsistent in what they represent. Some contain operations not compatible with the crop harvested. Some files remove the grain and most of the cornstalks while others somehow harvest corn leaving most of the corn stalks still standing. Some contain planting operations not compatible with the tillage system intended and not compatible with the residue conditions being planted into.

Examples of corn - wheat files from MD in CMZ 59, 65, and 66. Existing file named **MD Corn7wheat59:**

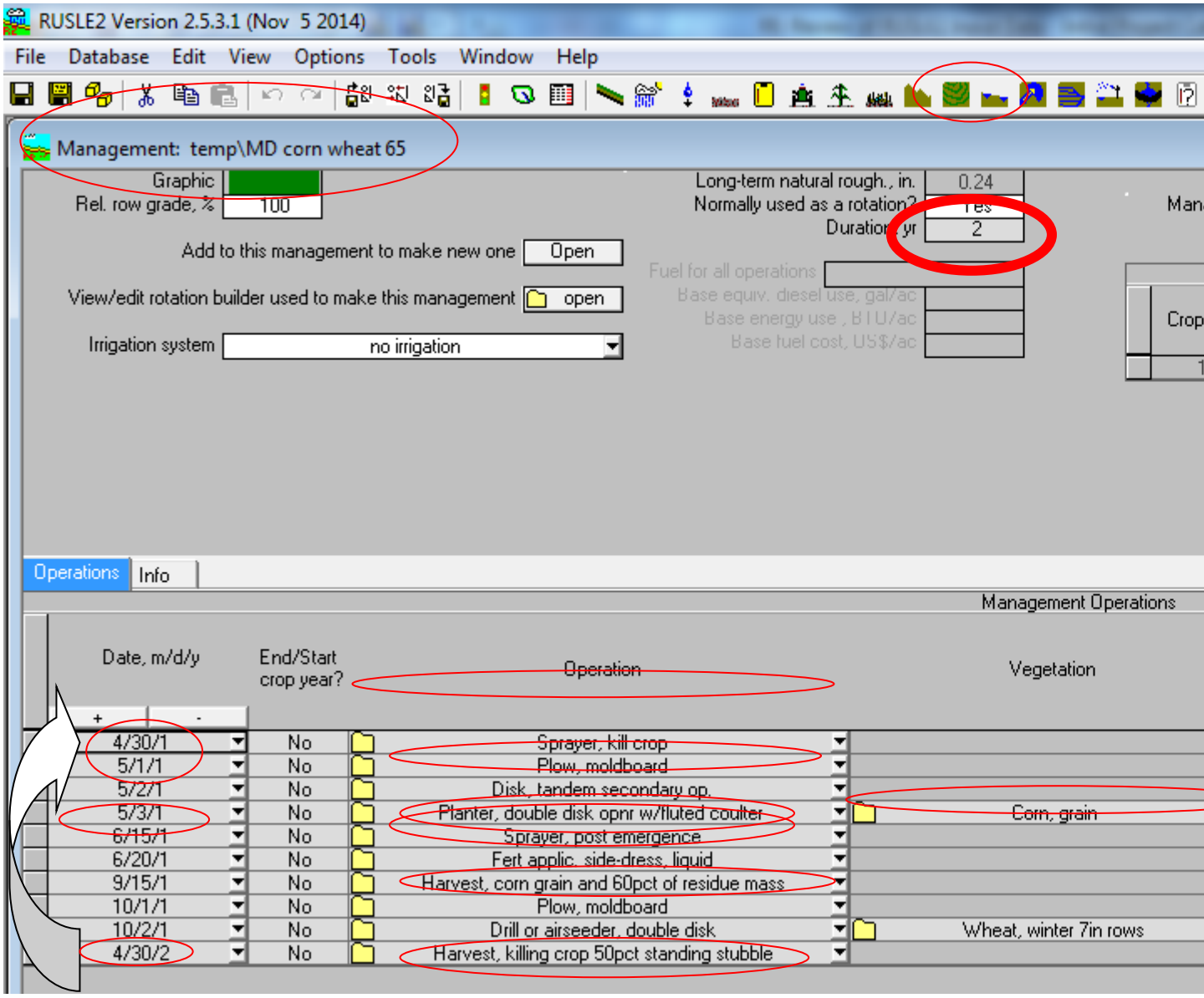


This file represents a two grain crop sequence in just 1 year in which corn is planted in an otherwise undisturbed soil using a conventional planter following winter wheat planted immediately after corn harvest in a chiseled and disked seedbed and harvested for grain 2 months too early on April 30 one day before the rotation repeats with Corn again planted on May 1. The resulting net C factor is **0.55**

If this is supposed to be a plowed system, the corn year is incorrect since there is no tillage. If intended to be No-till it is still incorrect because the planter used, can't function properly to adequately place and cover the seed in an untilled seedbed. Instead of a moldboard plow ahead of wheat seeding, a chisel plow is used in this example.

The corn harvest operation used is incorrect since 70% of 8 to 10 foot tall corn stalks would not be standing after running a combine. The combine header is typically run a foot to 18 inches above the ground bending the stalks over at that height and the combine tires flatten considerable residue. All the husks, cobs and some leaves and stalk material passes through the separator and falls flat on the ground as the machine passes over the corn bending the remaining material over about a foot to 18 inches above the ground. 50% standing is the recommended harvest operation for corn harvest.

Corn and Wheat file named **MDcorn wheat65:**

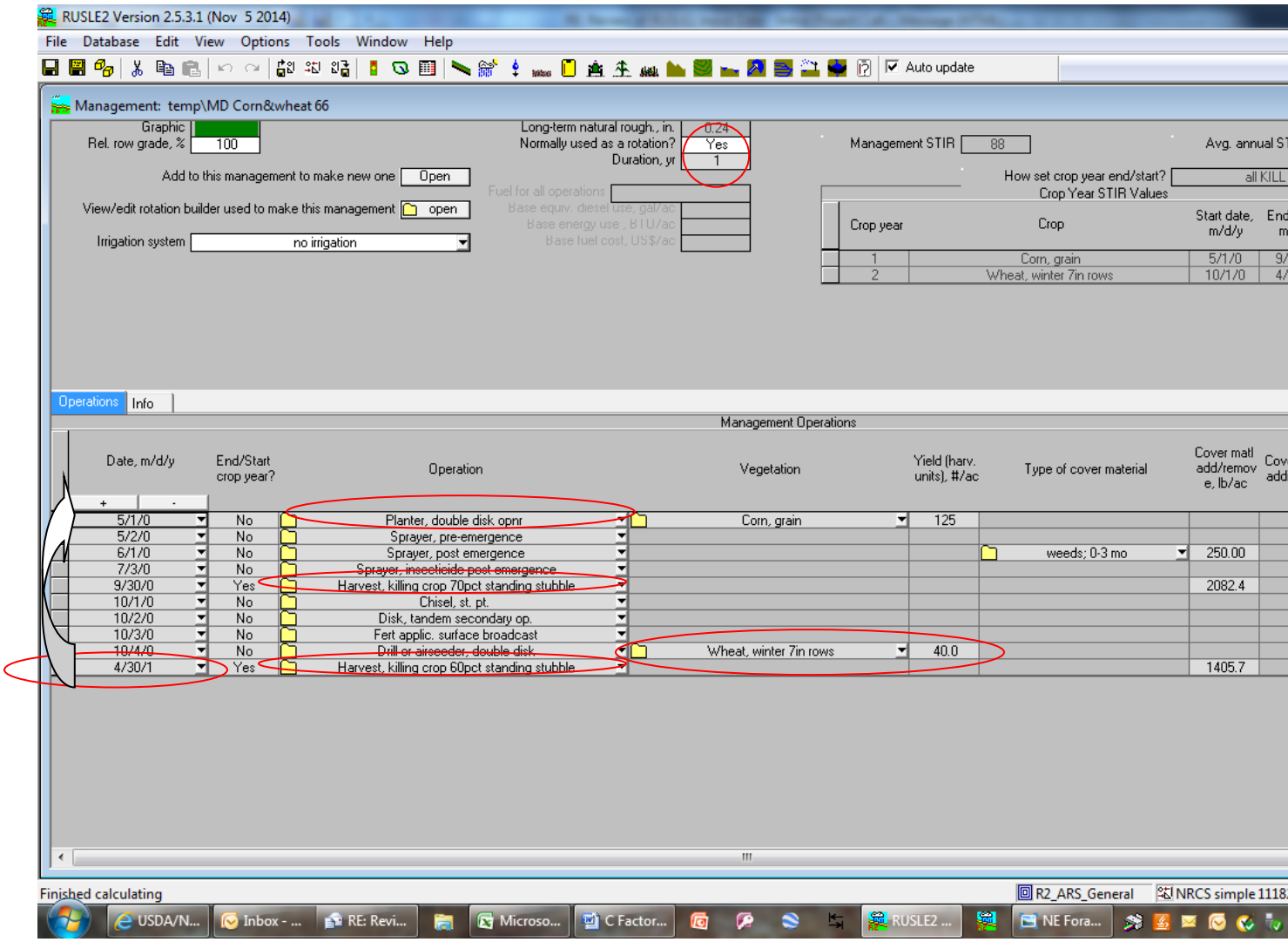


This is a 2 year crop sequence of Corn planted with a No-till planter in a conventional moldboard plowed seedbed and **harvested for grain with 60% of the corn stalk biomass also harvested and removed from the field,** followed immediately after harvest by wheat planted in a moldboard plowed seedbed and **harvested as grain** with all the residue left and 50% standing and 50% flat, **two months too early.**

As this rotation repeats chronologically in RUSLE2, the sequence of dates with wheat harvest on 4/30/2 and a sprayer the same day in year 1 tells RUSLE2 that there it is a full year of fallow with no operations or crop in a **2 year crop sequence** rather than 1 so it has a Net C of **0.214**

Corn and Wheat file named **MDcorn&wheat66**

Like the MD Corn Wheat 59 file this is a 2 grain crop sequence in 1 year of apparently No-till corn planted in otherwise undisturbed wheat residue with a regular double disk opener planter and harvested with a combine Sept 30 leaving 70% of the corn stalks standing upright, followed immediately by wheat for grain planted in a chisel plowed and disked seedbed, harvested for grain 2 months too early on April 30th.



These files all contain both corn and wheat crop intervals where the wheat vegetation file and the wheat harvest operation tell RUSLE2 that the wheat is harvested as grain and that mature residue is modeled on a mid spring date when the wheat would not be in that mature condition. No wheat grain would be ready for harvest until about the 1st of July. In RUSLE2 the growth curve will be truncated early by the harvest operation on April 30th and will not represent the maximum biomass or the correct type of residue if harvested on that date. Merely inputting an April 30 harvest date in the management doesn't grow the wheat any faster in RUSLE2. This directly impacts the C factor and residue cover values. My experience as a RUSLE2 expert, as an Agronomist and farmer causes me to question whether winter wheat is actually harvested on April 30th for grain in this area as these files would indicate.

Unless the wheat harvest date is adjusted to around the first of July the wheat isn't ripe for harvest on April 30. On July 1 a short season corn is can be grown and harvested late to allow it to fully mature and dry down.

To support my gut feeling that the April 30th date is too early to harvest wheat as grain in your area, I checked the straight wheat files. I find more realistic wheat harvest dates of July 1st in all states except VA which is June 2. I also checked the official NRCS files for CMZ 4.1 and find that both double cropped Corn and double cropped Soybeans were plowed, disked and planted on July 1 following normal winter wheat grain harvest not on April 30 as is contained in all the double crop files in this study.

Additionally The USDA National Agricultural Statistics Service report of Usual Planting and Harvest Dates certainly support late June to Mid July wheat harvest dates rather than the April 30th date contained in the Corn-Wheat and Soybean-Wheat files.

Usual Planting and Harvesting Dates by Crop – Maryland

State	2009 Harvested acres	Usual planting dates			Usual harvesting dates		
		Begin	Most active	End	Begin	Most active	End
	(1,000 acres)						
Barley, fall	48	Sep 17	Oct 1 - Oct 21	Nov 7	Jun 12	Jun 16 - Jun 28	Jul 8
Corn for grain	425	Apr 20	Apr 30 - May 20	Jun 7	Sep 9	Sep 22 - Oct 22	Nov 17
Corn for silage	40	Apr 20	Apr 30 - May 20	Jun 7	Aug 24	Sep 9 - Oct 1	Oct 14
Hay, alfalfa	40	(NA)	(NA)	(NA)	May 12	(NA)	Nov 30
Hay, other	170	(NA)	(NA)	(NA)	May 10	(NA)	Nov 19
Potatoes, summer	2.3	Apr 7	Apr 12 - Apr 28	May 10	Jul 1	Jul 20 - Aug 11	Aug 28
Soybeans	475	May 11	May 28 - Jun 26	Jul 16	Oct 5	Oct 18 - Nov 15	Dec 1
Wheat, winter	195	Oct 5	Oct 17 - Nov 6	Nov 19	Jun 22	Jun 28 - Jul 12	Jul 20

(NA) Not available.

Usual Planting and Harvesting Dates by Crop – Pennsylvania

State	2009 Harvested acres	Usual planting dates			Usual harvesting dates		
		Begin	Most active	End	Begin	Most active	End
	(1,000 acres)						
Barley, fall	45	Aug 25	Sep 15 - Oct 15	Oct 25	Jun 20	Jun 25 - Jul 20	Aug 10
Corn for grain	920	Apr 30	May 10 - May 25	Jun 15	Sep 25	Oct 15 - Nov 20	Dec 10
Corn for silage	420	Apr 30	May 10- May 25	Jun 30	Aug 30	Sep 10 - Oct 10	Nov 5
Hay, alfalfa	500	(NA)	(NA)	(NA)	May 15	(NA)	Nov 15
Hay, other	1,050	(NA)	(NA)	(NA)	May 30	(NA)	Sep 25
Oats, spring	80	Apr 15	Apr 15 - May 10	May 25	Jul 20	Jul 25 - Aug 20	Aug 30
Potatoes, fall	9.5	Apr 10	Apr 30 - May 25	Jun 10	Aug 10	Aug 25 - Oct 10	Oct 30
Soybeans	445	May 10	May 20 - Jun 10	Jul 5	Oct 5	Oct 20 - Nov 10	Nov 30
Tobacco, Class 3A [1]	6.2	May 25	May 30 - Jun 15	Jun 25	Aug 10	Aug 20 - Sep 10	Sep 25
Tobacco, Class 4 [2]	2.0	May 25	May 30 - Jun 15	Jun 25	Aug 10	Aug 20 - Sep 10	Sep 25
Wheat, winter	175	Aug 30	Sep 15 - Oct 15	Oct 30	Jul 5	Jul 10 - Jul 30	Aug 10

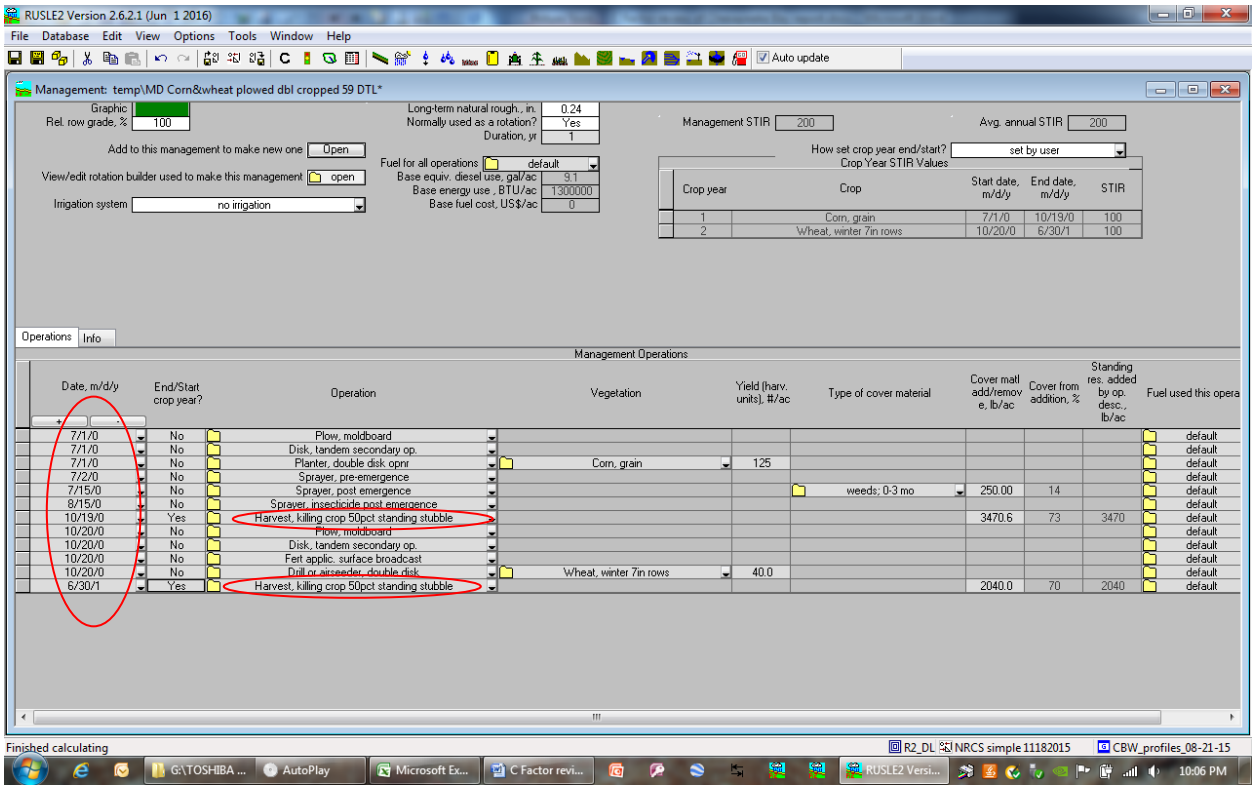
(NA) Not available.
[1] Includes light air-cured types 31-32.
[2] Includes cigar filler type 41.

Usual Planting and Harvesting Dates by Crop – Virginia

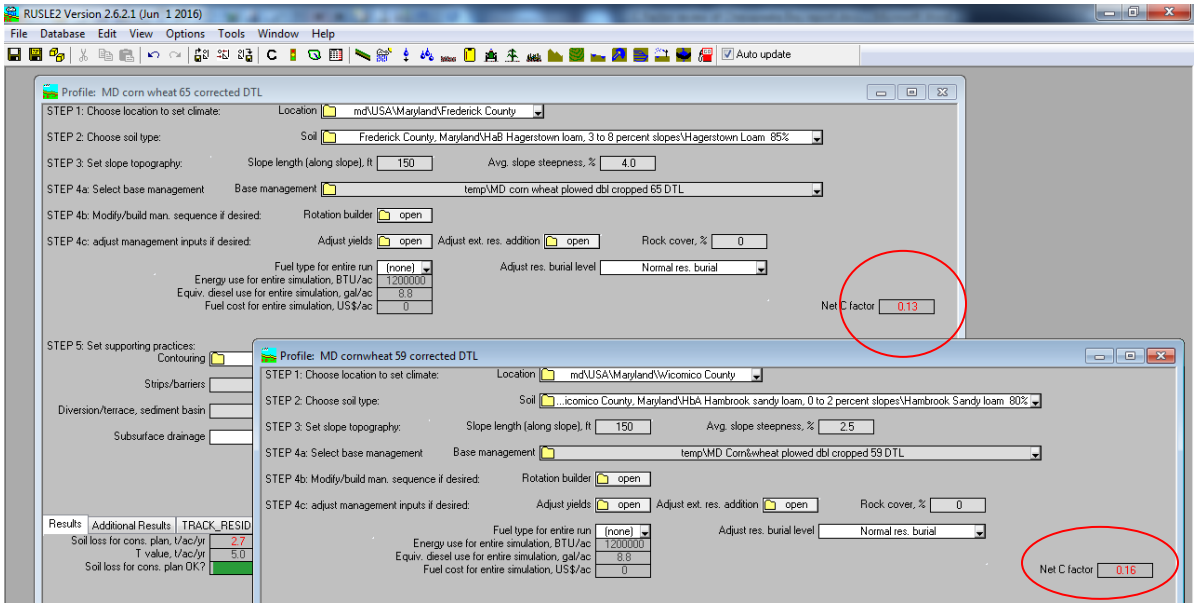
State	2009 Harvested acres	Usual planting dates			Usual harvesting dates		
		Begin	Most active	End	Begin	Most active	End
	(1,000 acres)						
Barley, fall	43	Sep 18	Sep 26 - Oct 29	Nov 8	May 28	Jun 6 - Jun 25	Jul 1
Corn for grain	330	Apr 5	Apr 11 - May 20	May 29	Aug 31	Sep 6 - Oct 28	Nov 9
Corn for silage	135	Apr 5	Apr 11 - May 20	May 29	Aug 12	Aug 20 - Sep 27	Oct 5
Cotton, all	63.0	Apr 23	Apr 25 - May 11	May 16	Sep 30	Oct 8 - Nov 20	Nov 27
Hay, alfalfa	90	(NA)	(NA)	(NA)	May 1	(NA)	Oct 20
Hay, other	1,090	(NA)	(NA)	(NA)	May 25	(NA)	Oct 1
Oats, fall	4	Sep 15	Sep 27 - Oct 29	Nov 9	May 28	Jun 9 - Jul 3	Jul 20
Peanuts	12	Apr 25	Apr 30 - May 18	May 25	Sep 18	Sep 25 - Oct 17	Oct 24
Soybeans	570	May 5	May 15 - Jul 3	Jul 9	Oct 4	Oct 16 - Nov 28	Dec 4
Tobacco, Class 1 [1]	17.5	Apr 29	May 3 - May 20	May 26	Jul 26	Aug 4 - Sep 29	Oct 8
Tobacco, Class 2 [2]	0.7	May 7	May 11 - May 29	Jun 4	Aug 7	Aug 12 - Sep 10	Sep 20
Tobacco, Class 3A [3]	2.0	May 12	May 16 - Jun 9	Jun 16	Aug 17	Aug 27 - Sep 24	Sep 30
Wheat, winter	210	Sep 25	Oct 10 - Nov 21	Dec 1	Jun 9	Jun 16 - Jul 5	Jul 12

(NA) Not available.
[1] Includes flue-cured types 11-14.
[2] Includes fire-cured types 21-23.
[3] Includes light air-cured types 31-32.

If the actual scenario being modeled is supposed to be Corn grain and wheat grain with both using a plowed tillage system, the properly built 1 year management should be as follows below: Note that the Corn dates are two months later than regular corn and that harvest is about 6 weeks later than regular corn but possible using a short season variety. Notice that wheat planting is about a month later than normal wheat resulting in somewhat less growth in the fall but still harvested normally about July 1st. Wheat stubble harvest is optional but should be included or either not included in all double cropped scenarios to reduce variability when comparing outputs across states and CMZ's.

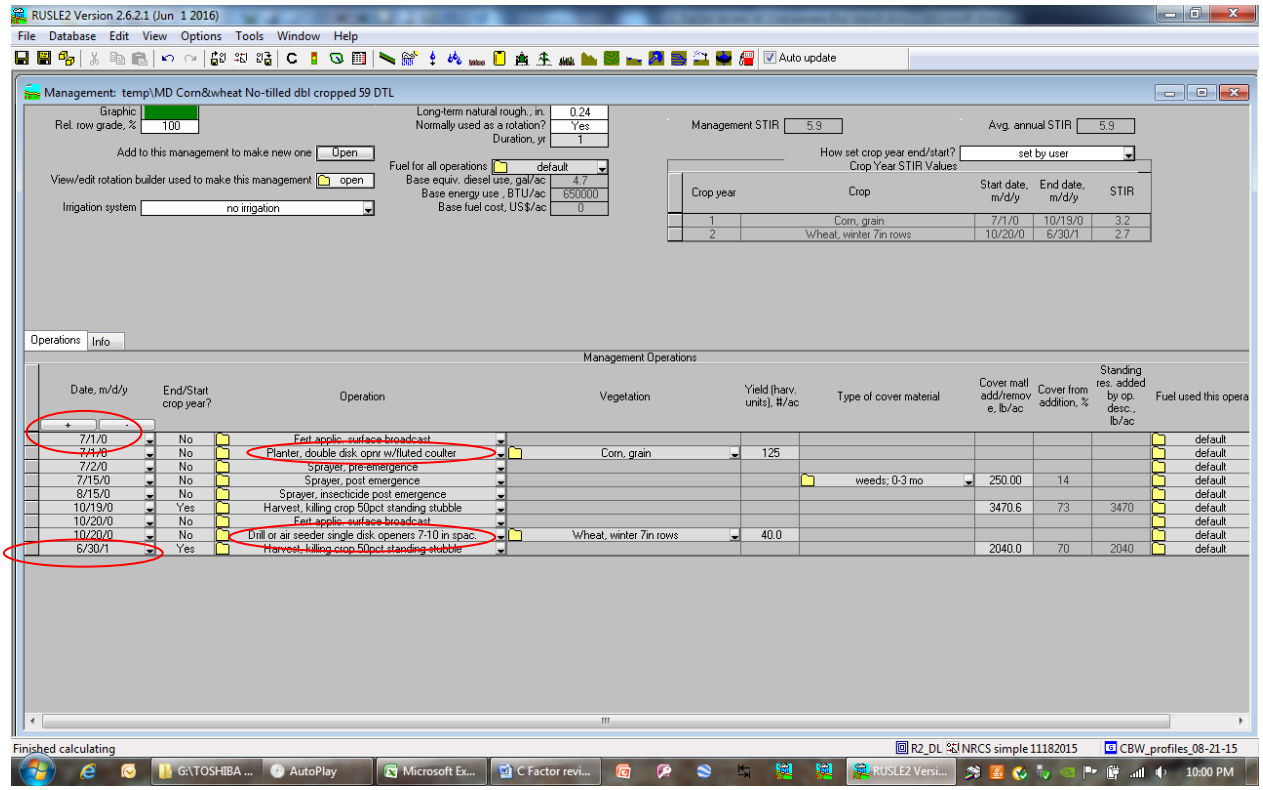


Upon making two revised RUSLE2 runs for MD Corn wheat in CMZ 59 and 65 using the corrected managements the resulting net C values are much more comparible because they represent real conditions and similar cropping and tillage systems. Revised net C for MD 59 Cornwheat double cropped is 0.16 while the corrected C value for MD 65 Corn Wheat double cropped is 0.13. These differences are likely attributed to differerent climate files and different yields and are much more reasonable.



The files representing Not plowed scenarios also need to be revised and re run. In a true No-till double cropped system where corn and wheat are both planted directly into an untilled seedbed, there is significantly lower erosion than if the previous crop residue is plowed and buried prior to planting. It is critical that these managements be created correctly for Corn (or soybeans) and Wheat scenarios to properly account for mature grain and the stage of plant growth and amount of wheat biomass entering the residue pools at the beginning of the corn or soybean crop interval. Wheat stubble harvest is optional but should be assumed or not assumed in all double cropped scenarios to reduce variability when comparing outputs across states and CMZ's

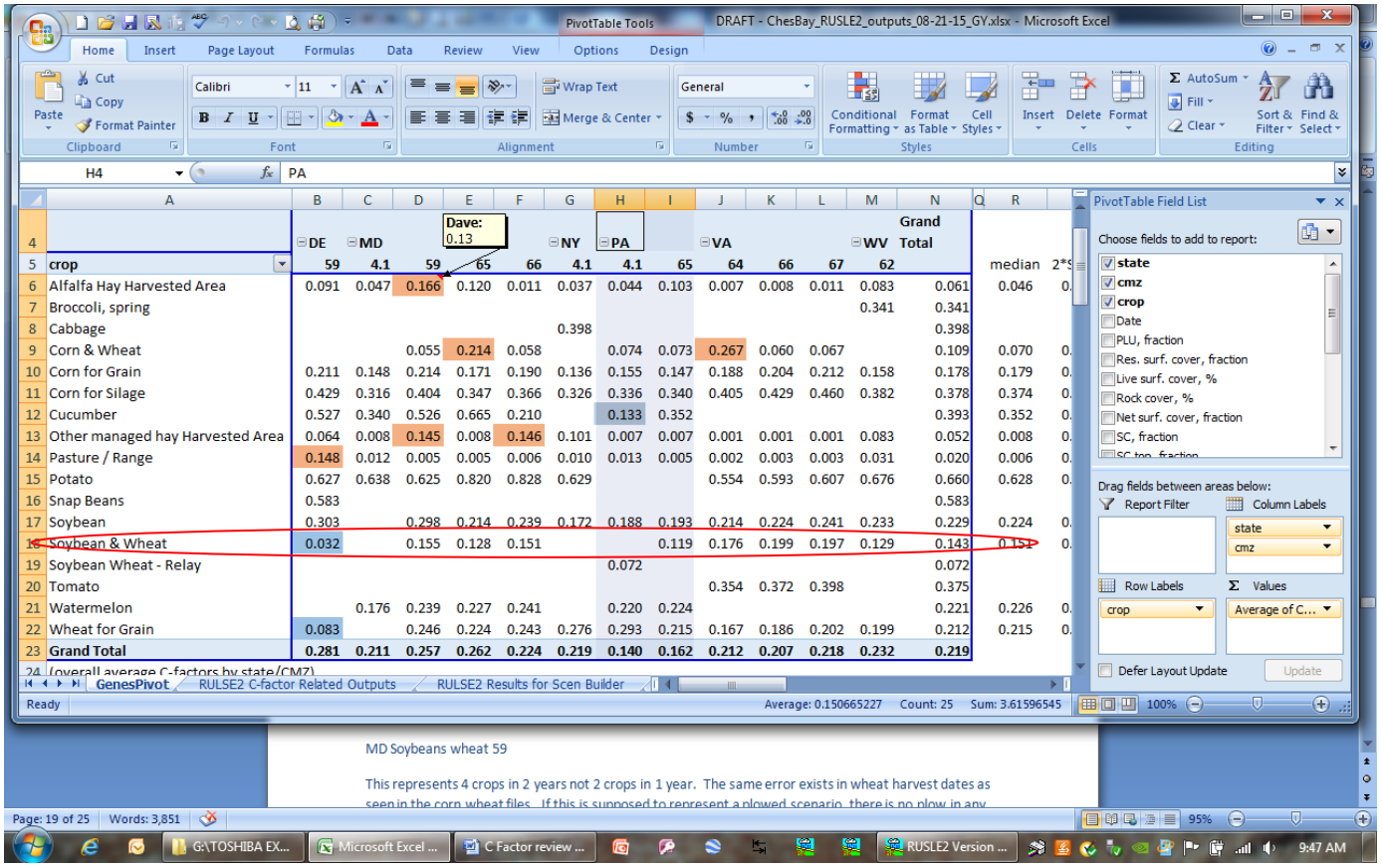
A properly constructed not plowed or No-till double cropped Corn-Wheat management should look like this:



I also noted in one Corn Wheat scenario that the corn yield was using the 112 bu default yield instead of the 120 bu yield used for corn in that CMZ. This is another error causing variability made either when creating the Corn Wheat management or not checked and reset when making the run.

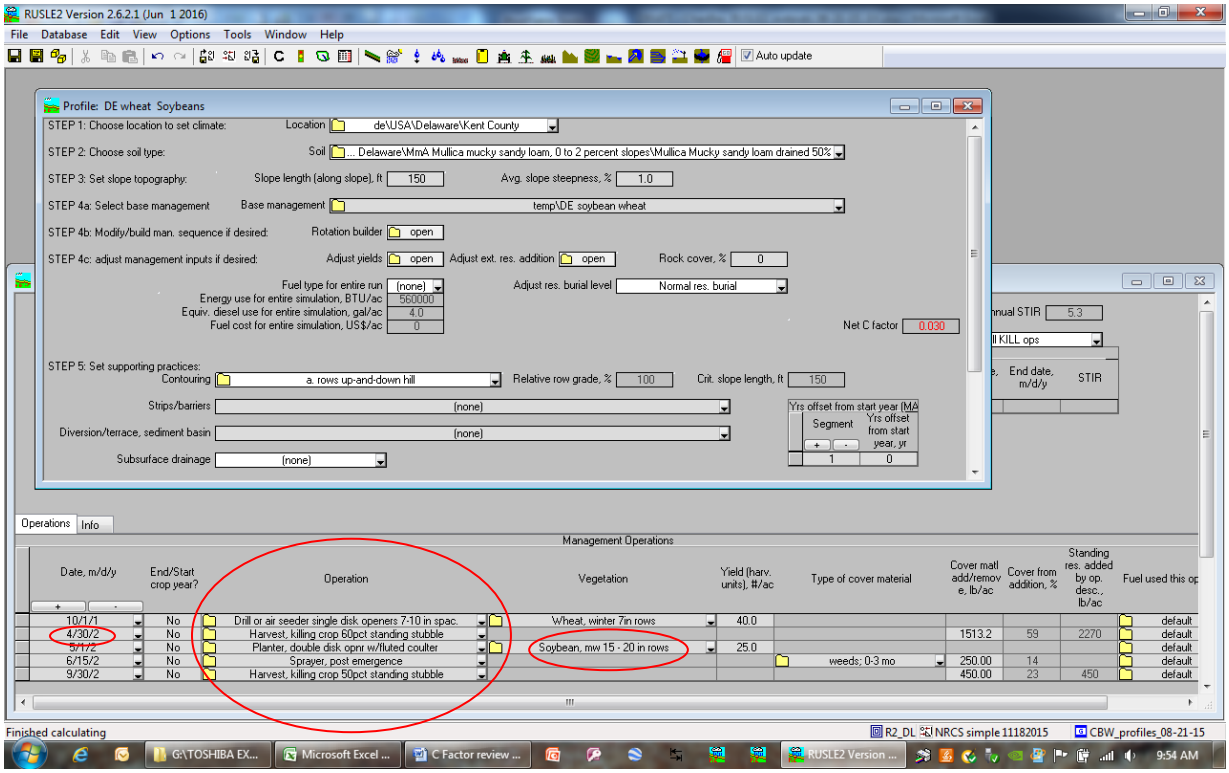
Soybeans and Wheat double cropped management scenarios

The comparison table of Net C factors shows only one scenario in DE as being out of range with the others. What this doesn't indicate is whether all the others are incorrect as well.



This is the file representing the out of range value in the summary table

DE Soybeans wheat 59 file



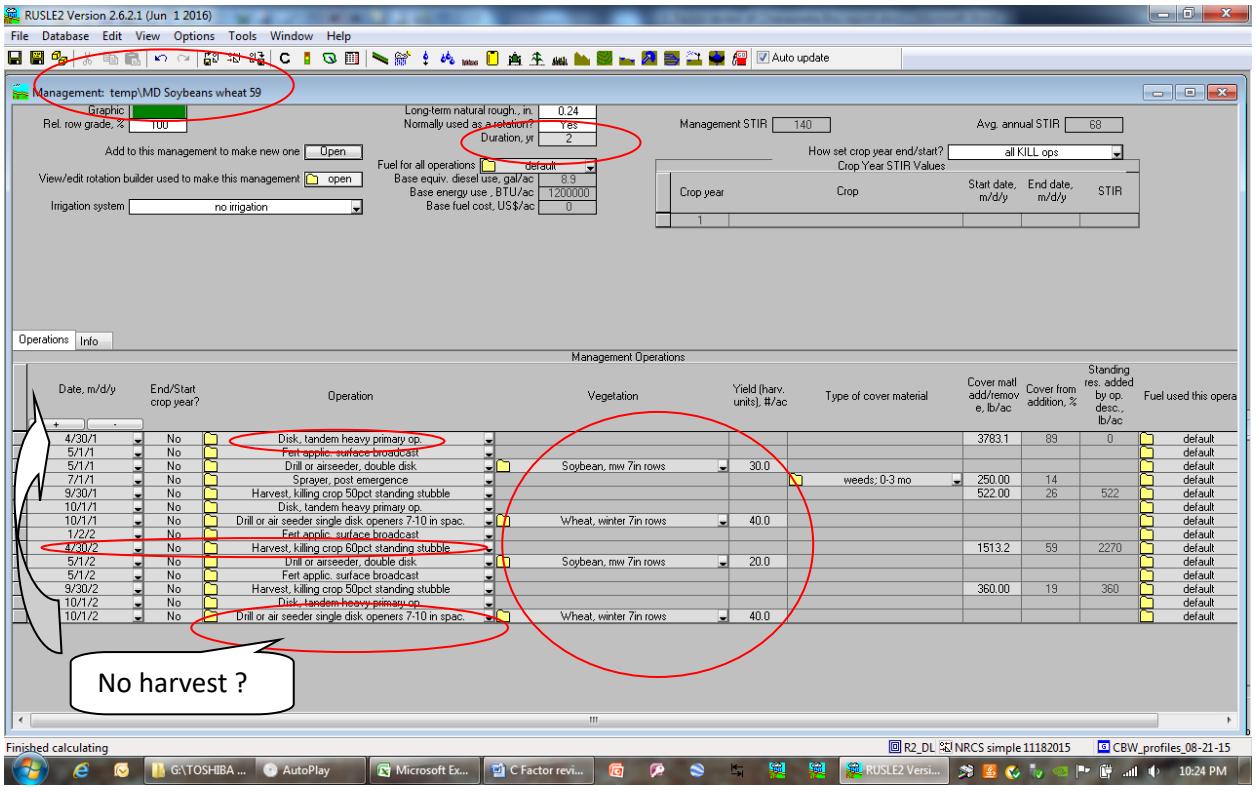
This is a **No-till soybeans and wheat file not a plowed tillage system**. Note the absence of tillage. Wheat harvest is too early on April 30. Soybeans are planted in narrow rows rather than drilled as in other scenarios so canopy closure would be slower than drilled beans.

There are similar problems with the Soybean and Wheat double cropped management scenarios in this crop grouping having wrong planting and harvest operations, and missing tillage operations if they are to represent plowed systems. The harvest date for wheat is universally too early as described under the Corn Wheat discussion above.

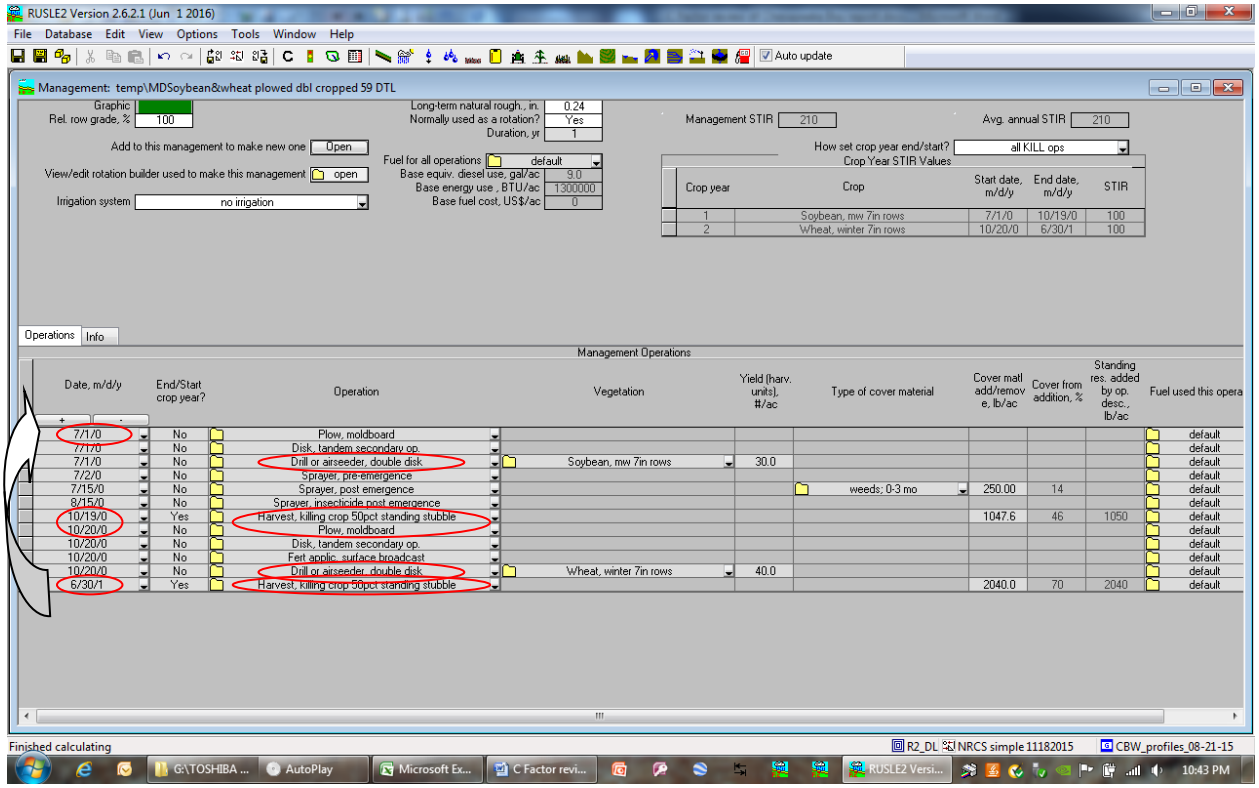
MD Soybeans wheat 59

This file represents 2 soybean crops plus 1 wheat grain and one wheat cover crop in 2 years not 2 crops in 1 year. Notice the second wheat crop is not harvested but gets terminated and disked under as the rotation cycles back to year 1.

The same error exists in wheat harvest date as seen in the corn wheat files. If this is supposed to represent a plowed scenario, there is no plow in any of the years and in fact it includes No-till drills. Yields for soybeans are 20 bu in one year and 30 in another.

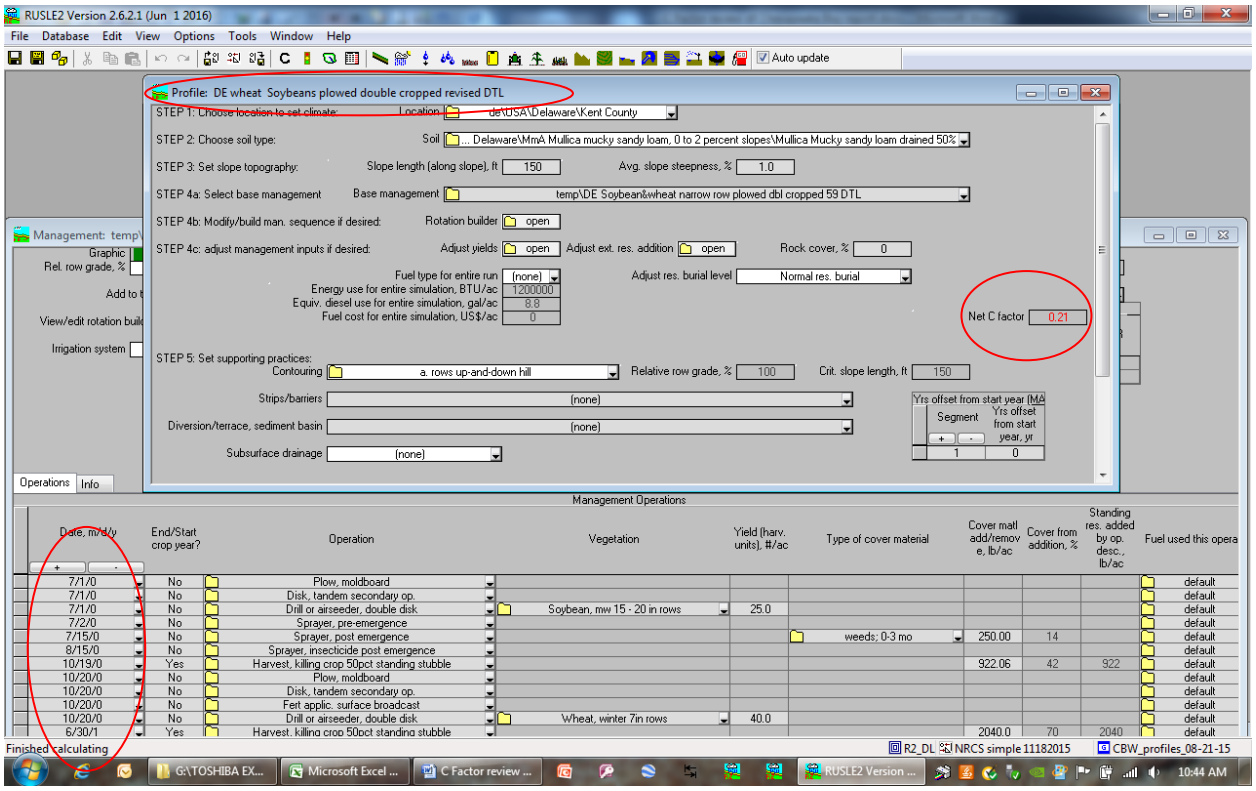


Correctly built Soybean wheat plowed double cropped example:

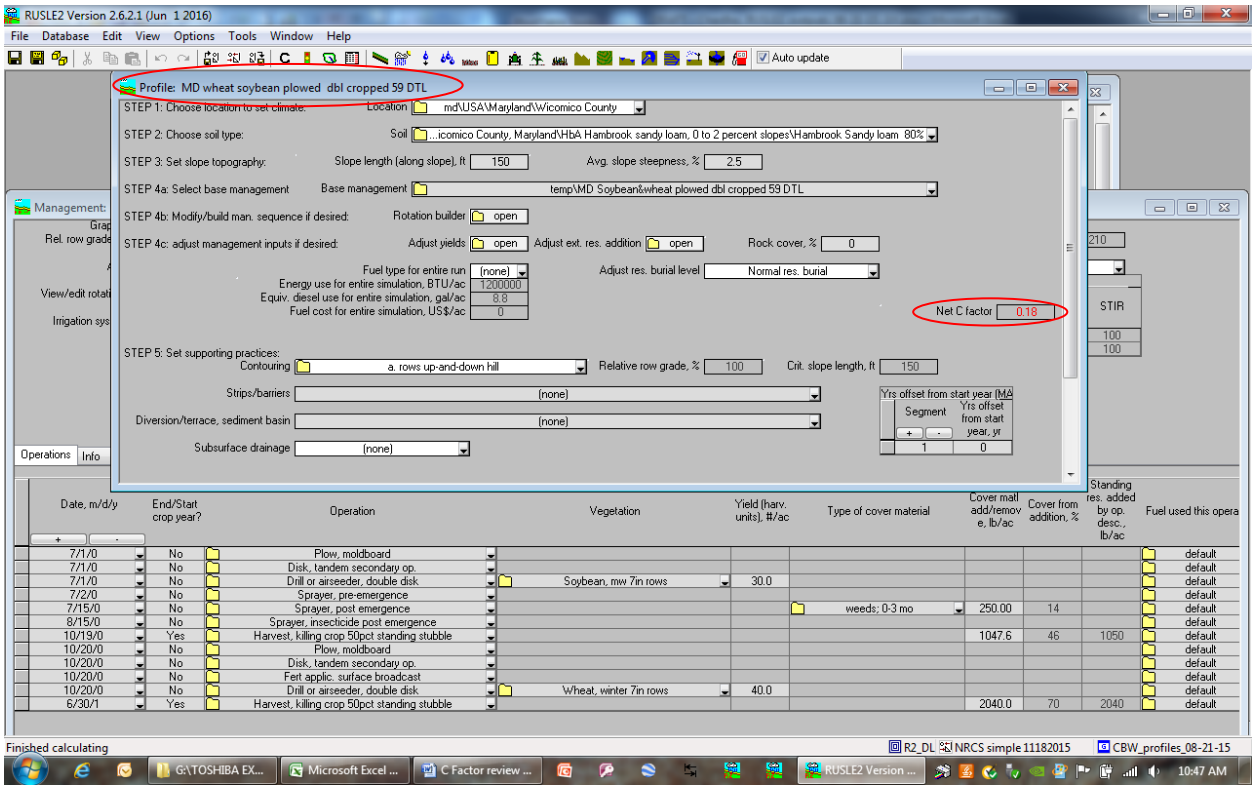


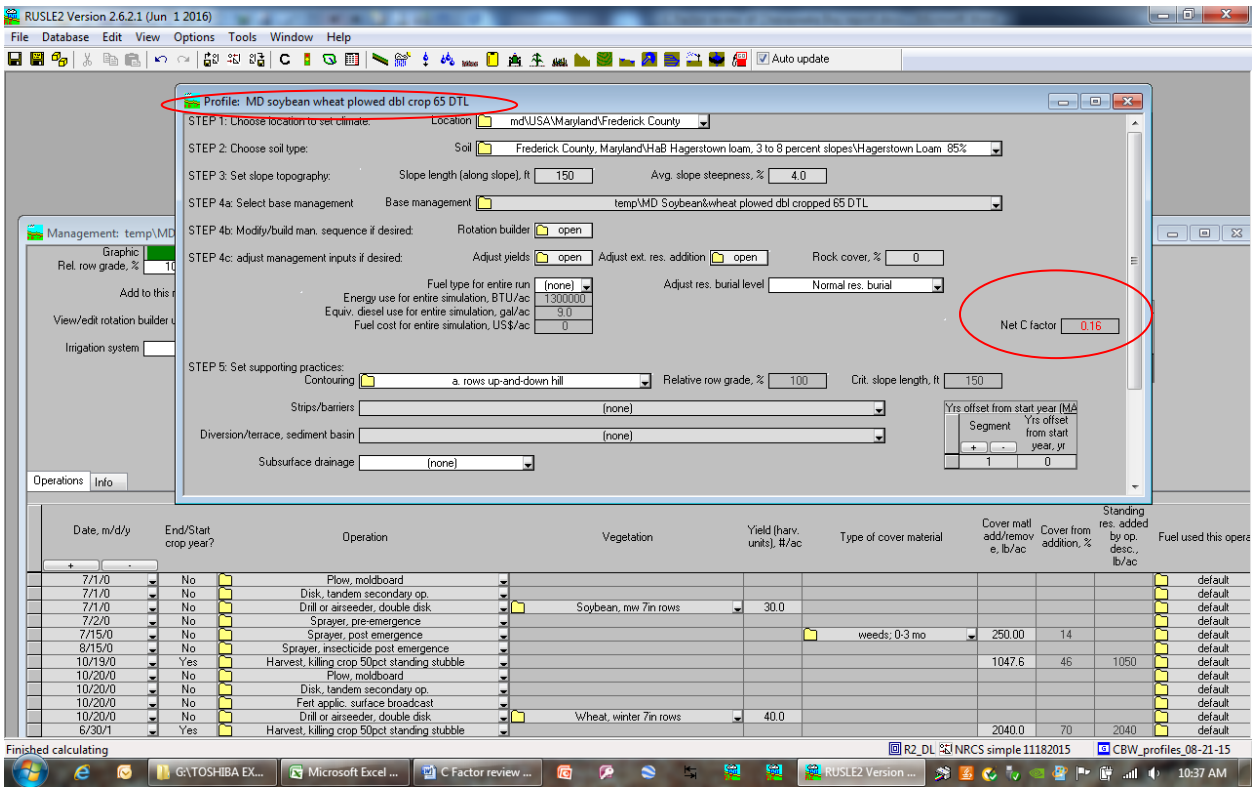
Note in this revised Soybean-wheat double crop example below that the Soybean planting dates are two months later than regular soybeans and that harvest is a bit later than regular soybeans but possible using a short season variety. Notice that wheat planting is about a month later than normal wheat resulting in somewhat less growth in the fall but still harvested normally for grain about July 1st with soybeans repeating.

Upon making revised RUSLE2 runs for DE Soybeans wheat in CMZ 59 and MD Soybeans and Wheat in CMZ 59 using the corrected managements the resulting net C values are much more comparible because they represent realistic conditions and similar cropping and tillage systems. Revised net C for **DE 59** Soybean wheat double cropped is 0.21, the corrected C value for **MD 59** Soybeans Wheat double cropped is 0.18 compared to the corrected Soybeans Wheat double cropped **MD 65** is 0.16. These differences are likely attributed to differerent climate files and different yields and are much more reasonable.

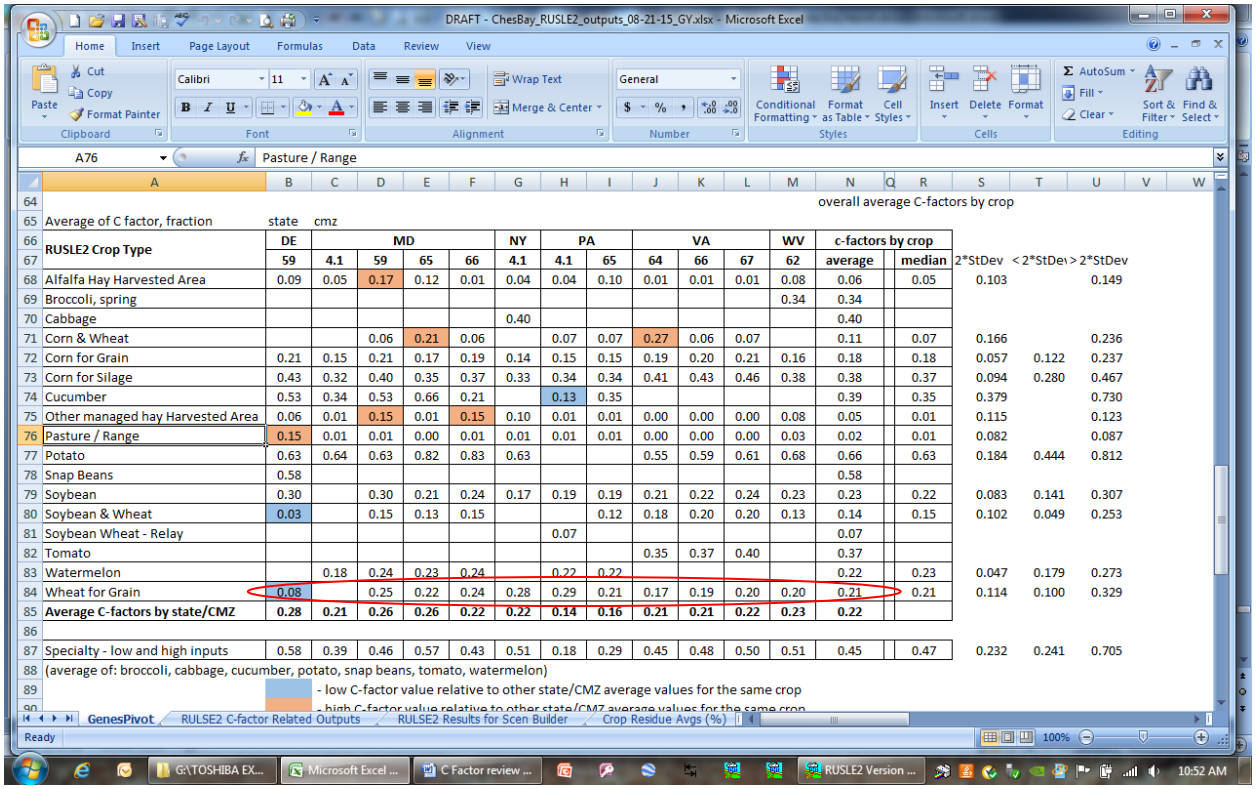


I recommend that all Soybean Wheat management files be corrected as illustrated and that all the runs be re done in this crop category. Wheat stubble harvest is optional but should be assumed or not assumed in all double cropped scenarios to reduce variability when comparing outputs across states and CMZ's. This will eliminate variability due to different systems and incorrectly built managements being being run and compared.


RUSLE2 Version 2.6.2.1 (Jun 1 2016)
File Database Edit View Options Tools Window Help
Auto update
Profile: MD wheat soybean plowed dbl cropped 59 DTL
STEP 1: Choose location to set climate:
Location md\USA\Maryland\Wicomico County
STEP 2: Choose soil type:
Soil ...icomico County, Maryland\HbA Hambrook sandy loam, 0 to 2 percent slopes\Hambrook Sandy loam 80%
STEP 3: Set slope topography:
Slope length (along slope), ft 150
Avg. slope steepness, % 2.5
STEP 4a: Select base management
Base management temp\MD Soybean&wheat plowed dbl cropped 59 DTL
STEP 4b: Modify/build man. sequence if desired:
Rotation builder open
STEP 4c: adjust management inputs if desired:
Adjust yields open
Adjust ext. res. addition open
Rock cover, % 0
Fuel type for entire run (none)
Energy use for entire simulation, BTU/ac 1200000
Equiv. diesel use for entire simulation, gal/ac 8.8
Fuel cost for entire simulation, US$/ac 0
Adjust res. burial level Normal res. burial
Net C factor 0.18
STEP 5: Set supporting practices:
Contouring a. rows up-and-down hill
Relative row grade, % 100
Crit. slope length, ft 150
Strips/barriers (none)
Diversion/terrace, sediment basin (none)
Subsurface drainage (none)
Yrs offset from start year (MA
Segment
Yrs offset from start year, yr
1 0
Operations Info
Date, m/d/y
End/Start crop year?
Operation
Vegetation
Yield (harv. units), #/ac
Type of cover material
Cover matl add/remove, lb/ac
Cover from addition, %
Standing res. added by op. desc., lb/ac
Fuel used this opera
7/1/0 No Plow, moldboard default
7/1/0 No Disk, tandem secondary op. default
7/1/0 No Drill or airseeder, double disk Soybean, mw 7in rows 30.0 default
7/2/0 No Sprayer, pre-emergence default
7/15/0 No Sprayer, post emergence weeds; 0-3 mo 250.00 14 default
8/15/0 No Sprayer, insecticide post emergence default
10/19/0 Yes Harvest, killing crop 50pct standing stubble 1047.6 46 1050 default
10/20/0 No Plow, moldboard default
10/20/0 No Disk, tandem secondary op. default
10/20/0 No Fert applic. surface broadcast default
10/20/0 No Drill or airseeder, double disk Wheat, winter 7in rows 40.0 default
6/30/1 Yes Harvest, killing crop 50pct standing stubble 2040.0 70 2040 default
Finished calculating
R2_DL NRCS simple 11182015
CBW_profiles_08-21-15
10:47 AM


RUSLE2 Version 2.6.2.1 (Jun 1 2016)
File Database Edit View Options Tools Window Help
Auto update
Profile: MD soybean wheat plowed dbl crop 65 DTL
STEP 1: Choose location to set climate:
Location md\USA\Maryland\Frederick County
STEP 2: Choose soil type:
Soil Frederick County, Maryland\HaB Hagerstown loam, 3 to 8 percent slopes\Hagerstown Loam 85%
STEP 3: Set slope topography:
Slope length (along slope), ft 150
Avg. slope steepness, % 4.0
STEP 4a: Select base management
Base management temp\MD Soybean&wheat plowed dbl cropped 65 DTL
STEP 4b: Modify/build man. sequence if desired:
Rotation builder open
STEP 4c: adjust management inputs if desired:
Adjust yields open
Adjust ext. res. addition open
Rock cover, % 0
Fuel type for entire run (none)
Energy use for entire simulation, BTU/ac 1300000
Equiv. diesel use for entire simulation, gal/ac 9.0
Fuel cost for entire simulation, US$/ac 0
Adjust res. burial level Normal res. burial
Net C factor 0.16
STEP 5: Set supporting practices:
Contouring a. rows up-and-down hill
Relative row grade, % 100
Crit. slope length, ft 150
Strips/barriers (none)
Diversion/terrace, sediment basin (none)
Subsurface drainage (none)
Yrs offset from start year (MA
Segment
Yrs offset from start year, yr
1 0
Operations Info
Date, m/d/y
End/Start crop year?
Operation
Vegetation
Yield (harv. units), #/ac
Type of cover material
Cover matl add/remove, lb/ac
Cover from addition, %
Standing res. added by op. desc., lb/ac
Fuel used this opera
7/1/0 No Plow, moldboard default
7/1/0 No Disk, tandem secondary op. default
7/1/0 No Drill or airseeder, double disk Soybean, mw 7in rows 30.0 default
7/2/0 No Sprayer, pre-emergence default
7/15/0 No Sprayer, post emergence weeds; 0-3 mo 250.00 14 default
8/15/0 No Sprayer, insecticide post emergence default
10/19/0 Yes Harvest, killing crop 50pct standing stubble 1047.6 46 1050 default
10/20/0 No Plow, moldboard default
10/20/0 No Disk, tandem secondary op. default
10/20/0 No Fert applic. surface broadcast default
10/20/0 No Drill or airseeder, double disk Wheat, winter 7in rows 40.0 default
6/30/1 Yes Harvest, killing crop 50pct standing stubble 2040.0 70 2040 default
Finished calculating
R2_DL NRCS simple 11182015
CBW_profiles_08-21-15
10:37 AM

Wheat for grain



Average of C factor, fraction — state cmz

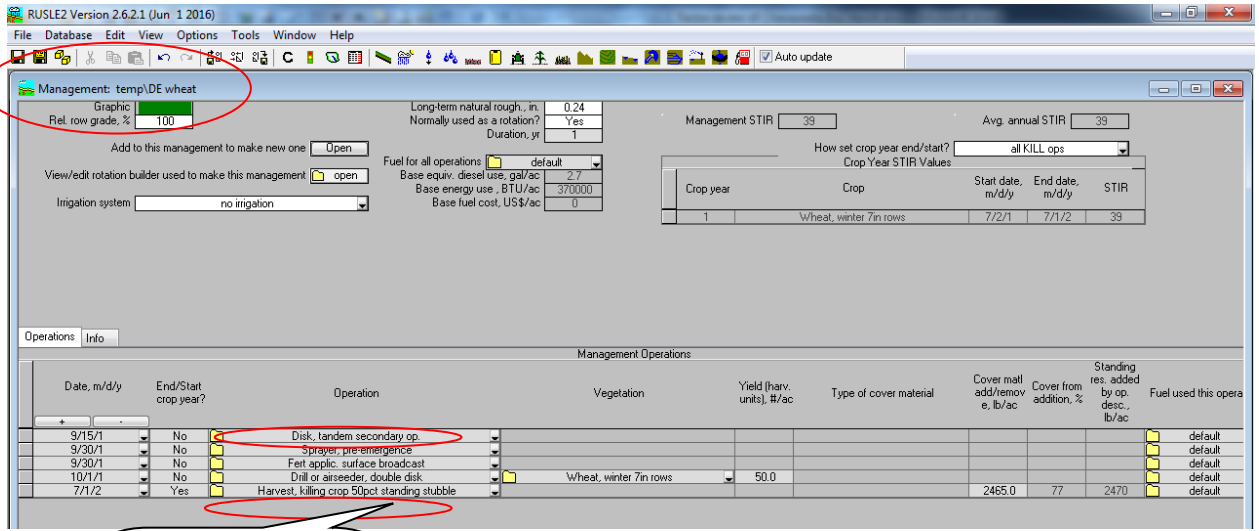
RUSLE2 Crop Type	DE	MD				NY	PA		VA			WV	c-factors by crop		2*StDev	<2*StDev>	2*StDev
	59	4.1	59	65	66	4.1	4.1	65	64	66	67	62	average	median			
Alfalfa Hay Harvested Area	0.09	0.05	0.17	0.12	0.01	0.04	0.04	0.10	0.01	0.01	0.01	0.08	0.06	0.05	0.103		0.149
Broccoli, spring												0.34	0.34				
Cabbage						0.40							0.40				
Corn & Wheat			0.06	0.21	0.06		0.07	0.07	0.27	0.06	0.07		0.11	0.07	0.166		0.236
Corn for Grain	0.21	0.15	0.21	0.17	0.19	0.14	0.15	0.15	0.19	0.20	0.21	0.16	0.18	0.18	0.057	0.122	0.237
Corn for Silage	0.43	0.32	0.40	0.35	0.37	0.33	0.34	0.34	0.41	0.43	0.46	0.38	0.38	0.37	0.094	0.280	0.467
Cucumber	0.53	0.34	0.53	0.66	0.21		0.13	0.35					0.39	0.35	0.379		0.730
Other managed hay Harvested Area	0.06	0.01	0.15	0.01	0.15	0.10	0.01	0.01	0.00	0.00	0.00	0.08	0.05	0.01	0.115		0.123
Pasture / Range	0.15	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.03	0.02	0.01	0.082		0.087
Potato	0.63	0.64	0.63	0.82	0.83	0.63			0.55	0.59	0.61	0.68	0.66	0.63	0.184	0.444	0.812
Snap Beans	0.58												0.58				
Soybean	0.30		0.30	0.21	0.24	0.17	0.19	0.19	0.21	0.22	0.24	0.23	0.23	0.22	0.083	0.141	0.307
Soybean & Wheat	0.03		0.15	0.13	0.15			0.12	0.18	0.20	0.20	0.13	0.14	0.15	0.102	0.049	0.253
Soybean Wheat - Relay							0.07						0.07				
Tomato									0.35	0.37	0.40		0.37				
Watermelon		0.18	0.24	0.23	0.24		0.22	0.22					0.22	0.23	0.047	0.179	0.273
Wheat for Grain	0.08		0.25	0.22	0.24	0.28	0.29	0.21	0.17	0.19	0.20	0.20	0.21	0.21	0.114	0.100	0.329
Average C-factors by state/CMZ	**0.28**	**0.21**	**0.26**	**0.26**	**0.22**	**0.22**	**0.14**	**0.16**	**0.21**	**0.21**	**0.22**	**0.23**	**0.22**				
Specialty - low and high inputs	0.58	0.39	0.46	0.57	0.43	0.51	0.18	0.29	0.45	0.48	0.50	0.51	0.45	0.47	0.232	0.241	0.705

(average of: broccoli, cabbage, cucumber, potato, snap beans, tomato, watermelon)

overall average C-factors by crop

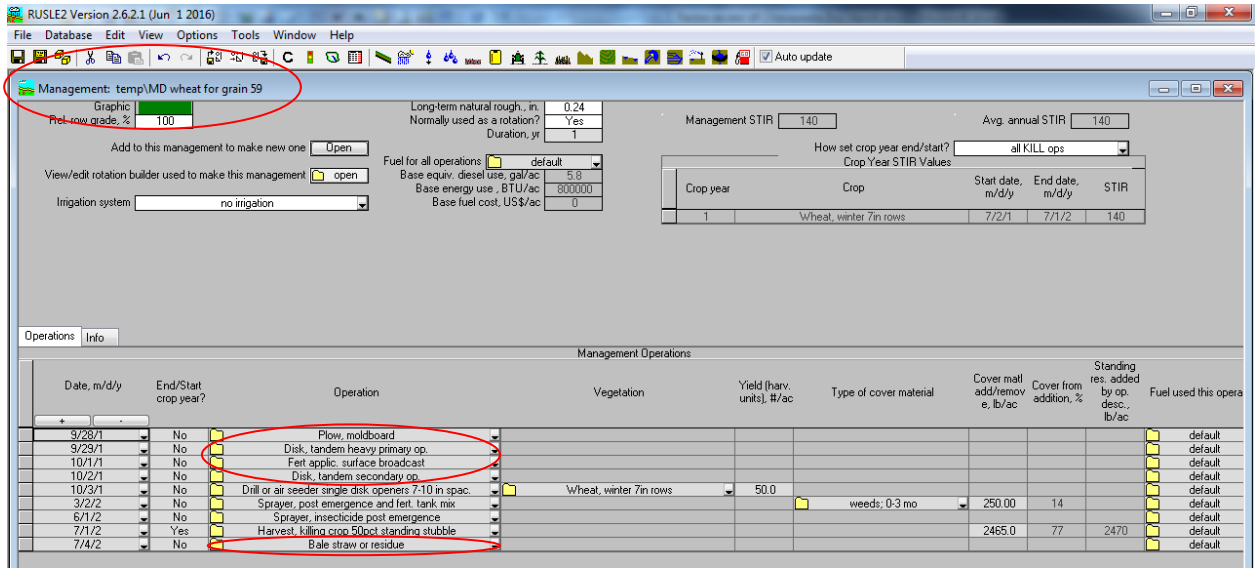
- low C-factor value relative to other state/CMZ average values for the same crop

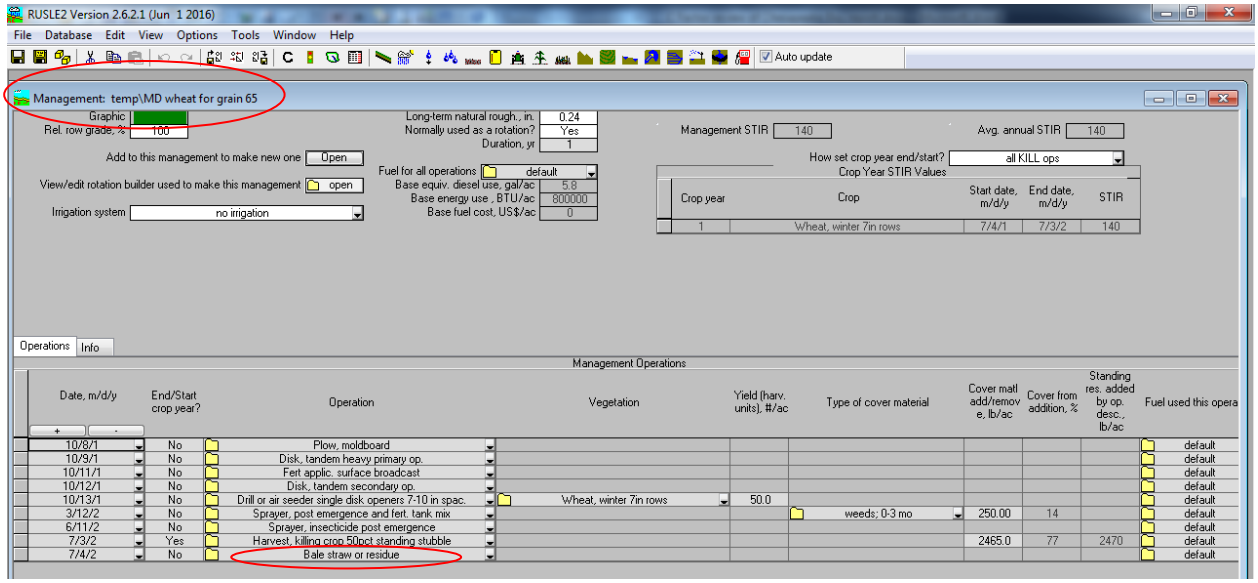
These files appear to be in pretty good shape except the DE wheat file is not for a plow based tillage system and did not bale and harvest the straw therefore a significantly lower net C factor of 0.08 resulted. See below.

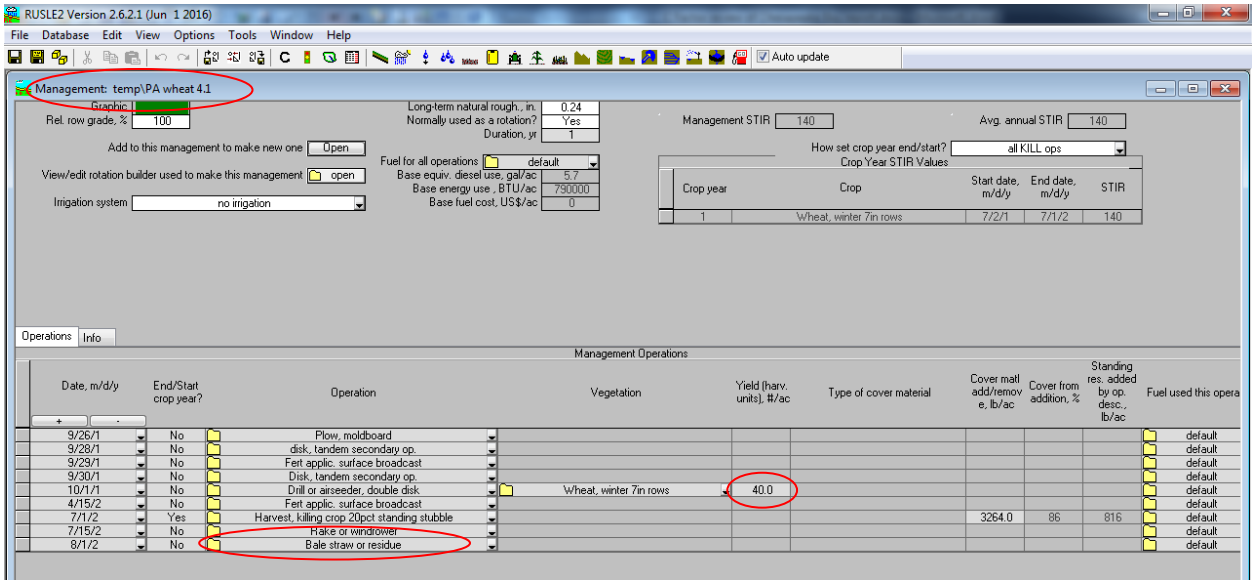


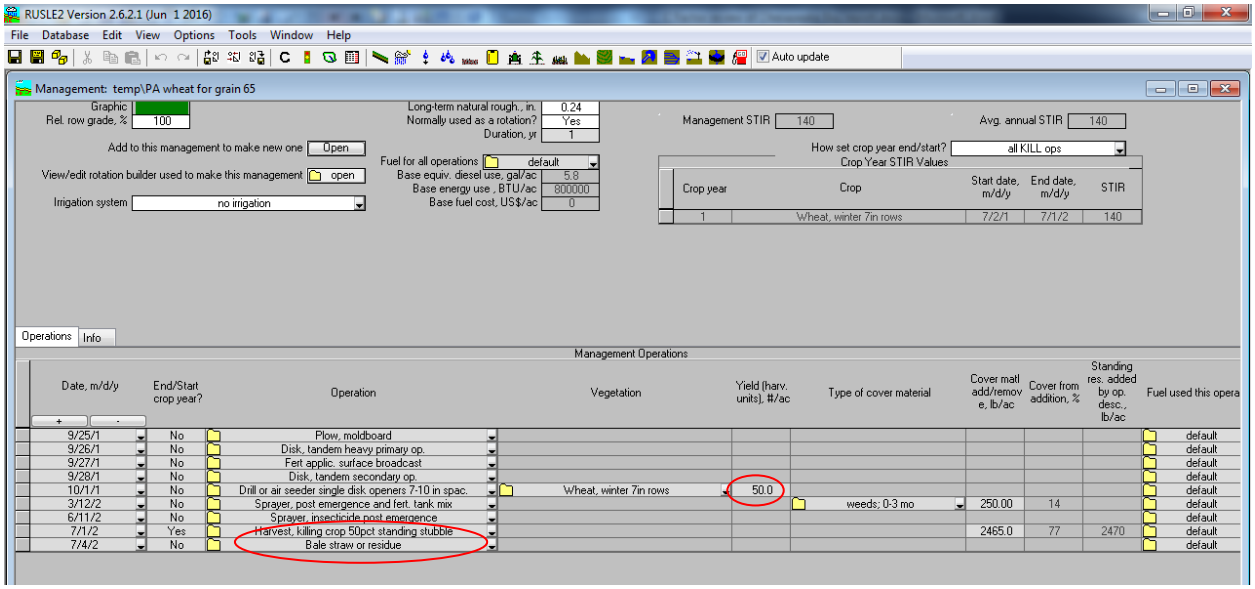
Straw not baled and removed

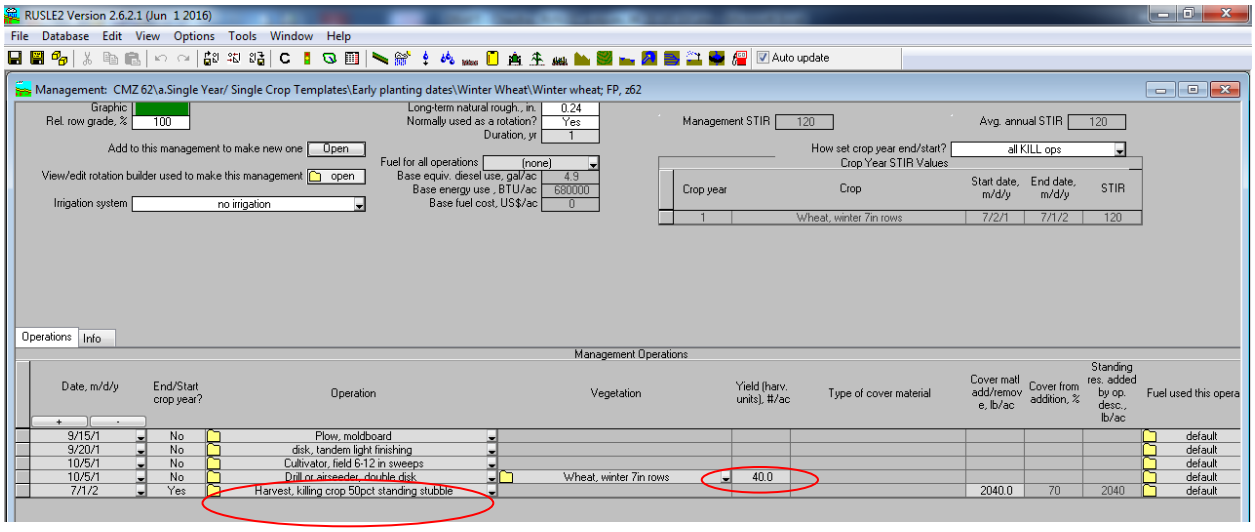
Several of the other wheat grain files I checked include a plow and disk and baled the straw after grain harvest but some omitted the straw baling. This inconsistency in the amount of crop residue being left after grain harvest affects the Net C factor. Continuous wheat is not as likely to be grown as frequently as continuous corn, corn silage or soybeans due to disease and insect problems, commodity prices and government programs.

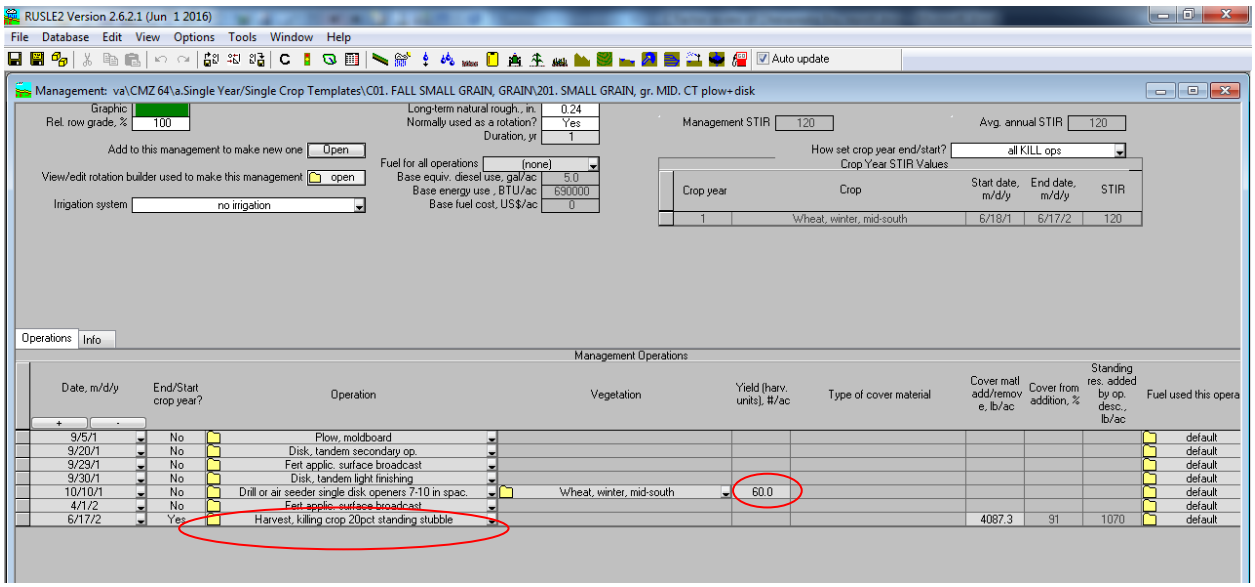


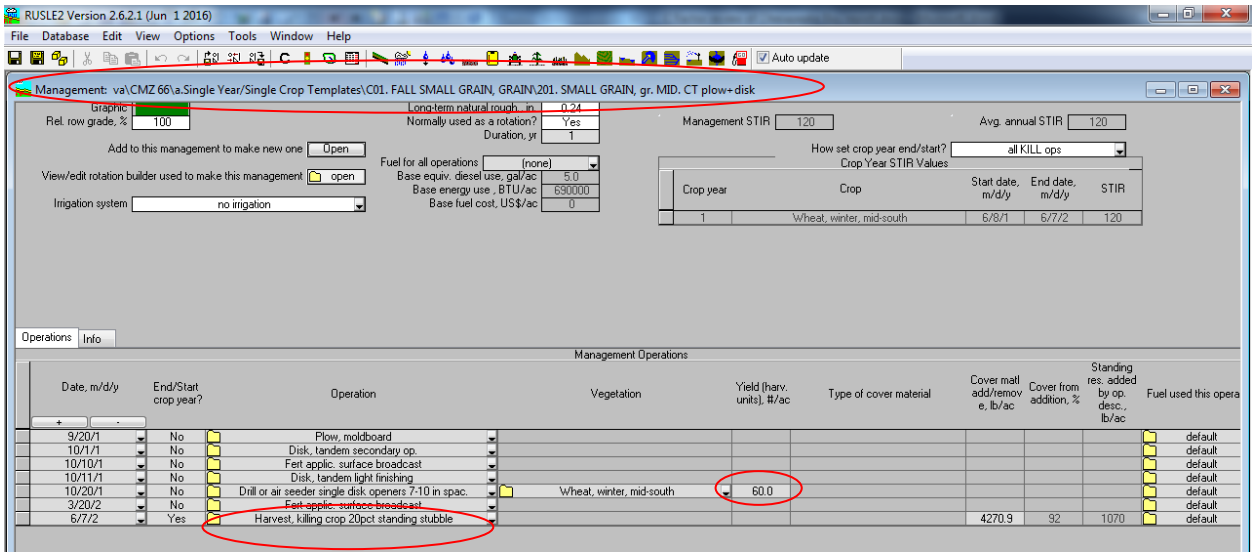


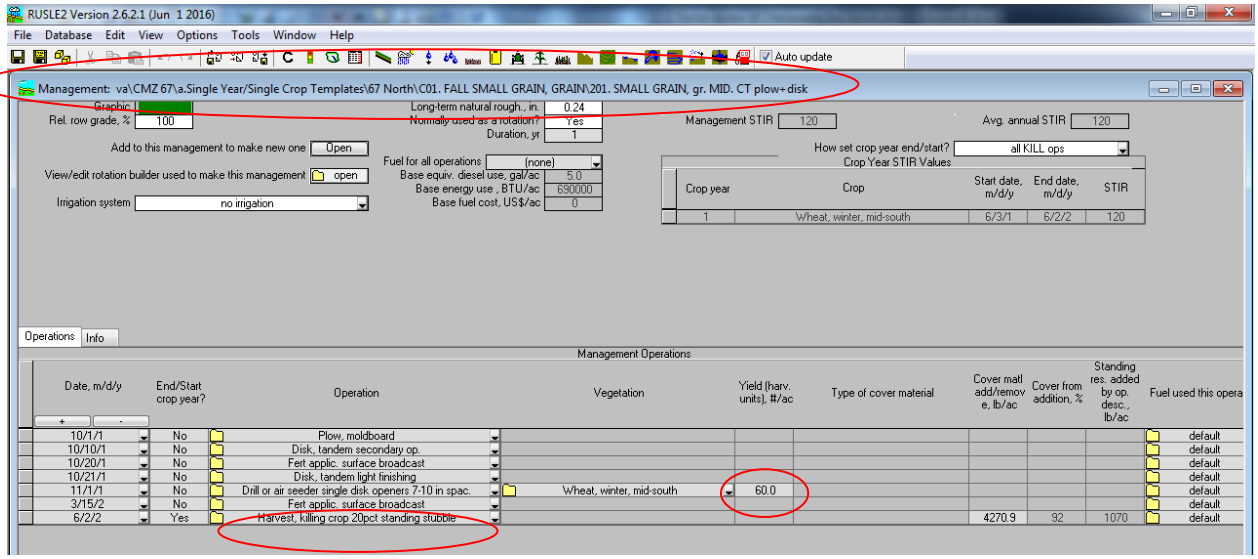

RUSLE2 Version 2.6.2.1 (Jun 1 2016)
File Database Edit View Options Tools Window Help
Auto update
Management: temp\PA wheat 4.1
Graphic
Rel. row grade, %
100
Long-term natural rough., in.
0.24
Normally used as a rotation?
Yes
Duration, yr
1
Management STIR
140
Avg. annual STIR
140
Add to this management to make new one
Open
How set crop year end/start?
all KILL ops
Crop Year STIR Values
View/edit rotation builder used to make this management
open
Fuel for all operations
default
Base equiv. diesel use, gal/ac
5.7
Base energy use , BTU/ac
790000
Base fuel cost, US$/ac
0
Irrigation system
no irrigation
Crop year
Crop
Start date, m/d/y
End date, m/d/y
STIR
1
Wheat, winter 7in rows
7/2/1
7/1/2
140
Operations
Info
Management Operations
Date, m/d/y
End/Start crop year?
Operation
Vegetation
Yield (harv. units), #/ac
Type of cover material
Cover matl add/remove, lb/ac
Cover from addition, %
Standing res. added by op. desc., lb/ac
Fuel used this opera
9/26/1 No Plow, moldboard default
9/28/1 No disk, tandem secondary op. default
9/29/1 No Fert applic. surface broadcast default
9/30/1 No Disk, tandem secondary op. default
10/1/1 No Drill or airseeder, double disk Wheat, winter 7in rows 40.0 default
4/15/2 No Fert applic. surface broadcast default
7/1/2 Yes Harvest, killing crop 20pct standing stubble 3264.0 86 816 default
7/15/2 No Rake or windrower default
8/1/2 No Bale straw or residue default


RUSLE2 Version 2.6.2.1 (Jun 1 2016)
File Database Edit View Options Tools Window Help
Auto update
Management: temp\PA wheat for grain 65
Graphic
Rel. row grade, %
100
Long-term natural rough., in.
0.24
Normally used as a rotation?
Yes
Duration, yr
1
Management STIR
140
Avg. annual STIR
140
Add to this management to make new one
Open
How set crop year end/start?
all KILL ops
Crop Year STIR Values
View/edit rotation builder used to make this management
open
Fuel for all operations
default
Base equiv. diesel use, gal/ac
5.8
Base energy use , BTU/ac
800000
Base fuel cost, US$/ac
0
Irrigation system
no irrigation
Crop year
Crop
Start date, m/d/y
End date, m/d/y
STIR
1
Wheat, winter 7in rows
7/2/1
7/1/2
140
Operations
Info
Management Operations
Date, m/d/y
End/Start crop year?
Operation
Vegetation
Yield (harv. units), #/ac
Type of cover material
Cover matl add/remove, lb/ac
Cover from addition, %
Standing res. added by op. desc., lb/ac
Fuel used this opera
9/25/1 No Plow, moldboard default
9/26/1 No Disk, tandem heavy primary op. default
9/27/1 No Fert applic. surface broadcast default
9/28/1 No Disk, tandem secondary op. default
10/1/1 No Drill or air seeder single disk openers 7-10 in spac. Wheat, winter 7in rows 50.0 default
3/12/2 No Sprayer, post emergence and fert. tank mix weeds; 0-3 mo 250.00 14 default
6/11/2 No Sprayer, insecticide post emergence default
7/1/2 Yes Harvest, killing crop 50pct standing stubble 2465.0 77 2470 default
7/4/2 No Bale straw or residue default


RUSLE2 Version 2.6.2.1 (Jun 1 2016)
File Database Edit View Options Tools Window Help
Auto update
Management: CMZ 62\a.Single Year/ Single Crop Templates\Early planting dates\Winter Wheat\Winter wheat; FP, z62
Graphic
Rel. row grade, %
100
Long-term natural rough., in.
0.24
Normally used as a rotation?
Yes
Duration, yr
1
Management STIR
120
Avg. annual STIR
120
Add to this management to make new one
Open
How set crop year end/start?
all KILL ops
Fuel for all operations
(none)
View/edit rotation builder used to make this management
open
Base equiv. diesel use, gal/ac
4.9
Base energy use , BTU/ac
680000
Base fuel cost, US$/ac
0
Irrigation system
no irrigation
Crop Year STIR Values
Crop year
Crop
Start date, m/d/y
End date, m/d/y
STIR
1
Wheat, winter 7in rows
7/2/1
7/1/2
120
Operations
Info
Management Operations
Date, m/d/y
End/Start crop year?
Operation
Vegetation
Yield (harv. units), #/ac
Type of cover material
Cover matl add/remove, lb/ac
Cover from addition, %
Standing res. added by op. desc., lb/ac
Fuel used this opera
9/15/1
No
Plow, moldboard
default
9/20/1
No
disk, tandem light finishing
default
10/5/1
No
Cultivator, field 6-12 in sweeps
default
10/5/1
No
Drill or airseeder, double disk
Wheat, winter 7in rows
40.0
default
7/1/2
Yes
Harvest, killing crop 50pct standing stubble
2040.0
70
2040
default


RUSLE2 Version 2.6.2.1 (Jun 1 2016)
File Database Edit View Options Tools Window Help
Auto update
Management: va\CMZ 64\a.Single Year/Single Crop Templates\C01. FALL SMALL GRAIN, GRAIN\201. SMALL GRAIN, gr. MID. CT plow+disk
Graphic
Rel. row grade, %
100
Long-term natural rough., in.
0.24
Normally used as a rotation?
Yes
Duration, yr
1
Management STIR
120
Avg. annual STIR
120
Add to this management to make new one
Open
How set crop year end/start?
all KILL ops
Fuel for all operations
(none)
View/edit rotation builder used to make this management
open
Base equiv. diesel use, gal/ac
5.0
Base energy use , BTU/ac
690000
Base fuel cost, US$/ac
0
Irrigation system
no irrigation
Crop Year STIR Values
Crop year
Crop
Start date, m/d/y
End date, m/d/y
STIR
1
Wheat, winter, mid-south
6/18/1
6/17/2
120
Operations
Info
Management Operations
Date, m/d/y
End/Start crop year?
Operation
Vegetation
Yield (harv. units), #/ac
Type of cover material
Cover matl add/remove, lb/ac
Cover from addition, %
Standing res. added by op. desc., lb/ac
Fuel used this opera
9/5/1
No
Plow, moldboard
default
9/20/1
No
Disk, tandem secondary op.
default
9/29/1
No
Fert applic. surface broadcast
default
9/30/1
No
Disk, tandem light finishing
default
10/10/1
No
Drill or air seeder single disk openers 7-10 in spac.
Wheat, winter, mid-south
60.0
default
4/1/2
No
Fert applic. surface broadcast
default
6/17/2
Yes
Harvest, killing crop 20pct standing stubble
4087.3
91
1070
default

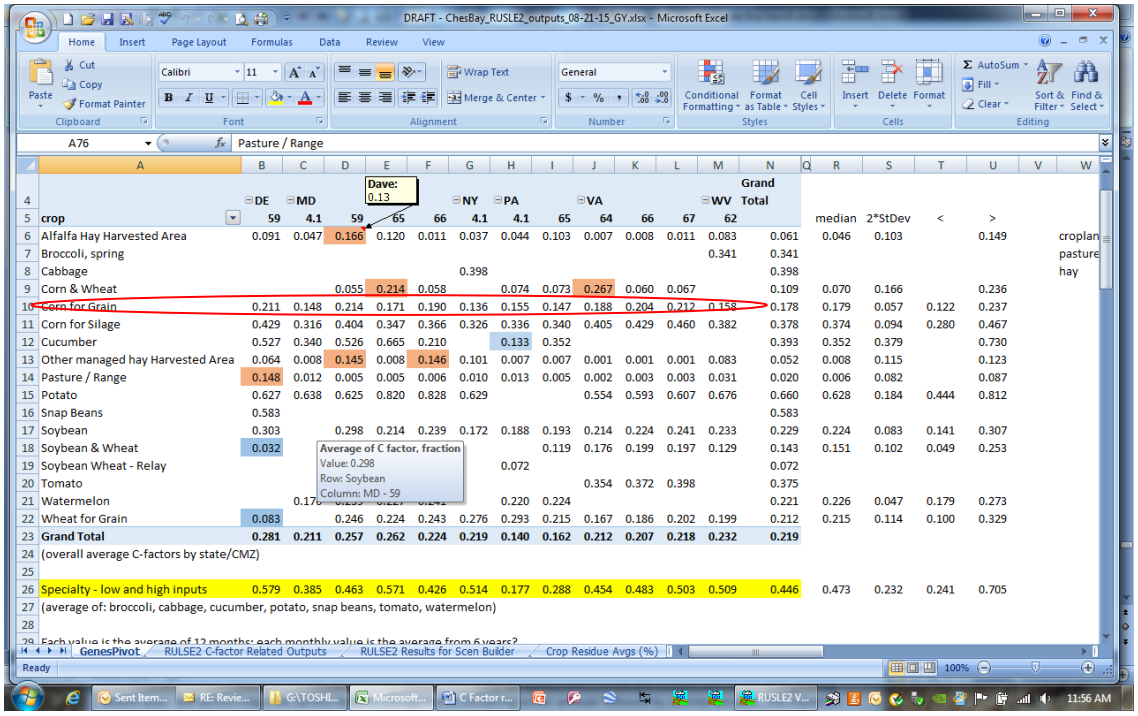

RUSLE2 Version 2.6.2.1 (Jun 1 2016)
File Database Edit View Options Tools Window Help
Auto update
Management: va\CMZ 66\a.Single Year/Single Crop Templates\C01. FALL SMALL GRAIN, GRAIN\201. SMALL GRAIN, gr. MID. CT plow+disk
Graphic
Rel. row grade, %
100
Long-term natural rough., in.
0.24
Normally used as a rotation?
Yes
Duration, yr
1
Management STIR
120
Avg. annual STIR
120
Add to this management to make new one
Open
How set crop year end/start?
all KILL ops
Fuel for all operations
(none)
View/edit rotation builder used to make this management
open
Base equiv. diesel use, gal/ac
5.0
Base energy use , BTU/ac
690000
Base fuel cost, US$/ac
0
Irrigation system
no irrigation
Crop Year STIR Values
Crop year
Crop
Start date, m/d/y
End date, m/d/y
STIR
1
Wheat, winter, mid-south
6/8/1
6/7/2
120
Operations
Info
Management Operations
Date, m/d/y
End/Start crop year?
Operation
Vegetation
Yield (harv. units), #/ac
Type of cover material
Cover matl add/remove, lb/ac
Cover from addition, %
Standing res. added by op. desc., lb/ac
Fuel used this opera
9/20/1
No
Plow, moldboard
default
10/1/1
No
Disk, tandem secondary op.
default
10/10/1
No
Fert applic. surface broadcast
default
10/11/1
No
Disk, tandem light finishing
default
10/20/1
No
Drill or air seeder single disk openers 7-10 in spac.
Wheat, winter, mid-south
60.0
default
3/20/2
No
Fert applic. surface broadcast
default
6/7/2
Yes
Harvest, killing crop 20pct standing stubble
4270.9
92
1070
default



Climatic differences and yield differences correctly account for the majority of differences between Net C factors across the other states and CMZs in this wheat crop type. However the fact that straw was not baled and removed in DE, WV and VA are likely the cause for Net C factors to be lower and residue amounts higher in these areas.

I recommend a common scenario be defined as to tillage system and whether the straw is baled and removed or not removed and depending on the decision, the Wheat grain management files be revised accordingly to represent the same system throughout the watershed and re run.

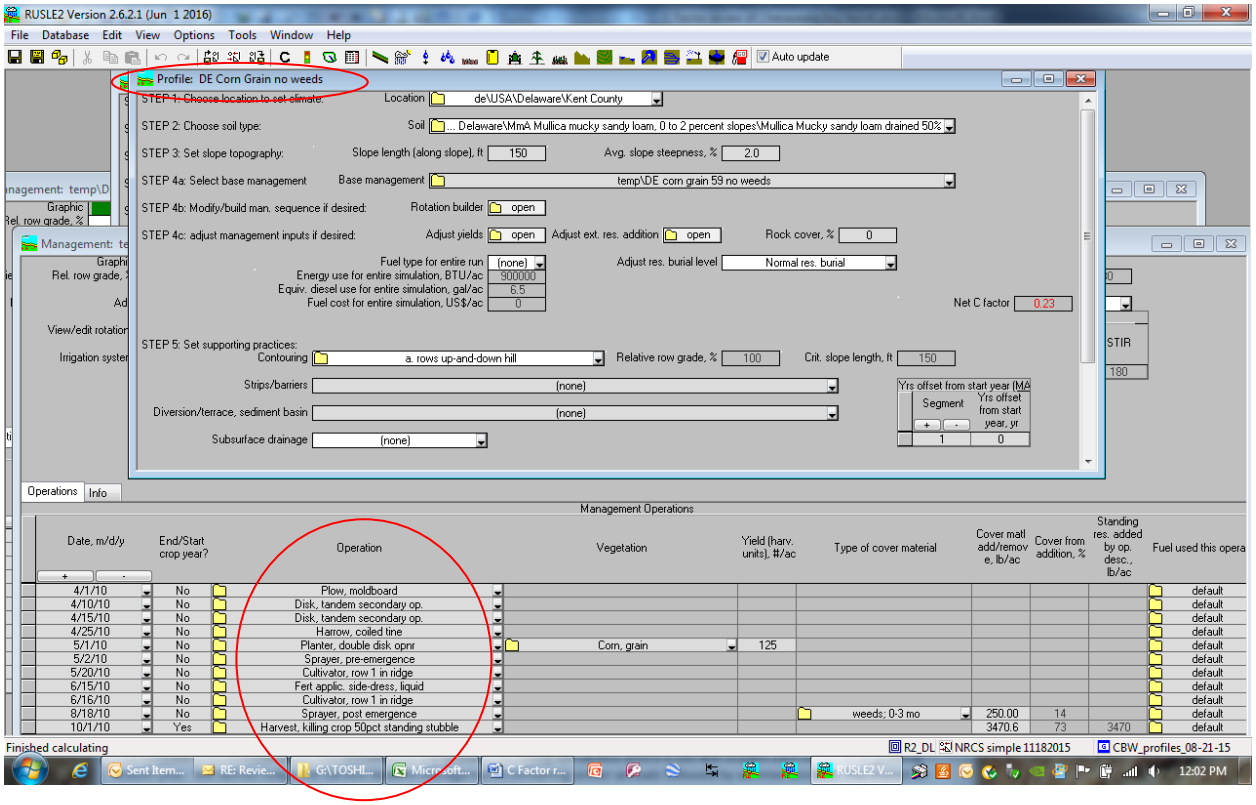
Corn for grain

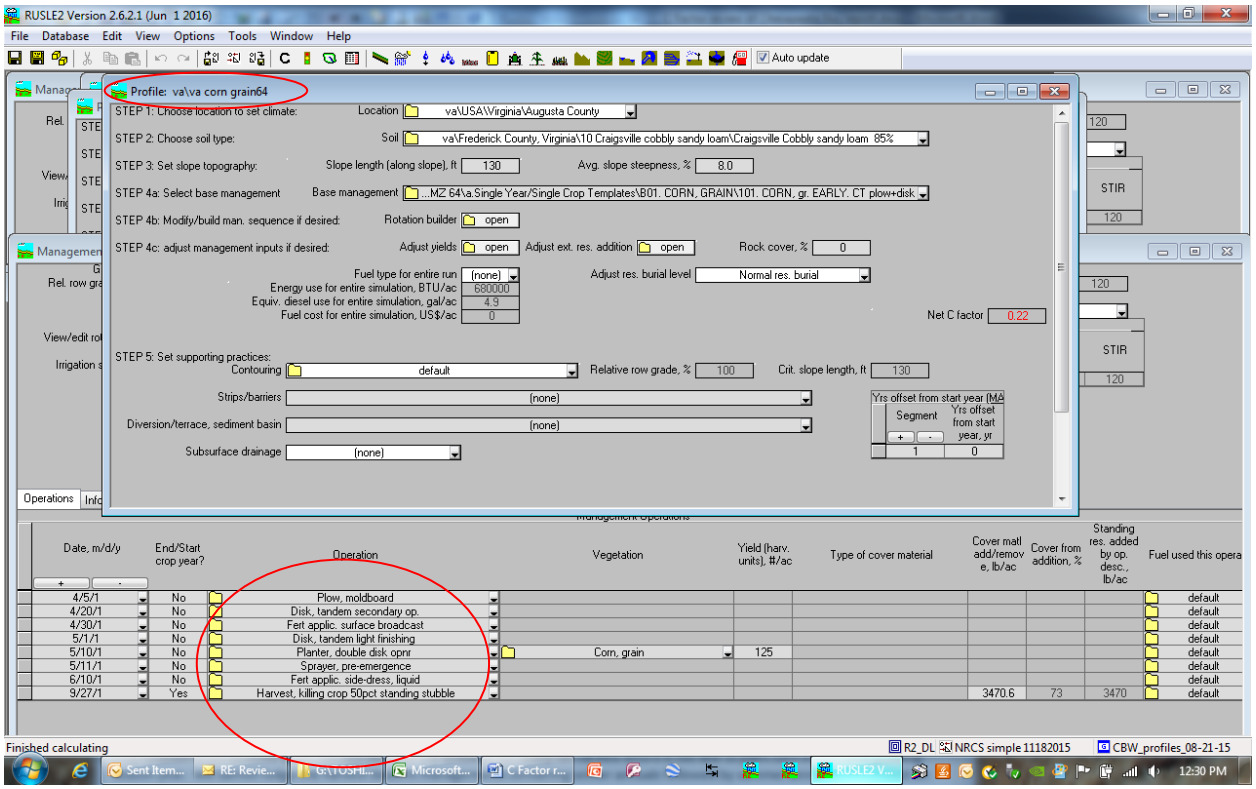


crop	DE 59	MD 4.1	59	65	66	NY 4.1	PA 4.1	65	VA 64	66	67	WV 62	Grand Total	median	2*StDev	<	>	
Alfalfa Hay Harvested Area	0.091	0.047	0.166	0.120	0.011	0.037	0.044	0.103	0.007	0.008	0.011	0.083	0.061	0.046	0.103		0.149	croplan
Broccoli, spring												0.341	0.341					pasture
Cabbage						0.398							0.398					hay
Corn & Wheat			0.055	0.214	0.058		0.074	0.073	0.267	0.060	0.067		0.109	0.070	0.166		0.236	
Corn for Grain	0.211	0.148	0.214	0.171	0.190	0.136	0.155	0.147	0.188	0.204	0.212	0.158	0.178	0.179	0.057	0.122	0.237	
Corn for Silage	0.429	0.316	0.404	0.347	0.366	0.326	0.336	0.340	0.405	0.429	0.460	0.382	0.378	0.374	0.094	0.280	0.467	
Cucumber	0.527	0.340	0.526	0.665	0.210		0.133	0.352					0.393	0.352	0.379		0.730	
Other managed hay Harvested Area	0.064	0.008	0.145	0.008	0.146	0.101	0.007	0.007	0.001	0.001	0.001	0.083	0.052	0.008	0.115		0.123	
Pasture / Range	0.148	0.012	0.005	0.005	0.006	0.010	0.013	0.005	0.002	0.003	0.003	0.031	0.020	0.006	0.082		0.087	
Potato	0.627	0.638	0.625	0.820	0.828	0.629			0.554	0.593	0.607	0.676	0.660	0.628	0.184	0.444	0.812	
Snap Beans	0.583												0.583					
Soybean	0.303		0.298	0.214	0.239	0.172	0.188	0.193	0.214	0.224	0.241	0.233	0.229	0.224	0.083	0.141	0.307	
Soybean & Wheat	0.032							0.119	0.176	0.199	0.197	0.129	0.143	0.151	0.102	0.049	0.253	
Soybean Wheat - Relay							0.072						0.072					
Tomato									0.354	0.372	0.398		0.375					
Watermelon		0.176						0.220	0.224				0.221	0.226	0.047	0.179	0.273	
Wheat for Grain	0.083		0.246	0.224	0.243	0.276	0.293	0.215	0.167	0.186	0.202	0.199	0.212	0.215	0.114	0.100	0.329	
Grand Total	**0.281**	**0.211**	**0.257**	**0.262**	**0.224**	**0.219**	**0.140**	**0.162**	**0.212**	**0.207**	**0.218**	**0.232**	**0.219**					
(overall average C-factors by state/CMZ)																		
Specialty - low and high inputs	0.579	0.385	0.463	0.571	0.426	0.514	0.177	0.288	0.454	0.483	0.503	0.509	0.446	0.473	0.232	0.241	0.705	
(average of: broccoli, cabbage, cucumber, potato, snap beans, tomato, watermelon)																		
Each value is the average of 12 months; each monthly value is the average from 6 years?																		

This crop group was not identified as having inconsistent C factors. However, I found some errors and inconsistencies in these corn grain management scenarios. Some files included a stalk shredder after harvest that would increase the percent residue cover over winter and early spring prior to plowing when compared to systems lacking this operation.

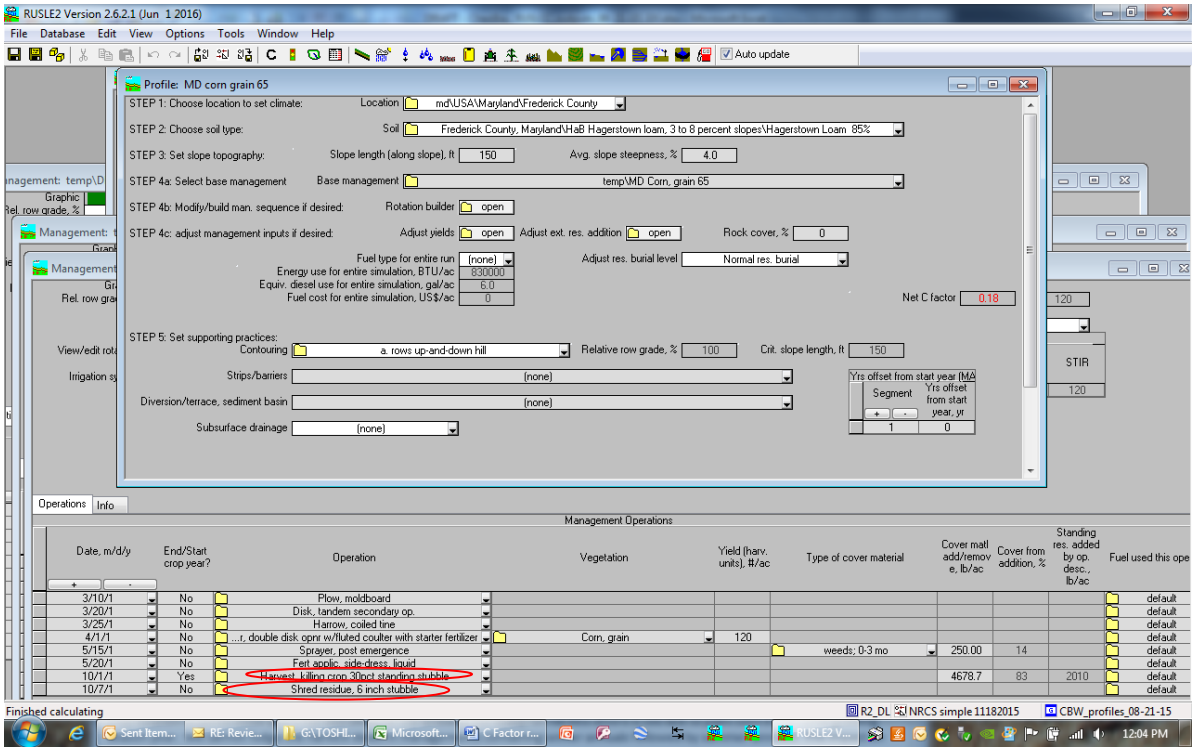
Good example correctly built:

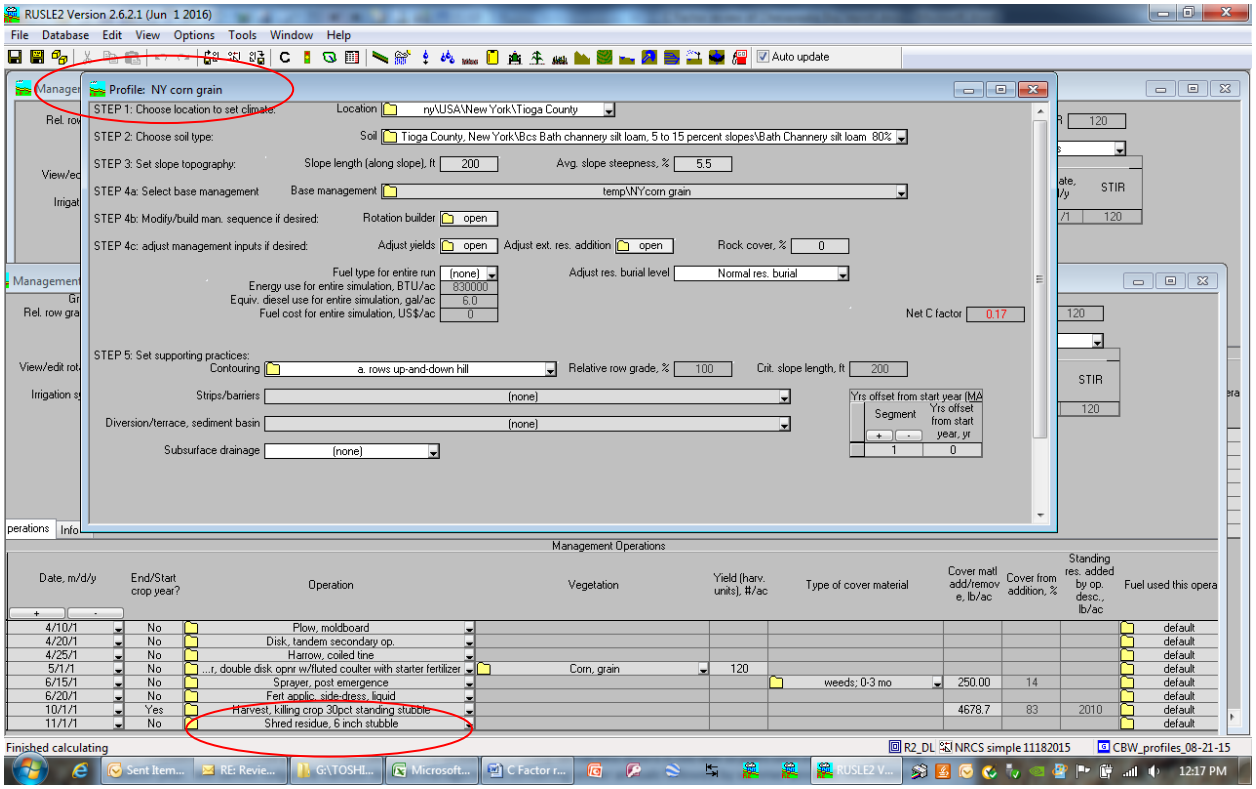


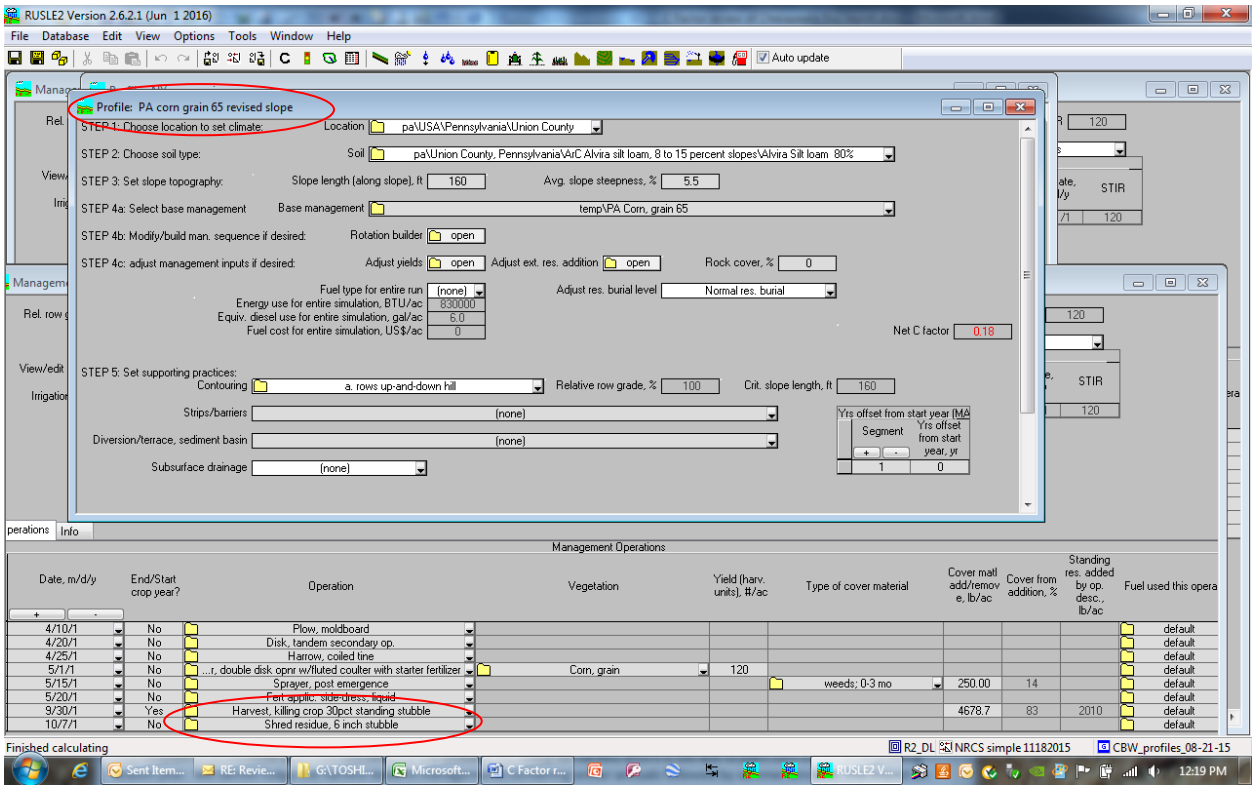


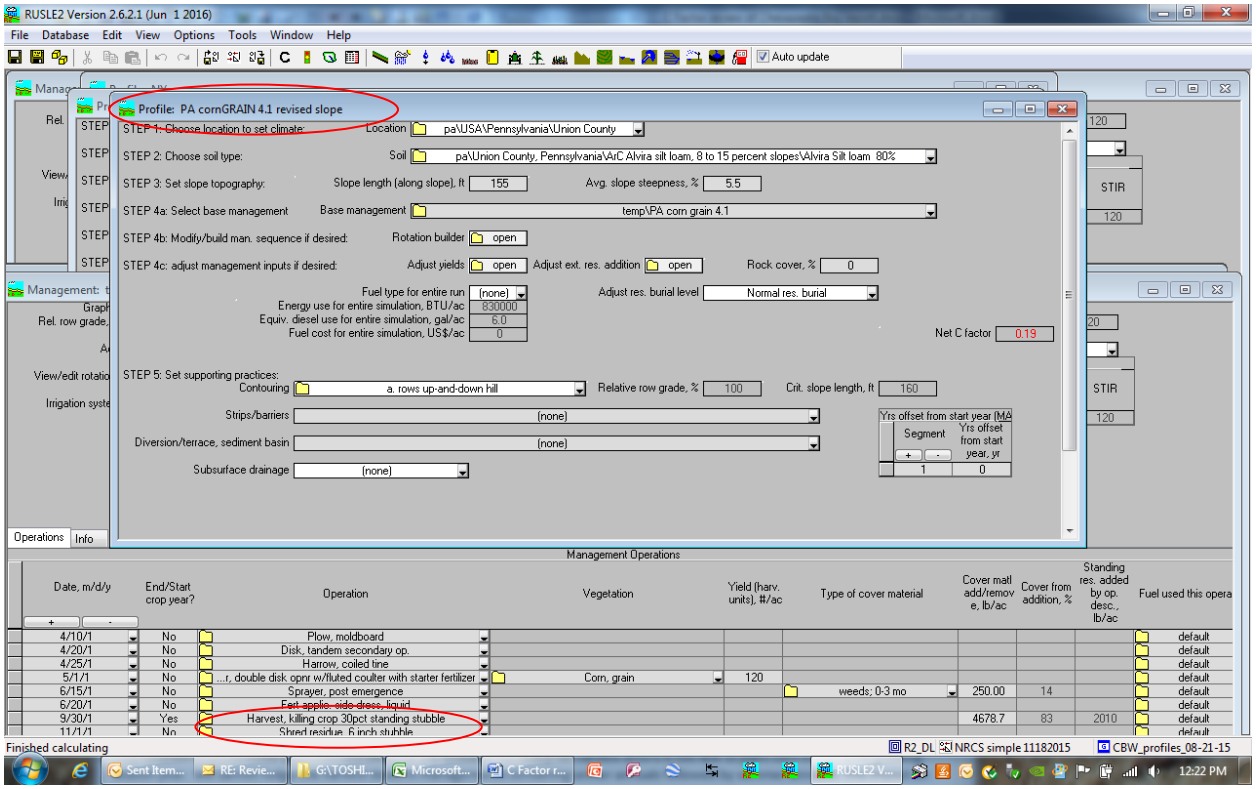
These two files are correctly built but neither has a stalk shredder following harvest as most of the rest of the corn grain managements do in the other states and CMZs across the region.

MD corn grain 65 example:



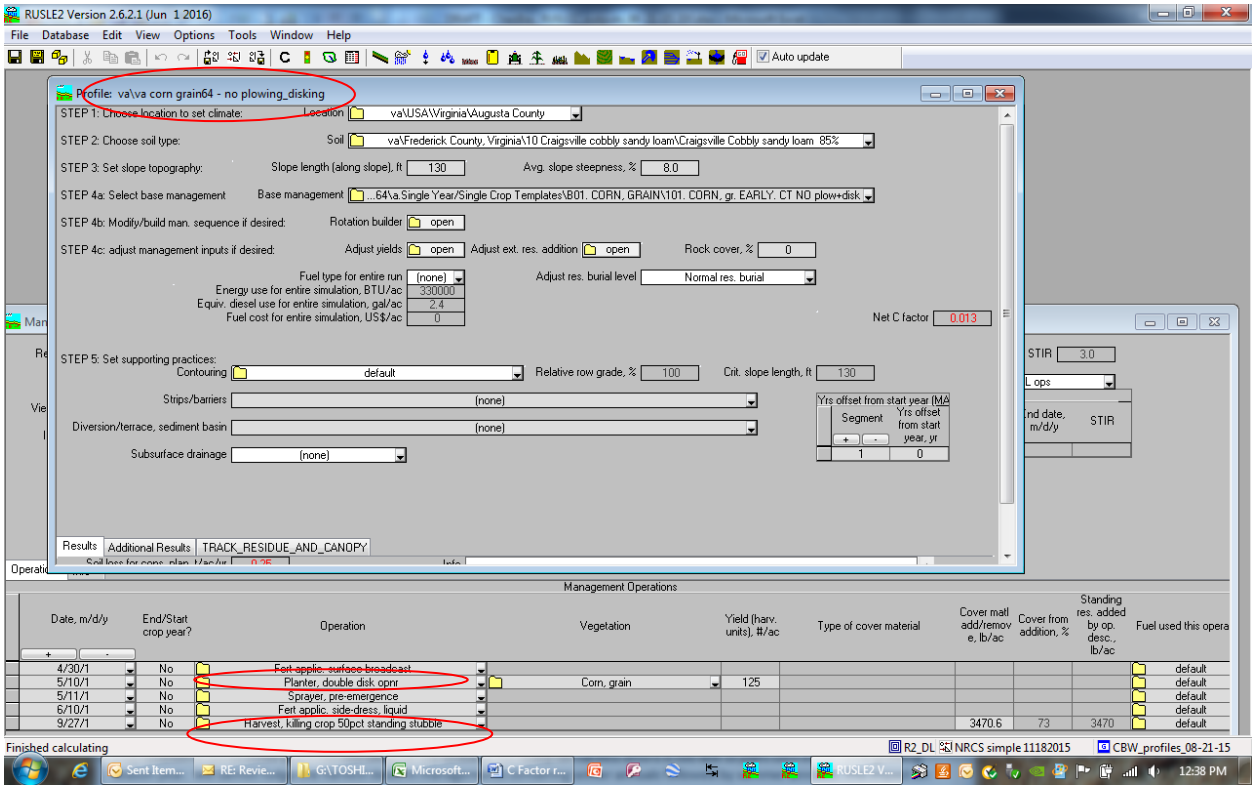



RUSLE2 Version 2.6.2.1 (Jun 1 2016)
File Database Edit View Options Tools Window Help
Auto update
Profile: PA corn grain 65 revised slope
STEP 1: Choose location to set climate:
Location pa\USA\Pennsylvania\Union County
STEP 2: Choose soil type:
Soil pa\Union County, Pennsylvania\ArC Alvira silt loam, 8 to 15 percent slopes\Alvira Silt loam 80%
STEP 3: Set slope topography:
Slope length (along slope), ft 160
Avg. slope steepness, % 5.5
STEP 4a: Select base management
Base management temp\PA Corn, grain 65
STEP 4b: Modify/build man. sequence if desired:
Rotation builder open
STEP 4c: adjust management inputs if desired:
Adjust yields open
Adjust ext. res. addition open
Rock cover, % 0
Fuel type for entire run (none)
Energy use for entire simulation, BTU/ac 830000
Equiv. diesel use for entire simulation, gal/ac 6.0
Fuel cost for entire simulation, US$/ac 0
Adjust res. burial level Normal res. burial
Net C factor 0.18
STEP 5: Set supporting practices:
Contouring a. rows up-and-down hill
Relative row grade, % 100
Crit. slope length, ft 160
Strips/barriers (none)
Diversion/terrace, sediment basin (none)
Subsurface drainage (none)
Yrs offset from start year (MA
Segment
Yrs offset from start year, yr
1 0
Management Operations
Date, m/d/y
End/Start crop year?
Operation
Vegetation
Yield (harv. units), #/ac
Type of cover material
Cover matl add/remove, lb/ac
Cover from addition, %
Standing res. added by op. desc., lb/ac
Fuel used this opera
4/10/1 No Plow, moldboard default
4/20/1 No Disk, tandem secondary op. default
4/25/1 No Harrow, coiled tine default
5/1/1 No ...r, double disk opnr w/fluted coulter with starter fertilizer Corn, grain 120 default
5/15/1 No Sprayer, post emergence weeds; 0-3 mo 250.00 14 default
5/20/1 No Fert applic, side-dress, liquid default
9/30/1 Yes Harvest, killing crop 30pct standing stubble 4678.7 83 2010 default
10/7/1 No Shred residue, 6 inch stubble default
Finished calculating
R2_DL NRCS simple 11182015
CBW_profiles_08-21-15
12:19 PM


RUSLE2 Version 2.6.2.1 (Jun 1 2016)
File Database Edit View Options Tools Window Help
Auto update
Profile: PA cornGRAIN 4.1 revised slope
STEP 1: Choose location to set climate:
Location pa\USA\Pennsylvania\Union County
STEP 2: Choose soil type:
Soil pa\Union County, Pennsylvania\ArC Alvira silt loam, 8 to 15 percent slopes\Alvira Silt loam 80%
STEP 3: Set slope topography:
Slope length (along slope), ft 155
Avg. slope steepness, % 5.5
STEP 4a: Select base management
Base management temp\PA corn grain 4.1
STEP 4b: Modify/build man. sequence if desired:
Rotation builder open
STEP 4c: adjust management inputs if desired:
Adjust yields open
Adjust ext. res. addition open
Rock cover, % 0
Fuel type for entire run (none)
Energy use for entire simulation, BTU/ac 830000
Equiv. diesel use for entire simulation, gal/ac 6.0
Fuel cost for entire simulation, US$/ac 0
Adjust res. burial level Normal res. burial
Net C factor 0.19
STEP 5: Set supporting practices:
Contouring a. rows up-and-down hill
Relative row grade, % 100
Crit. slope length, ft 160
Strips/barriers (none)
Diversion/terrace, sediment basin (none)
Subsurface drainage (none)
Yrs offset from start year (MA
Segment
Yrs offset from start year, yr
1 0
Management Operations
Date, m/d/y
End/Start crop year?
Operation
Vegetation
Yield (harv. units), #/ac
Type of cover material
Cover matl add/remove, lb/ac
Cover from addition, %
Standing res. added by op. desc., lb/ac
Fuel used this opera
4/10/1 No Plow, moldboard default
4/20/1 No Disk, tandem secondary op. default
4/25/1 No Harrow, coiled tine default
5/1/1 No ...r, double disk opnr w/fluted coulter with starter fertilizer Corn, grain 120 default
6/15/1 No Sprayer, post emergence weeds; 0-3 mo 250.00 14 default
6/20/1 No Fert applic, side-dress, liquid default
9/30/1 Yes Harvest, killing crop 30pct standing stubble 4678.7 83 2010 default
11/1/1 No Shred residue, 6 inch stubble default
Finished calculating
R2_DL NRCS simple 11182015
CBW_profiles_08-21-15
12:22 PM

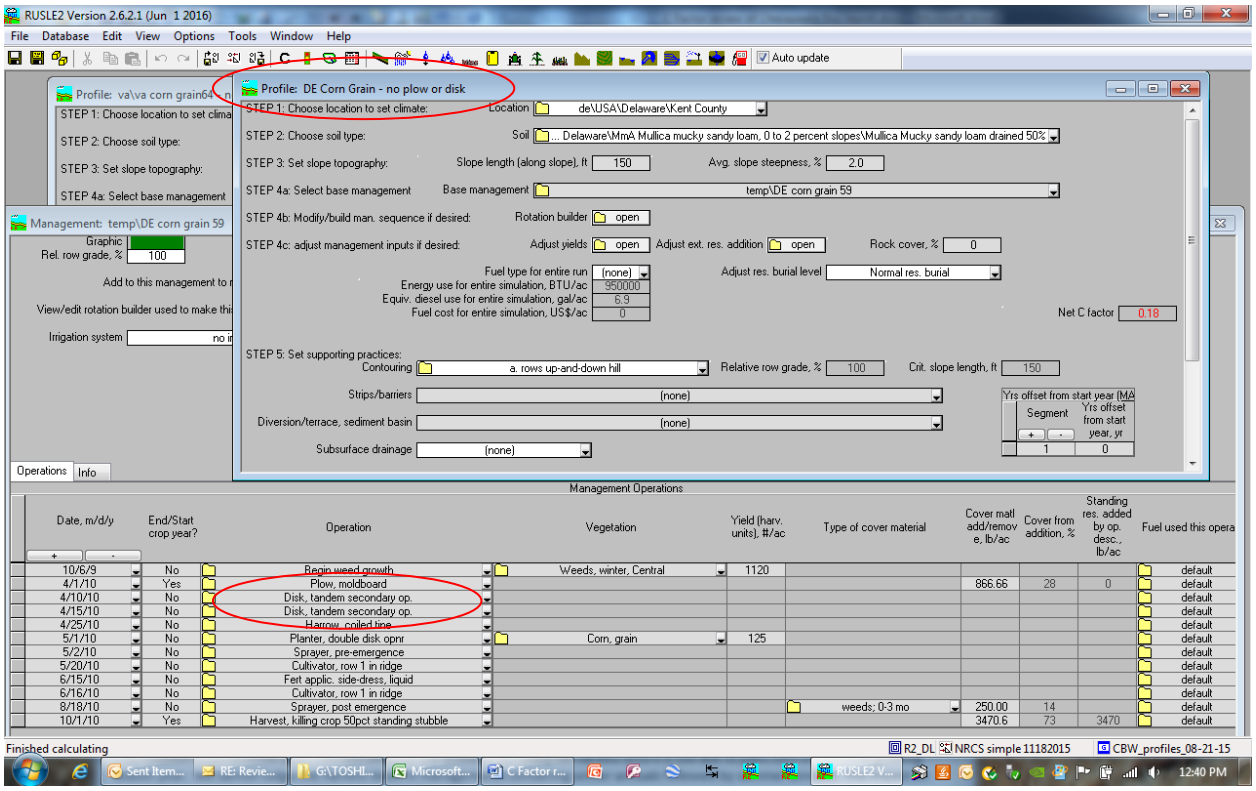
Corn grain files in MD, NY and PA are very similar and correctly built. Yields are similar but compared to the DE and VA corn grain files a more aggressive harvest operation leaving only 30% standing stubble and an additional stalk shredder operation are included that flattens the corn residue thus lowering the C factor and increasing the residue cover.

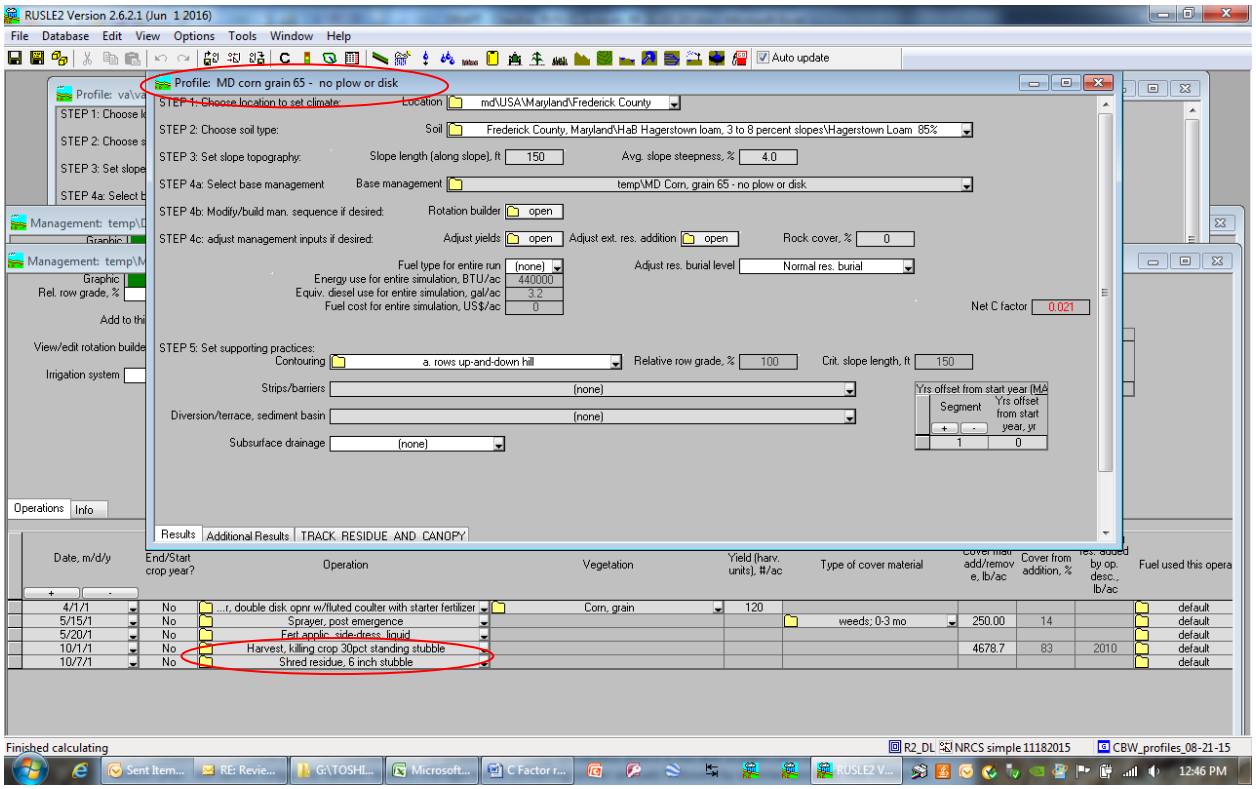
Corn grain Not plowed



The yields are fairly consistent but there are some errors in the no plow managements such as incorrect planters and row cultivations that would not be done in No-till systems and some post emerge sprayer operations two months too late in the growing season. I also see that some No plow Corn grain scenarios have a stalk shredder and some do not just as they did in the plowed corn grain scenarios across the region. This affects C factors and residue amounts.

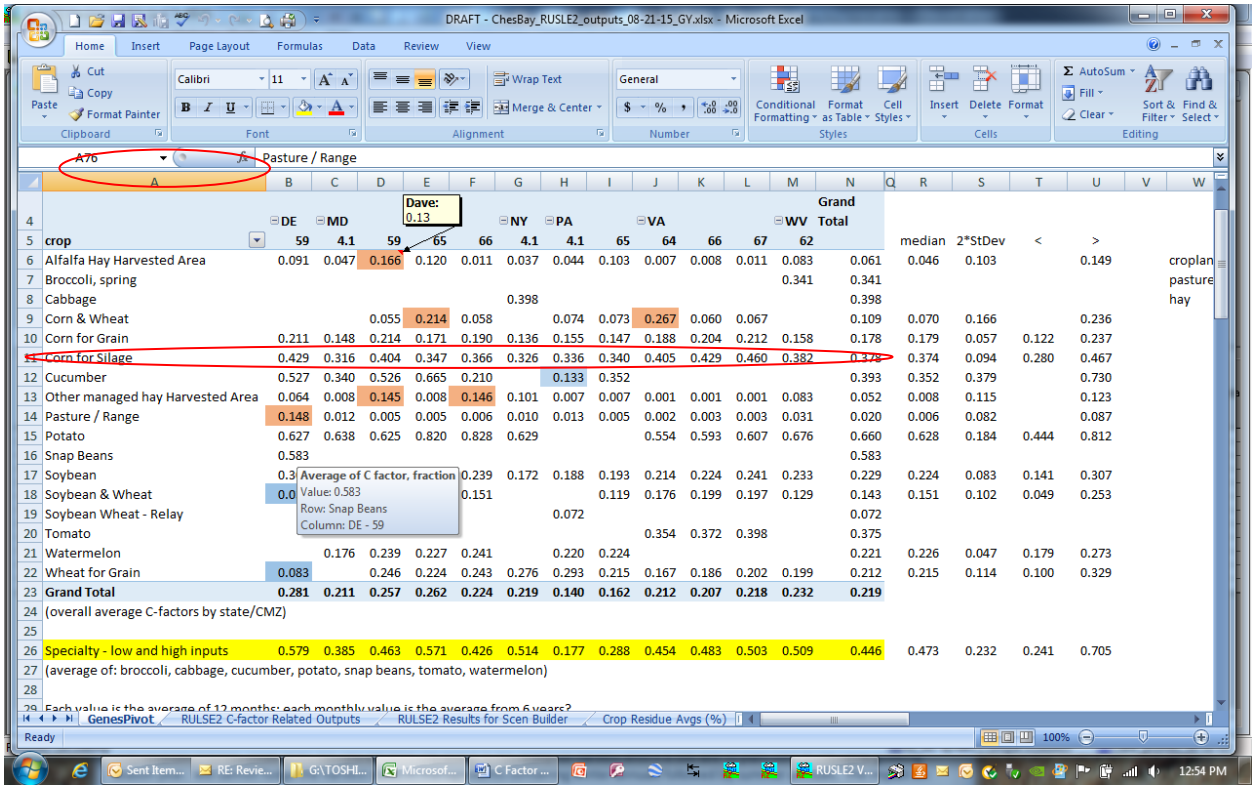
I found one run in DE that was supposed to be Corn grain with weeds **not plowed** but it still had the plow and disking operations in it. There was no management saved for the no plow scenario so it had repeated the plow and disk scenario. This is probably just a saving error or omission.





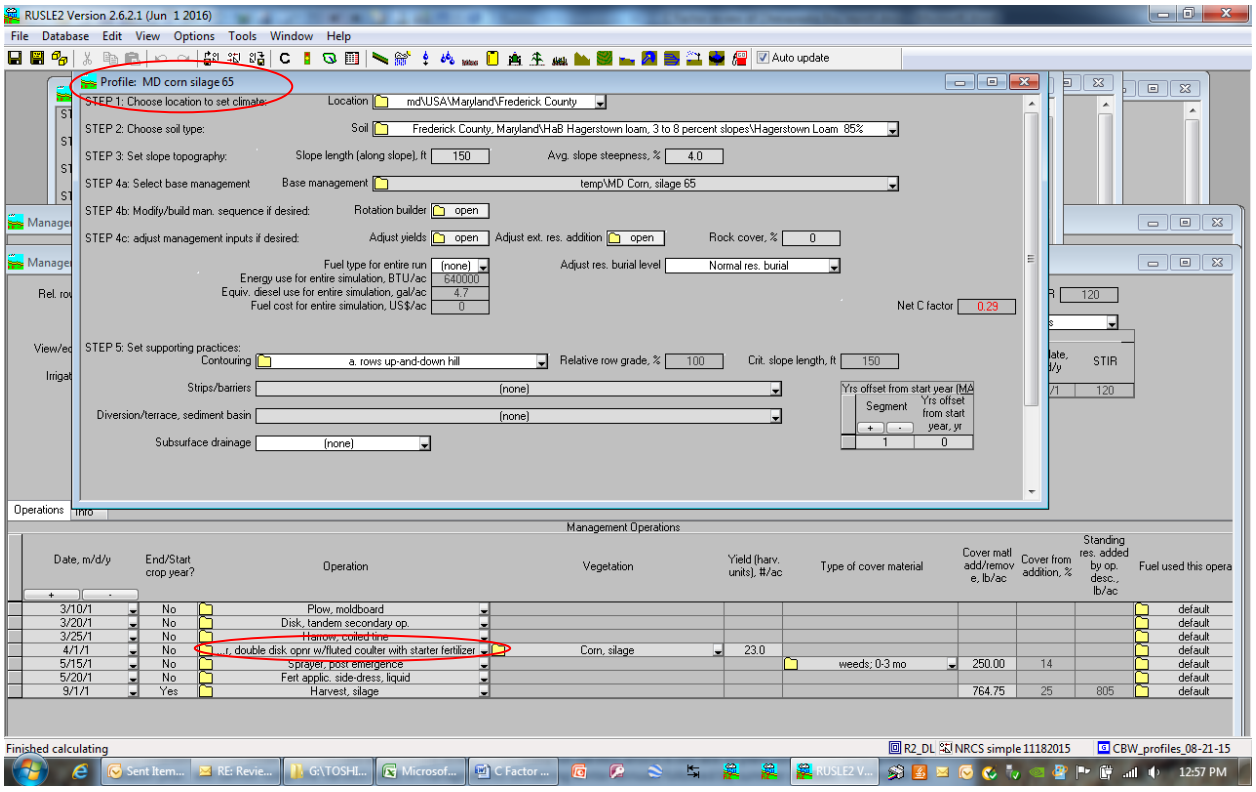
Taken individually the effects of these inconsistent entries in the Corn managements aren't large but when several errors exist in the same management they cause the outputs to be inconsistent with others in the same crop group set. I recommend that the corn grain Not plowed system to be modeled and compared across the region, be more consistent as to whether stalk shredding be done or not and that when Not plowed is modeled that the correct operations be included for a No-till system.

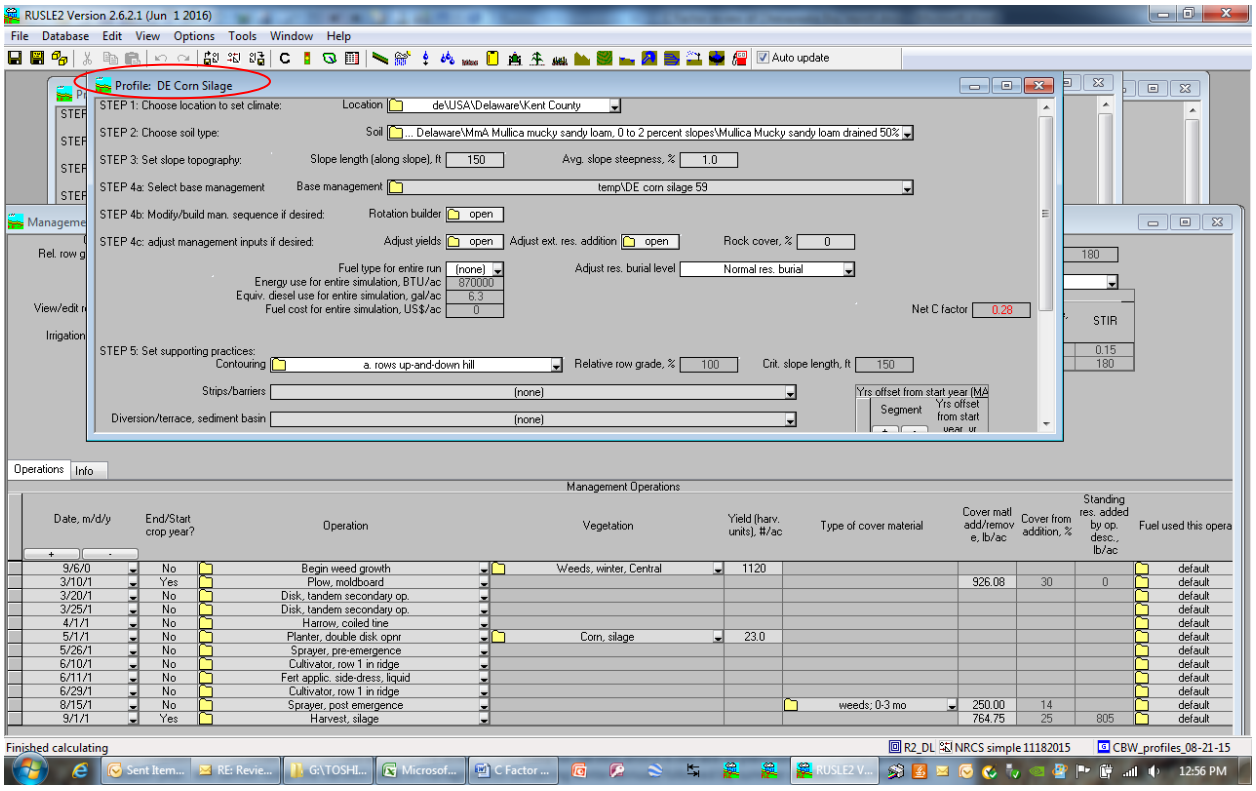
Corn silage

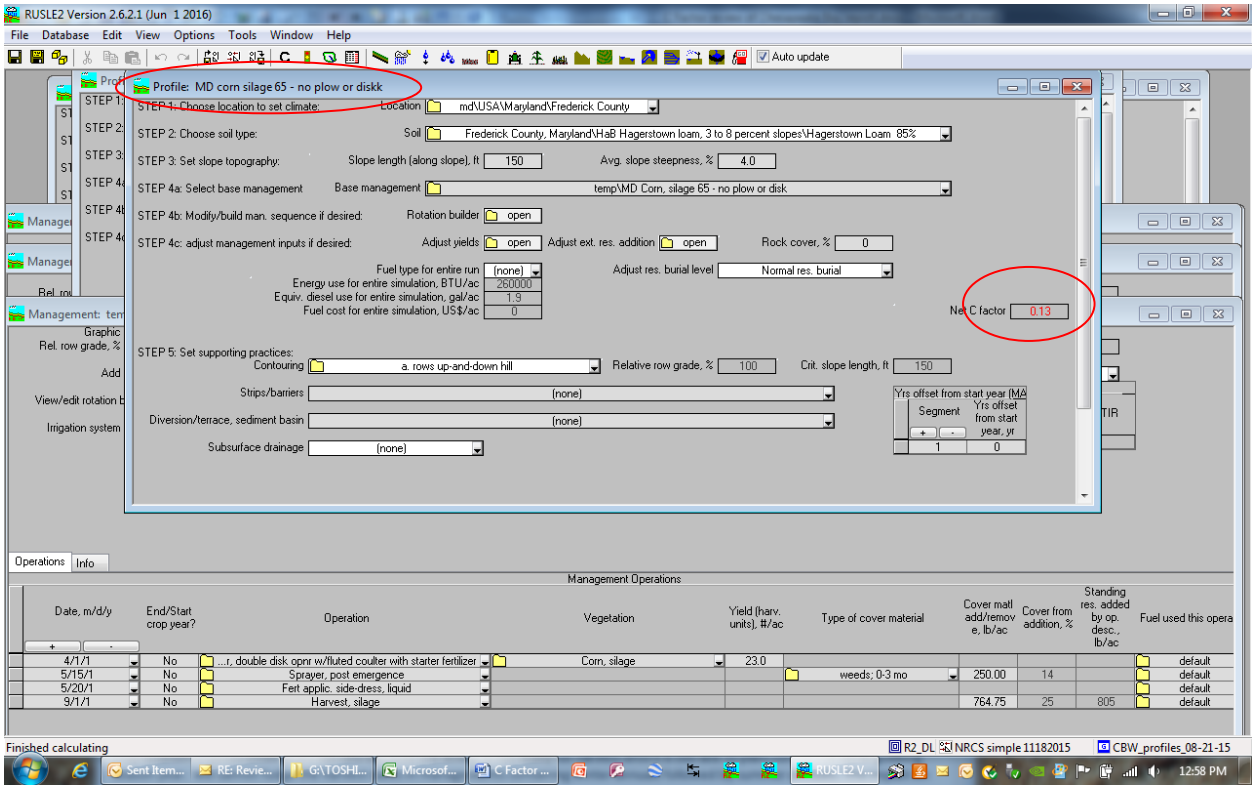


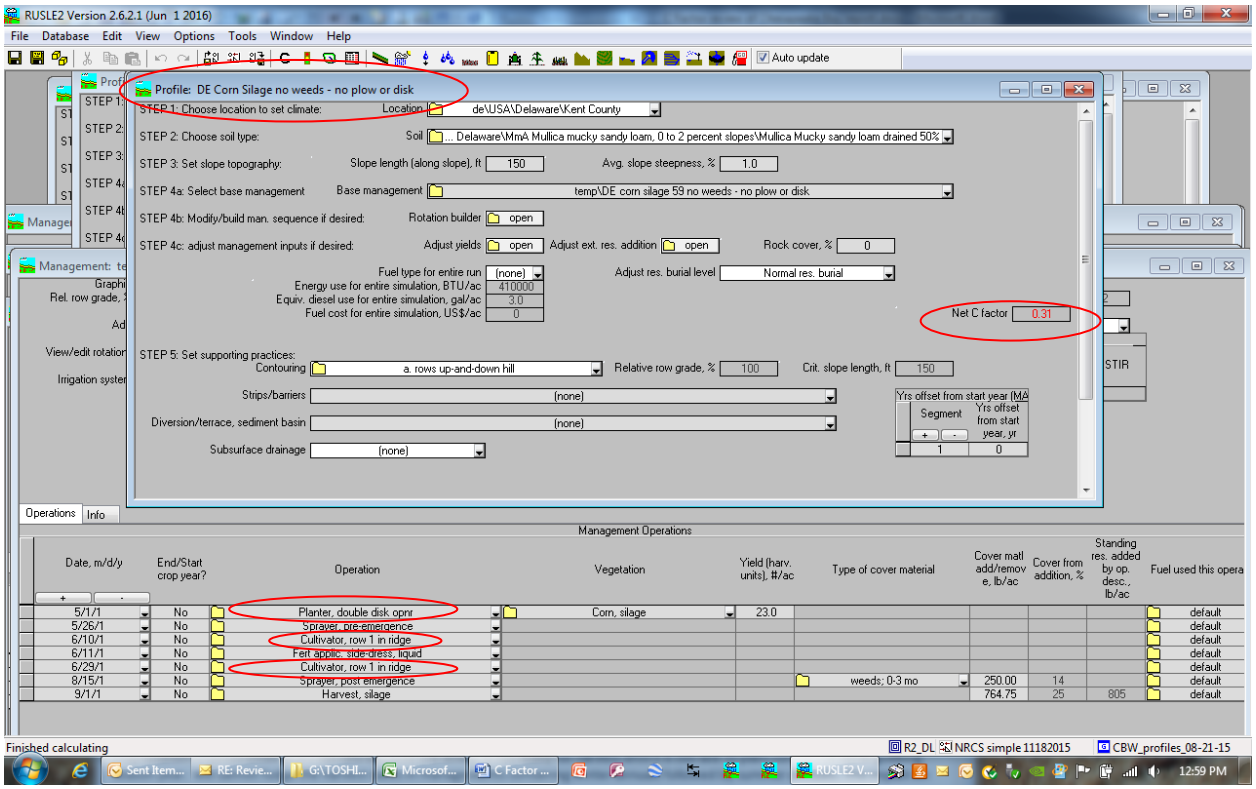
crop	DE 59	MD 4.1	59	65	66	NY 4.1	PA 4.1	65	VA 64	66	67	WV 62	Grand Total	median	2*StDev	<	>	
Alfalfa Hay Harvested Area	0.091	0.047	0.166	0.120	0.011	0.037	0.044	0.103	0.007	0.008	0.011	0.083	0.061	0.046	0.103		0.149	croplan
Broccoli, spring												0.341	0.341					pasture
Cabbage						0.398							0.398					hay
Corn & Wheat			0.055	0.214	0.058		0.074	0.073	0.267	0.060	0.067		0.109	0.070	0.166		0.236	
Corn for Grain	0.211	0.148	0.214	0.171	0.190	0.136	0.155	0.147	0.188	0.204	0.212	0.158	0.178	0.179	0.057	0.122	0.237	
Corn for Silage	0.429	0.316	0.404	0.347	0.366	0.326	0.336	0.340	0.405	0.429	0.460	0.382	0.378	0.374	0.094	0.280	0.467	
Cucumber	0.527	0.340	0.526	0.665	0.210		0.133	0.352					0.393	0.352	0.379		0.730	
Other managed hay Harvested Area	0.064	0.008	0.145	0.008	0.146	0.101	0.007	0.007	0.001	0.001	0.001	0.083	0.052	0.008	0.115		0.123	
Pasture / Range	0.148	0.012	0.005	0.005	0.006	0.010	0.013	0.005	0.002	0.003	0.003	0.031	0.020	0.006	0.082		0.087	
Potato	0.627	0.638	0.625	0.820	0.828	0.629			0.554	0.593	0.607	0.676	0.660	0.628	0.184	0.444	0.812	
Snap Beans	0.583												0.583					
Soybean	0.3				0.239	0.172	0.188	0.193	0.214	0.224	0.241	0.233	0.229	0.224	0.083	0.141	0.307	
Soybean & Wheat	0.0				0.151			0.119	0.176	0.199	0.197	0.129	0.143	0.151	0.102	0.049	0.253	
Soybean Wheat - Relay							0.072						0.072					
Tomato									0.354	0.372	0.398		0.375					
Watermelon		0.176	0.239	0.227	0.241		0.220	0.224					0.221	0.226	0.047	0.179	0.273	
Wheat for Grain	0.083		0.246	0.224	0.243	0.276	0.293	0.215	0.167	0.186	0.202	0.199	0.212	0.215	0.114	0.100	0.329	
Grand Total	**0.281**	**0.211**	**0.257**	**0.262**	**0.224**	**0.219**	**0.140**	**0.162**	**0.212**	**0.207**	**0.218**	**0.232**	**0.219**					
(overall average C-factors by state/CMZ)																		
Specialty - low and high inputs	0.579	0.385	0.463	0.571	0.426	0.514	0.177	0.288	0.454	0.483	0.503	0.509	0.446	0.473	0.232	0.241	0.705	
(average of: broccoli, cabbage, cucumber, potato, snap beans, tomato, watermelon)																		

This group appears to be fairly consistent. Corn Silage yields are consistent. The plowed scenarios appear to be built fairly well except for incorrect planter operations in a few cases.



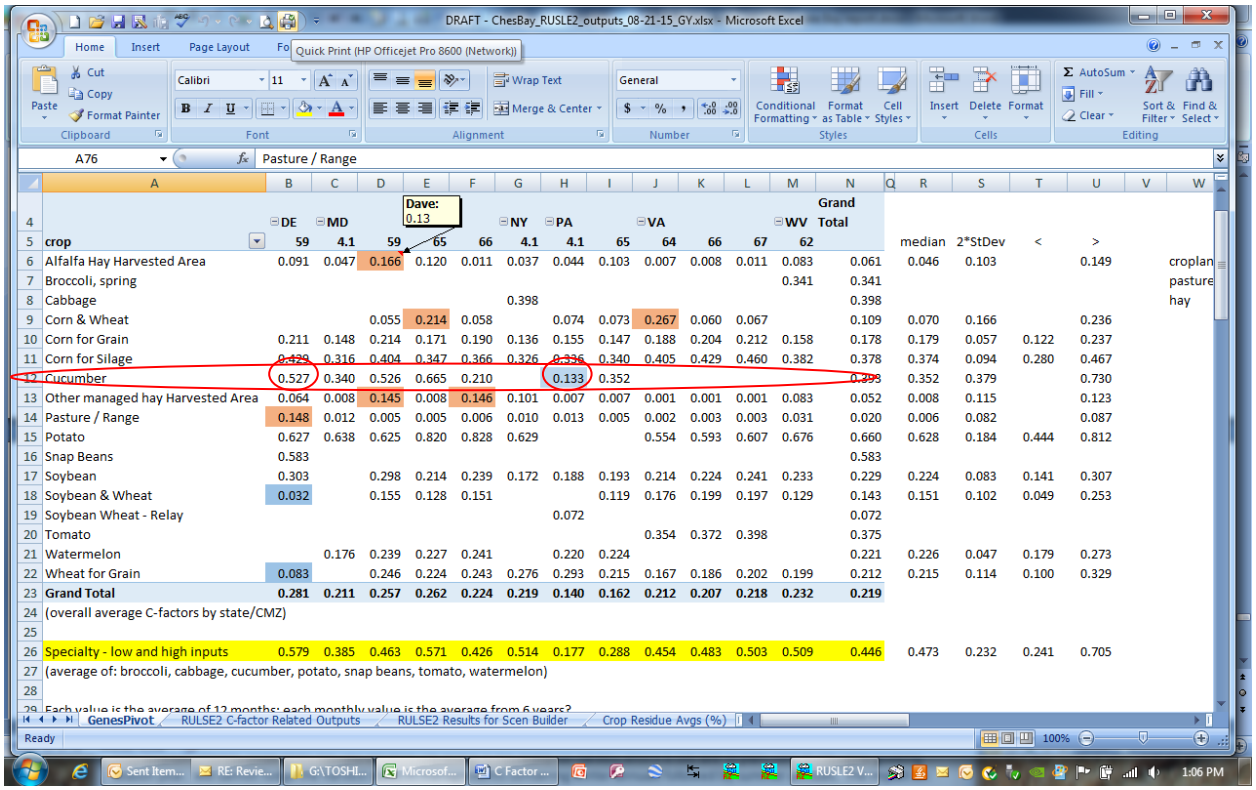

RUSLE2 Version 2.6.2.1 (Jun 1 2016)
File Database Edit View Options Tools Window Help
Auto update
Profile: DE Corn Silage
STEP 1: Choose location to set climate:
Location de\USA\Delaware\Kent County
STEP 2: Choose soil type:
Soil ... Delaware\MmA Mullica mucky sandy loam, 0 to 2 percent slopes\Mullica Mucky sandy loam drained 50%
STEP 3: Set slope topography:
Slope length (along slope), ft 150
Avg. slope steepness, % 1.0
STEP 4a: Select base management
Base management temp\DE corn silage 59
STEP 4b: Modify/build man. sequence if desired:
Rotation builder open
STEP 4c: adjust management inputs if desired:
Adjust yields open
Adjust ext. res. addition open
Rock cover, % 0
Fuel type for entire run (none)
Energy use for entire simulation, BTU/ac 870000
Equiv. diesel use for entire simulation, gal/ac 6.3
Fuel cost for entire simulation, US$/ac 0
Adjust res. burial level Normal res. burial
Net C factor 0.28
STEP 5: Set supporting practices:
Contouring a. rows up-and-down hill
Relative row grade, % 100
Crit. slope length, ft 150
Strips/barriers (none)
Diversion/terrace, sediment basin (none)
Yrs offset from start year (MA
Segment
Yrs offset from start year, yr
Operations
Info
Management Operations
Date, m/d/y
End/Start crop year?
Operation
Vegetation
Yield (harv. units), #/ac
Type of cover material
Cover matl add/remove, lb/ac
Cover from addition, %
Standing res. added by op. desc., lb/ac
Fuel used this opera
9/6/0 No Begin weed growth Weeds, winter, Central 1120 default
3/10/1 Yes Plow, moldboard 926.08 30 0 default
3/20/1 No Disk, tandem secondary op. default
3/25/1 No Disk, tandem secondary op. default
4/1/1 No Harrow, coiled tine default
5/1/1 No Planter, double disk opnr Corn, silage 23.0 default
5/26/1 No Sprayer, pre-emergence default
6/10/1 No Cultivator, row 1 in ridge default
6/11/1 No Fert applic. side-dress, liquid default
6/29/1 No Cultivator, row 1 in ridge default
8/15/1 No Sprayer, post emergence weeds; 0-3 mo 250.00 14 default
9/1/1 Yes Harvest, silage 764.75 25 805 default
Finished calculating
R2_DL NRCS simple 11182015
CBW_profiles_08-21-15
12:56 PM


RUSLE2 Version 2.6.2.1 (Jun 1 2016)
File Database Edit View Options Tools Window Help
Auto update
Profile: MD corn silage 65 - no plow or diskk
STEP 1: Choose location to set climate:
Location md\USA\Maryland\Frederick County
STEP 2: Choose soil type:
Soil Frederick County, Maryland\HaB Hagerstown loam, 3 to 8 percent slopes\Hagerstown Loam 85%
STEP 3: Set slope topography:
Slope length (along slope), ft 150
Avg. slope steepness, % 4.0
STEP 4a: Select base management
Base management temp\MD Corn, silage 65 - no plow or disk
STEP 4b: Modify/build man. sequence if desired:
Rotation builder open
STEP 4c: adjust management inputs if desired:
Adjust yields open
Adjust ext. res. addition open
Rock cover, % 0
Fuel type for entire run (none)
Energy use for entire simulation, BTU/ac 260000
Equiv. diesel use for entire simulation, gal/ac 1.9
Fuel cost for entire simulation, US$/ac 0
Adjust res. burial level Normal res. burial
Net C factor 0.13
STEP 5: Set supporting practices:
Contouring a. rows up-and-down hill
Relative row grade, % 100
Crit. slope length, ft 150
Strips/barriers (none)
Diversion/terrace, sediment basin (none)
Subsurface drainage (none)
Yrs offset from start year (MA
Segment
Yrs offset from start year, yr
1 0
Operations
Info
Management Operations
Date, m/d/y
End/Start crop year?
Operation
Vegetation
Yield (harv. units), #/ac
Type of cover material
Cover matl add/remove, lb/ac
Cover from addition, %
Standing res. added by op. desc., lb/ac
Fuel used this opera
4/1/1 No ...r, double disk opnr w/fluted coulter with starter fertilizer Corn, silage 23.0 default
5/15/1 No Sprayer, post emergence weeds; 0-3 mo 250.00 14 default
5/20/1 No Fert applic. side-dress, liquid default
9/1/1 No Harvest, silage 764.75 25 805 default
Finished calculating
R2_DL NRCS simple 11182015
CBW_profiles_08-21-15
12:58 PM

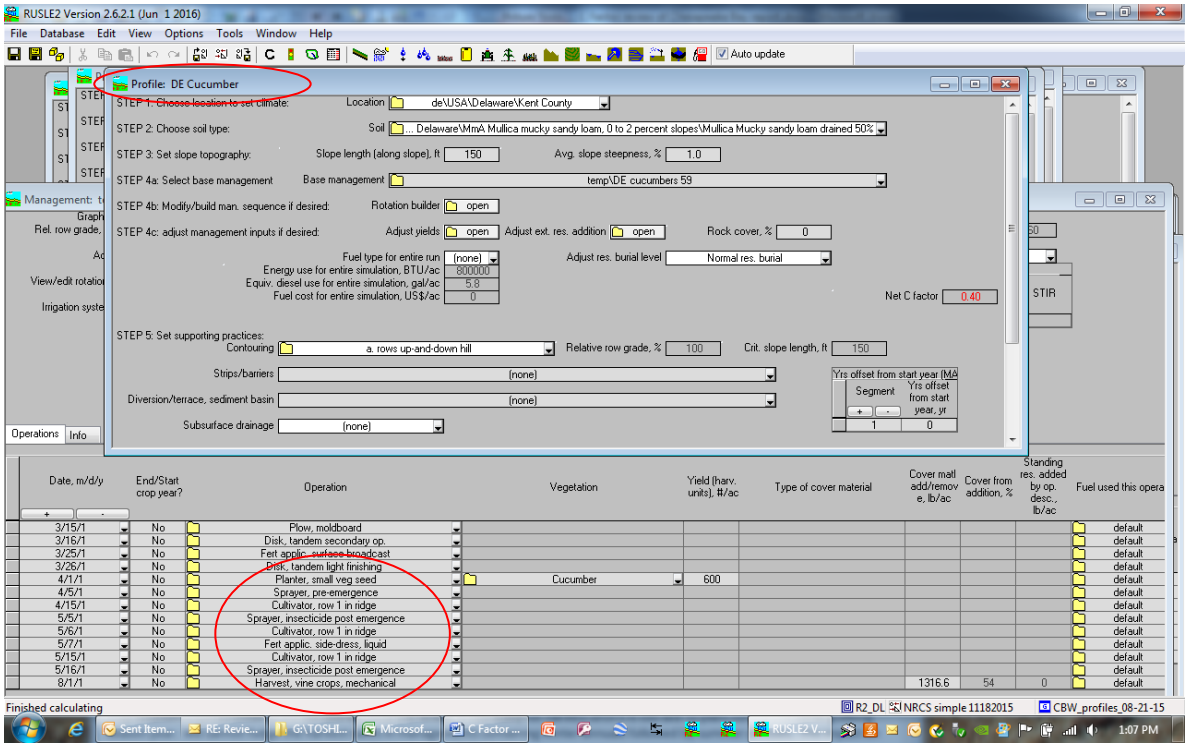


However, there are inconsistent operations in the not plowed scenarios including conventional planters and row cultivations that would not be correct for No-tilled conditions. This additional tillage buries residue and increases Net C factors over what they would be if built correctly for no-till.

Cucumber

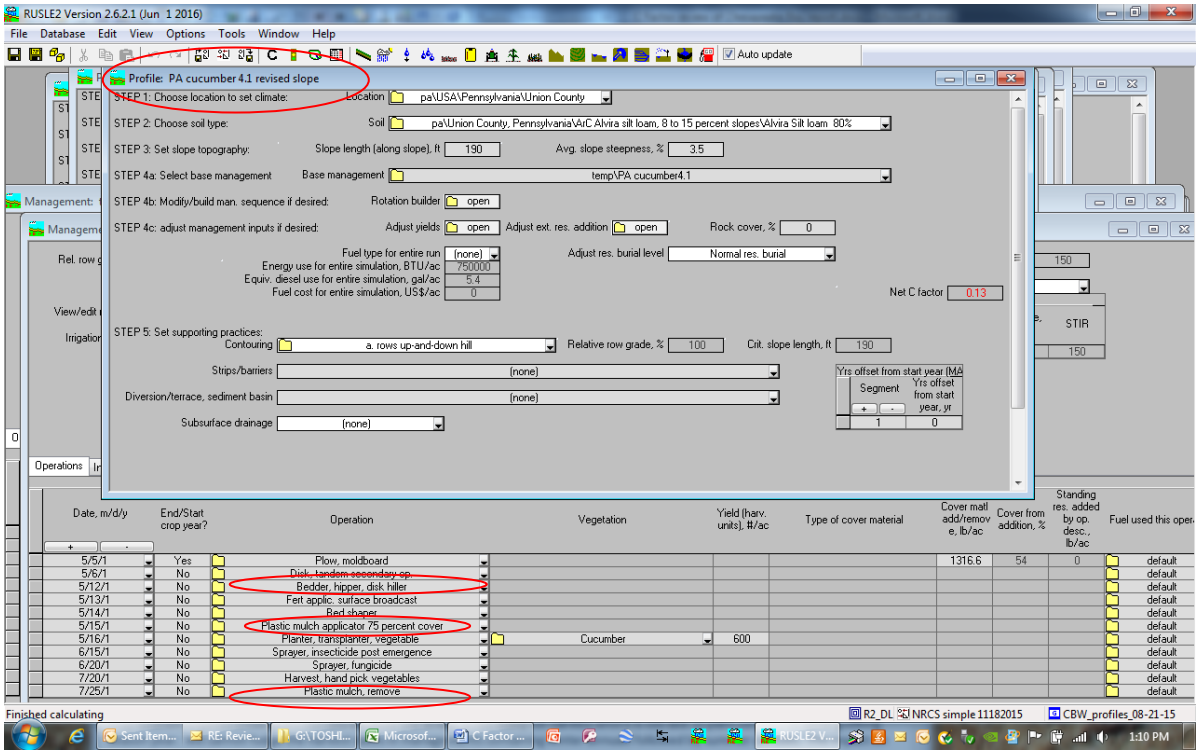


crop	DE 59	DE 4.1	MD 59	MD 65	NY 66	NY 4.1	PA 4.1	VA 65	VA 64	VA 66	VA 67	WV 62	Grand Total	median	2*StDev	<	>	
Alfalfa Hay Harvested Area	0.091	0.047	0.166	0.120	0.011	0.037	0.044	0.103	0.007	0.008	0.011	0.083	0.061	0.046	0.103		0.149	croplan
Broccoli, spring												0.341	0.341					pasture
Cabbage						0.398							0.398					hay
Corn & Wheat			0.055	0.214	0.058		0.074	0.073	0.267	0.060	0.067		0.109	0.070	0.166		0.236	
Corn for Grain	0.211	0.148	0.214	0.171	0.190	0.136	0.155	0.147	0.188	0.204	0.212	0.158	0.178	0.179	0.057	0.122	0.237	
Corn for Silage	0.429	0.316	0.404	0.347	0.366	0.326	0.336	0.340	0.405	0.429	0.460	0.382	0.378	0.374	0.094	0.280	0.467	
Cucumber	0.527	0.340	0.526	0.665	0.210		0.133	0.352					0.398	0.352	0.379		0.730	
Other managed hay Harvested Area	0.064	0.008	0.145	0.008	0.146	0.101	0.007	0.007	0.001	0.001	0.001	0.083	0.052	0.008	0.115		0.123	
Pasture / Range	0.148	0.012	0.005	0.005	0.006	0.010	0.013	0.005	0.002	0.003	0.003	0.031	0.020	0.006	0.082		0.087	
Potato	0.627	0.638	0.625	0.820	0.828	0.629			0.554	0.593	0.607	0.676	0.660	0.628	0.184	0.444	0.812	
Snap Beans	0.583												0.583					
Soybean	0.303		0.298	0.214	0.239	0.172	0.188	0.193	0.214	0.224	0.241	0.233	0.229	0.224	0.083	0.141	0.307	
Soybean & Wheat	0.032		0.155	0.128	0.151			0.119	0.176	0.199	0.197	0.129	0.143	0.151	0.102	0.049	0.253	
Soybean Wheat - Relay							0.072						0.072					
Tomato									0.354	0.372	0.398		0.375					
Watermelon		0.176	0.239	0.227	0.241		0.220	0.224					0.221	0.226	0.047	0.179	0.273	
Wheat for Grain	0.083		0.246	0.224	0.243	0.276	0.293	0.215	0.167	0.186	0.202	0.199	0.212	0.215	0.114	0.100	0.329	
Grand Total	**0.281**	**0.211**	**0.257**	**0.262**	**0.224**	**0.219**	**0.140**	**0.162**	**0.212**	**0.207**	**0.218**	**0.232**	**0.219**					
(overall average C-factors by state/CMZ)																		
Specialty - low and high inputs	0.579	0.385	0.463	0.571	0.426	0.514	0.177	0.288	0.454	0.483	0.503	0.509	0.446	0.473	0.232	0.241	0.705	
(average of: broccoli, cabbage, cucumber, potato, snap beans, tomato, watermelon)																		

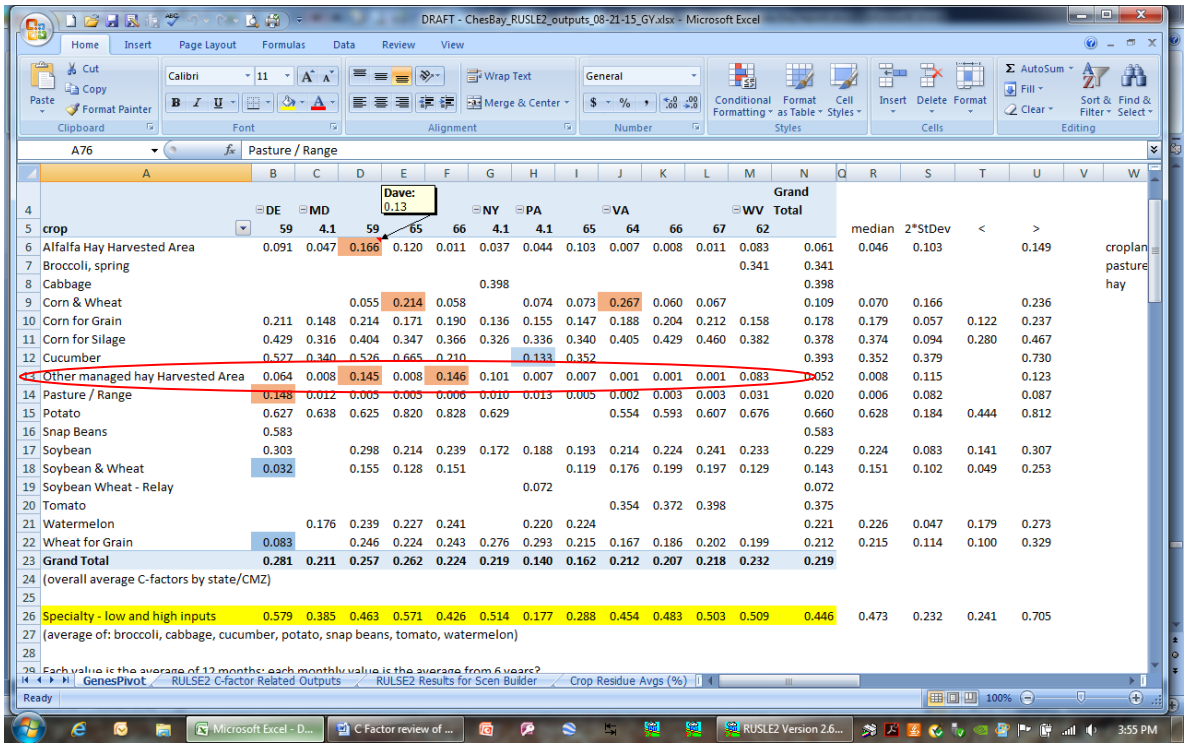


I compared the low value file to one of the higher files. These are two different systems. The DE file is flat planted and uses mechanical weed control vs. the PA 4.1 file which is bedded uses plastic mulch. I

recommend that one common system be described and the files revised to allow the same system to be compared.



Other managed hay



crop	DE 59	MD 4.1	MD 59	NY 65	NY 66	PA 4.1	PA 4.1	VA 65	VA 64	VA 66	WV 67	WV 62	Grand Total	median	2*StDev	<	>	
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Broccoli, spring												0.341	0.341					pasture
Cabbage						0.398							0.398					hay
Corn & Wheat			0.055	0.214	0.058		0.074	0.073	0.267	0.060	0.067		0.109	0.070	0.166		0.236	
Corn for Grain	0.211	0.148	0.214	0.171	0.190	0.136	0.155	0.147	0.188	0.204	0.212	0.158	0.178	0.179	0.057	0.122	0.237	
Corn for Silage	0.429	0.316	0.404	0.347	0.366	0.326	0.336	0.340	0.405	0.429	0.460	0.382	0.378	0.374	0.094	0.280	0.467	
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Other managed hay Harvested Area	0.064	0.008	0.145	0.008	0.146	0.101	0.007	0.007	0.001	0.001	0.001	0.083	0.052	0.008	0.115		0.123	
Pasture / Range	0.148	0.012	0.005	0.005	0.006	0.010	0.013	0.005	0.002	0.003	0.003	0.031	0.020	0.006	0.082		0.087	
Potato	0.627	0.638	0.625	0.820	0.828	0.629			0.554	0.593	0.607	0.676	0.660	0.628	0.184	0.444	0.812	
Snap Beans	0.583												0.583					
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Soybean Wheat - Relay							0.072						0.072					
Tomato									0.354	0.372	0.398		0.375					
Watermelon		0.176	0.239	0.227	0.241		0.220	0.224					0.221	0.226	0.047	0.179	0.273	
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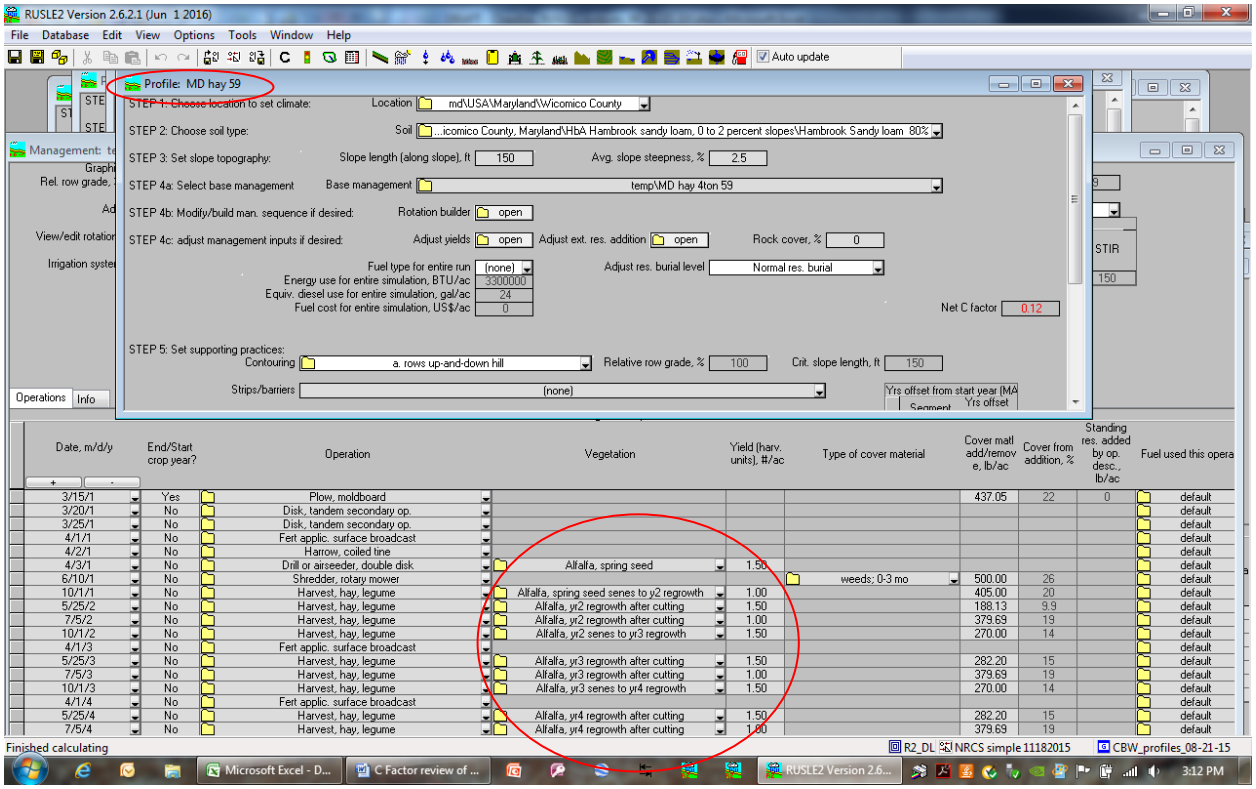
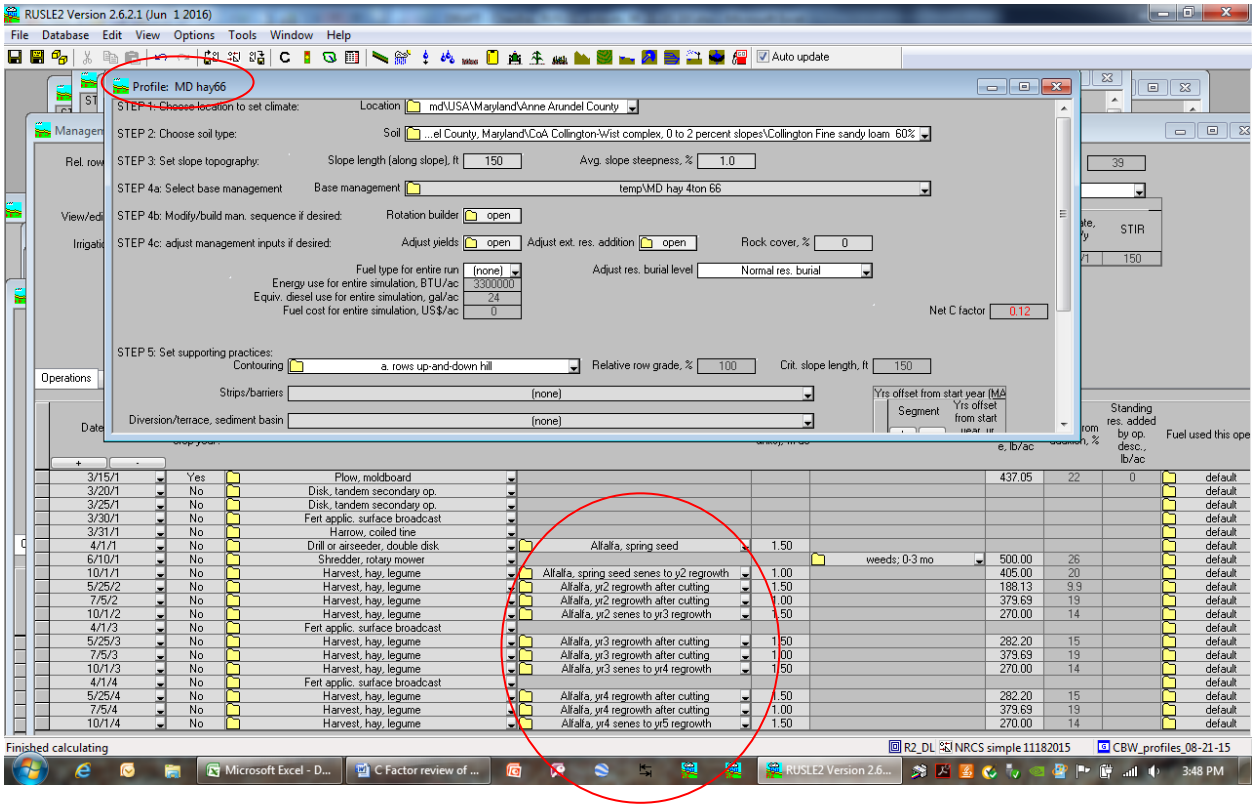
Grand Total	**0.281**	**0.211**	**0.257**	**0.262**	**0.224**	**0.219**	**0.140**	**0.162**	**0.212**	**0.207**	**0.218**	**0.232**	**0.219**					
(overall average C-factors by state/CMZ)																		
Specialty - low and high inputs	0.579	0.385	0.463	0.571	0.426	0.514	0.177	0.288	0.454	0.483	0.503	0.509	0.446	0.473	0.232	0.241	0.705	
(average of: broccoli, cabbage, cucumber, potato, snap beans, tomato, watermelon)																		
Each value is the average of 12 months; each monthly value is the average from 6 years?																		

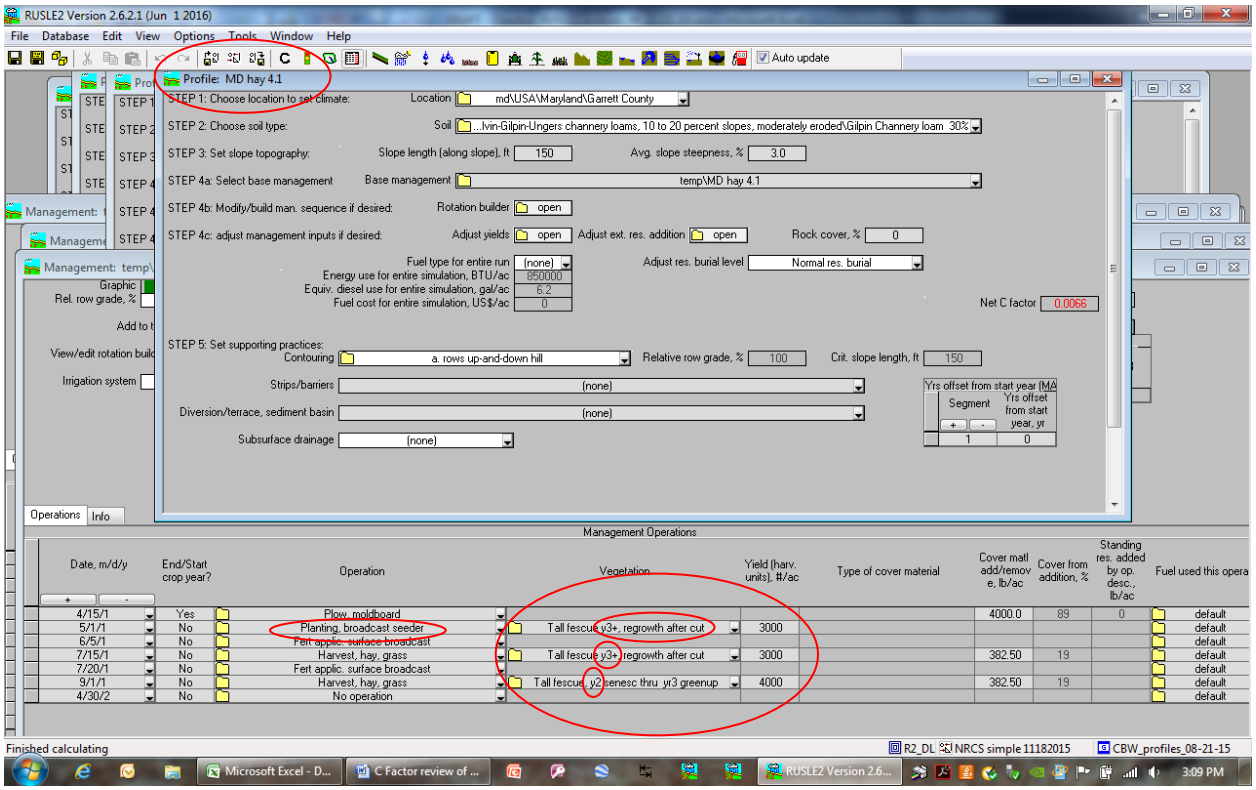
There is a large variability in the Net C factors in this other managed hay crop group because the managements do not describe similar systems. Additionally the files representing Net C factors that were assumed to be correct are in fact incorrectly built.



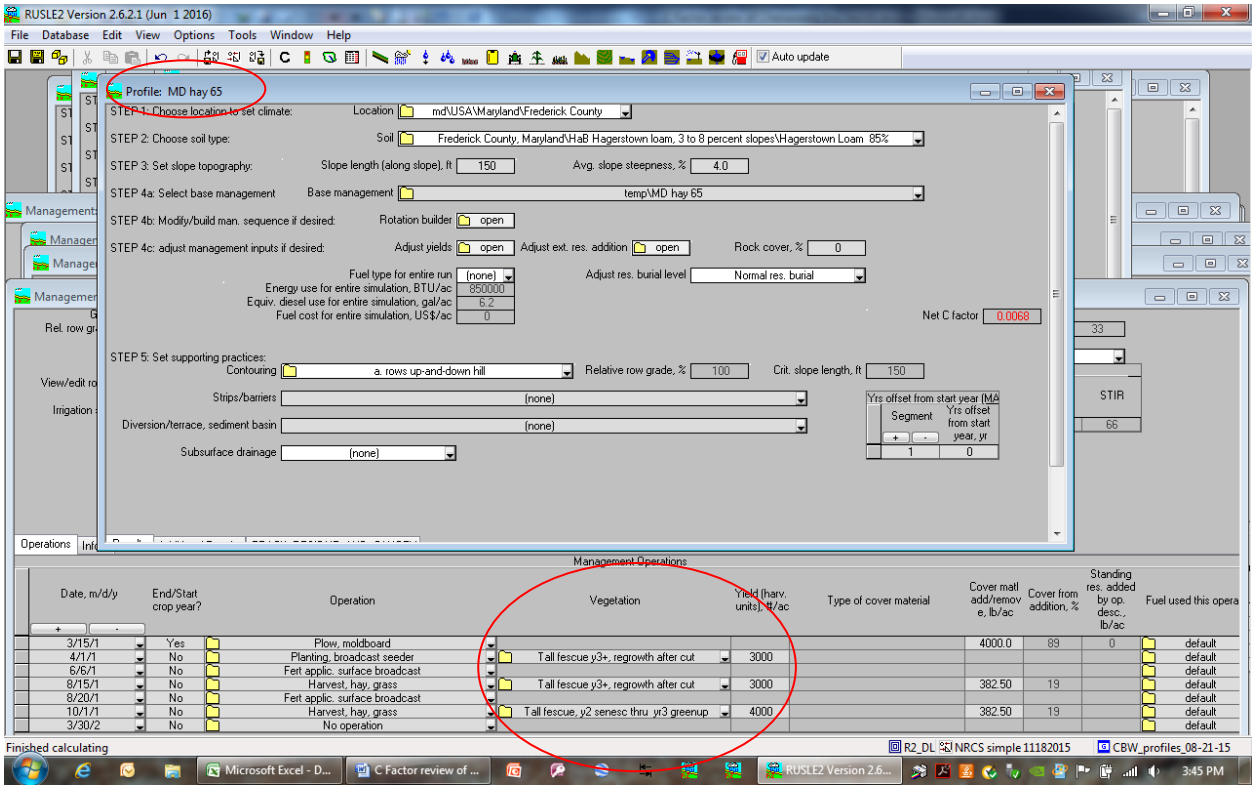
The MD Hay 59 file shown above as well as the MD hay 66 file shown below describe alfalfa hay but should not be included in this Other hay crop group. This file has one harvest in the seeding year and three harvest cuts in the following years with yields correctly entered to trigger growth at that level and delivering the yield to the next cutting. Good file. Just included in the wrong group.

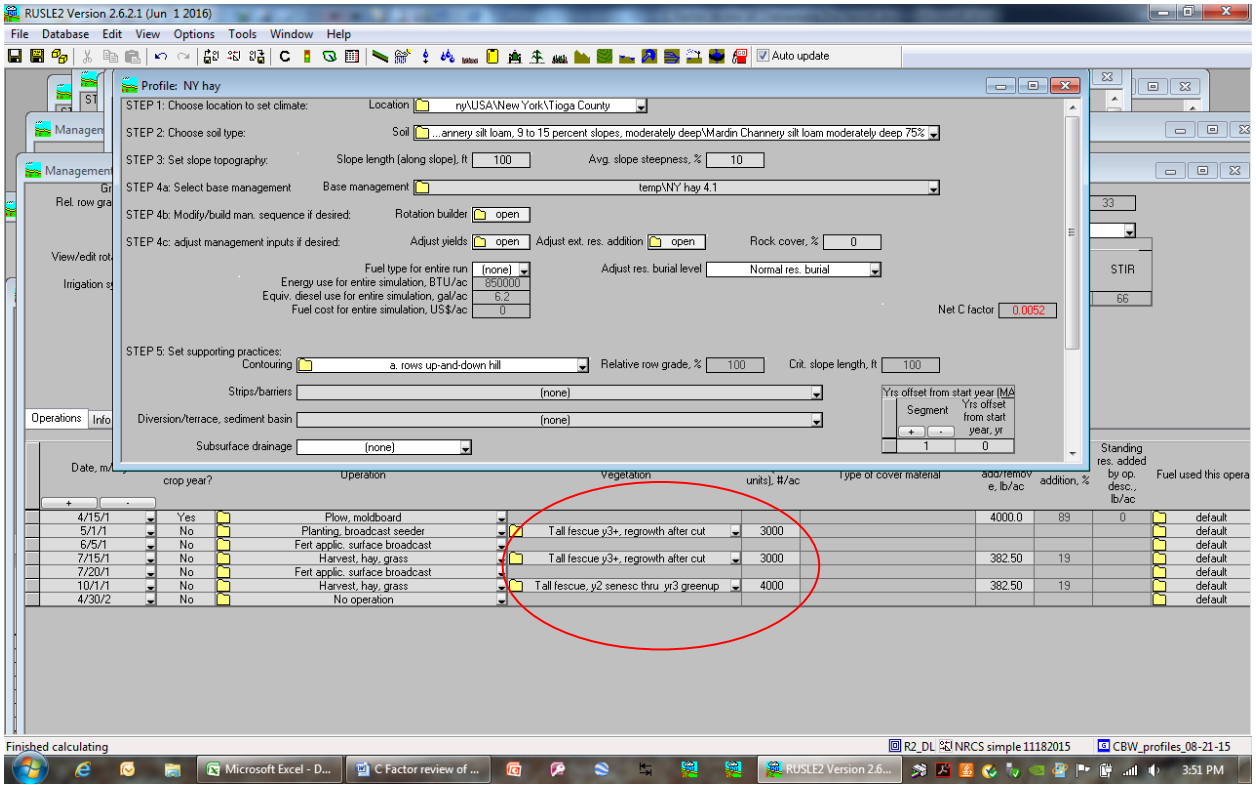


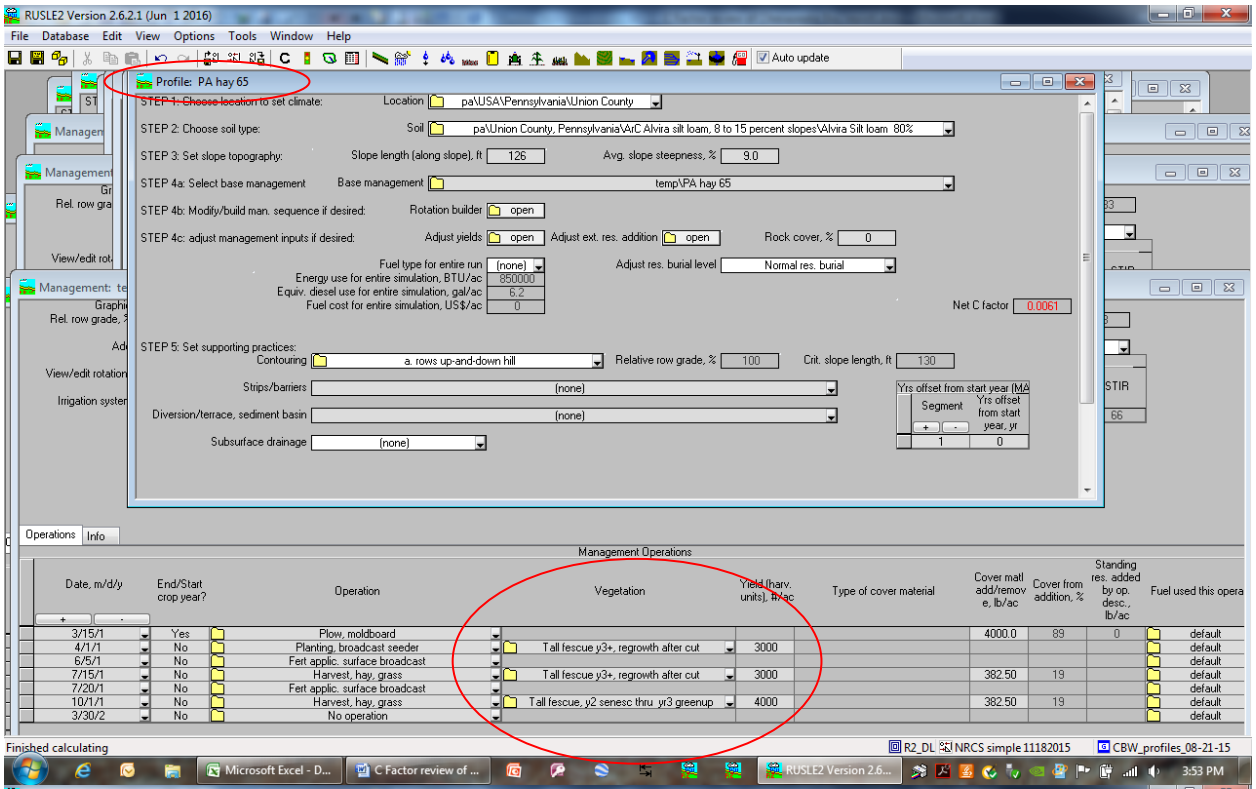
By comparison, files such as MD Hay 4.1 shown below describe Tall Fescue grass hay with three hay harvests in the seeding year. This file represents Fescue hay seeded on 5/1 but it would not produce a total of 10,000 pounds of hay in the seeding year. This file is incorrectly built using fescue vegetation regrowth files for years 2 and 3 which were built to represent a maturing stand. With tillage and planting beginning the crop interval, this file should include vegetations to represent the seeding period and regrowth for the 3 cuttings instead of the more mature vegetation files.

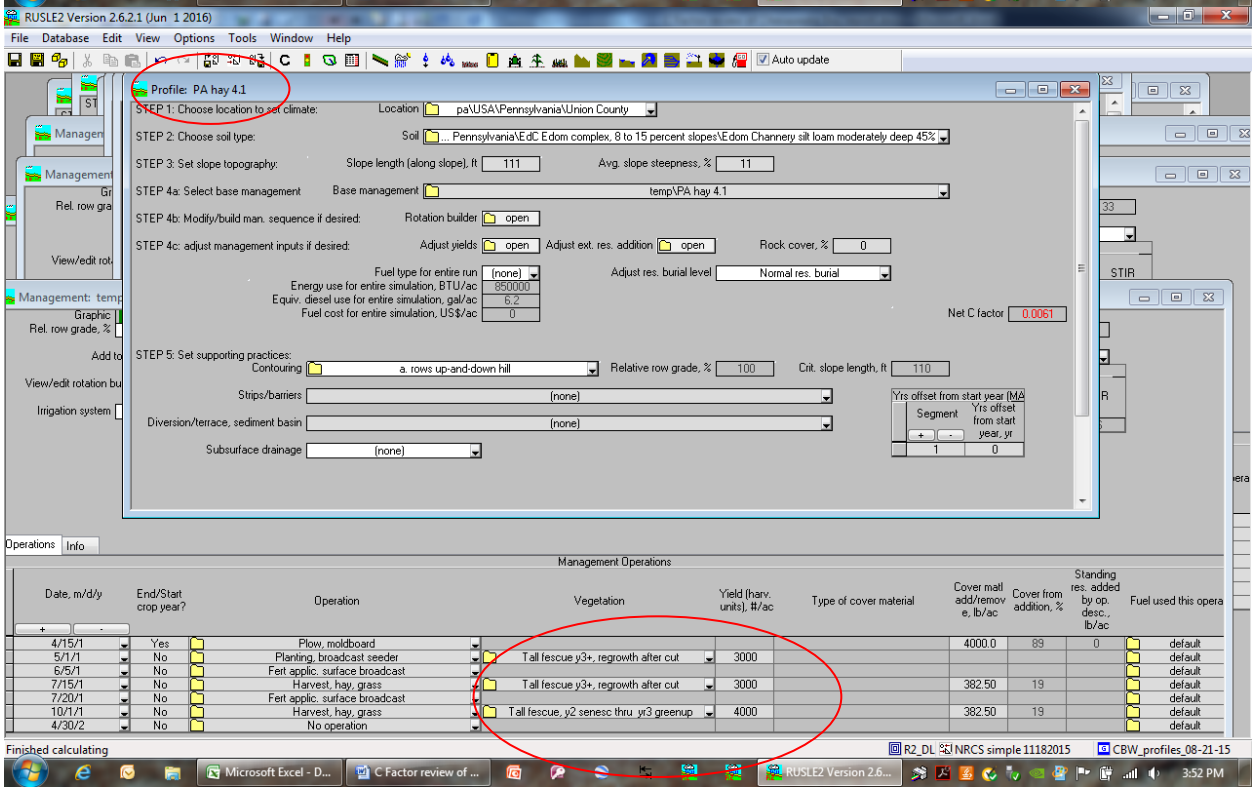


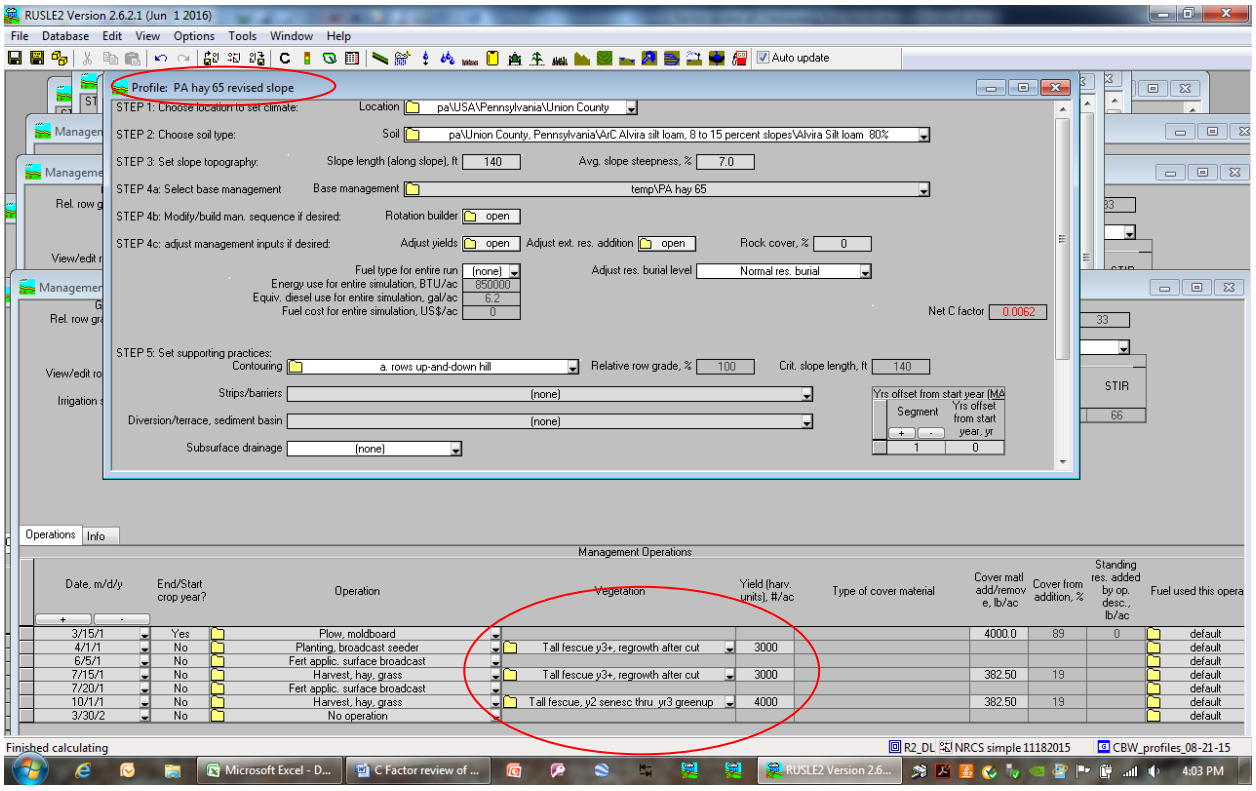
The same errors are contained in other MD, NY and PA files.






RUSLE2 Version 2.6.2.1 (Jun 1 2016)
File Database Edit View Options Tools Window Help
Auto update
Profile: PA hay 65
STEP 1: Choose location to set climate:
Location pa\USA\Pennsylvania\Union County
STEP 2: Choose soil type:
Soil pa\Union County, Pennsylvania\ArC Alvira silt loam, 8 to 15 percent slopes\Alvira Silt loam 80%
STEP 3: Set slope topography:
Slope length (along slope), ft 126
Avg. slope steepness, % 9.0
STEP 4a: Select base management
Base management temp\PA hay 65
STEP 4b: Modify/build man. sequence if desired:
Rotation builder open
STEP 4c: adjust management inputs if desired:
Adjust yields open
Adjust ext. res. addition open
Rock cover, % 0
Fuel type for entire run (none)
Energy use for entire simulation, BTU/ac 850000
Equiv. diesel use for entire simulation, gal/ac 6.2
Fuel cost for entire simulation, US$/ac 0
Adjust res. burial level Normal res. burial
Net C factor 0.0061
STEP 5: Set supporting practices:
Contouring a. rows up-and-down hill
Relative row grade, % 100
Crit. slope length, ft 130
Strips/barriers (none)
Diversion/terrace, sediment basin (none)
Subsurface drainage (none)
Yrs offset from start year (MA
Segment
Yrs offset from start year, yr
1 0
Operations Info
Management Operations
Date, m/d/y
End/Start crop year?
Operation
Vegetation
Yield (harv. units), #/ac
Type of cover material
Cover matl add/remove, lb/ac
Cover from addition, %
Standing res. added by op. desc., lb/ac
Fuel used this opera
3/15/1 Yes Plow, moldboard 4000.0 89 0 default
4/1/1 No Planting, broadcast seeder Tall fescue y3+, regrowth after cut 3000 default
6/5/1 No Fert applic. surface broadcast default
7/15/1 No Harvest, hay, grass Tall fescue y3+, regrowth after cut 3000 382.50 19 default
7/20/1 No Fert applic. surface broadcast default
10/1/1 No Harvest, hay, grass Tall fescue, y2 senesc thru yr3 greenup 4000 382.50 19 default
3/30/2 No No operation default
Finished calculating
R2_DL NRCS simple 11182015
CBW_profiles_08-21-15
Microsoft Excel - D...
C Factor review of ...
RUSLE2 Version 2.6...
3:53 PM


RUSLE2 Version 2.6.2.1 (Jun 1 2016)
File Database Edit View Options Tools Window Help
Auto update
Profile: PA hay 4.1
STEP 1: Choose location to set climate:
Location pa\USA\Pennsylvania\Union County
STEP 2: Choose soil type:
Soil ... Pennsylvania\EdC Edom complex, 8 to 15 percent slopes\Edom Channery silt loam moderately deep 45%
STEP 3: Set slope topography:
Slope length (along slope), ft 111
Avg. slope steepness, % 11
STEP 4a: Select base management
Base management temp\PA hay 4.1
STEP 4b: Modify/build man. sequence if desired:
Rotation builder open
STEP 4c: adjust management inputs if desired:
Adjust yields open
Adjust ext. res. addition open
Rock cover, % 0
Fuel type for entire run (none)
Energy use for entire simulation, BTU/ac 850000
Equiv. diesel use for entire simulation, gal/ac 6.2
Fuel cost for entire simulation, US$/ac 0
Adjust res. burial level Normal res. burial
Net C factor 0.0061
STEP 5: Set supporting practices:
Contouring a. rows up-and-down hill
Relative row grade, % 100
Crit. slope length, ft 110
Strips/barriers (none)
Diversion/terrace, sediment basin (none)
Subsurface drainage (none)
Yrs offset from start year (MA
Segment
Yrs offset from start year, yr
1 0
Operations Info
Management Operations
Date, m/d/y
End/Start crop year?
Operation
Vegetation
Yield (harv. units), #/ac
Type of cover material
Cover matl add/remove, lb/ac
Cover from addition, %
Standing res. added by op. desc., lb/ac
Fuel used this opera
4/15/1 Yes Plow, moldboard 4000.0 89 0 default
5/1/1 No Planting, broadcast seeder Tall fescue y3+, regrowth after cut 3000 default
6/5/1 No Fert applic. surface broadcast default
7/15/1 No Harvest, hay, grass Tall fescue y3+, regrowth after cut 3000 382.50 19 default
7/20/1 No Fert applic. surface broadcast default
10/1/1 No Harvest, hay, grass Tall fescue, y2 senesc thru yr3 greenup 4000 382.50 19 default
4/30/2 No No operation default
Finished calculating
R2_DL NRCS simple 11182015
CBW_profiles_08-21-15
Microsoft Excel - D...
C Factor review of ...
RUSLE2 Version 2.6...
3:52 PM


RUSLE2 Version 2.6.2.1 (Jun 1 2016)
File Database Edit View Options Tools Window Help
Auto update
Profile: PA hay 65 revised slope
STEP 1: Choose location to set climate:
Location
pa\USA\Pennsylvania\Union County
STEP 2: Choose soil type:
Soil
pa\Union County, Pennsylvania\ArC Alvira silt loam, 8 to 15 percent slopes\Alvira Silt loam 80%
STEP 3: Set slope topography:
Slope length (along slope), ft
140
Avg. slope steepness, %
7.0
STEP 4a: Select base management
Base management
temp\PA hay 65
STEP 4b: Modify/build man. sequence if desired:
Rotation builder
open
STEP 4c: adjust management inputs if desired:
Adjust yields
open
Adjust ext. res. addition
open
Rock cover, %
0
Fuel type for entire run
(none)
Energy use for entire simulation, BTU/ac
850000
Equiv. diesel use for entire simulation, gal/ac
6.2
Fuel cost for entire simulation, US$/ac
0
Adjust res. burial level
Normal res. burial
Net C factor
0.0062
STEP 5: Set supporting practices:
Contouring
a. rows up-and-down hill
Relative row grade, %
100
Crit. slope length, ft
140
Strips/barriers
(none)
Diversion/terrace, sediment basin
(none)
Subsurface drainage
(none)
Yrs offset from start year (MA
Segment
Yrs offset from start year, yr
1
0
Operations
Info
Management Operations
Date, m/d/y
End/Start crop year?
Operation
Vegetation
Yield (harv. units), #/ac
Type of cover material
Cover matl add/remove, lb/ac
Cover from addition, %
Standing res. added by op. desc., lb/ac
Fuel used this opera
3/15/1 Yes Plow, moldboard 4000.0 89 0 default
4/1/1 No Planting, broadcast seeder Tall fescue y3+, regrowth after cut 3000 default
6/5/1 No Fert applic. surface broadcast default
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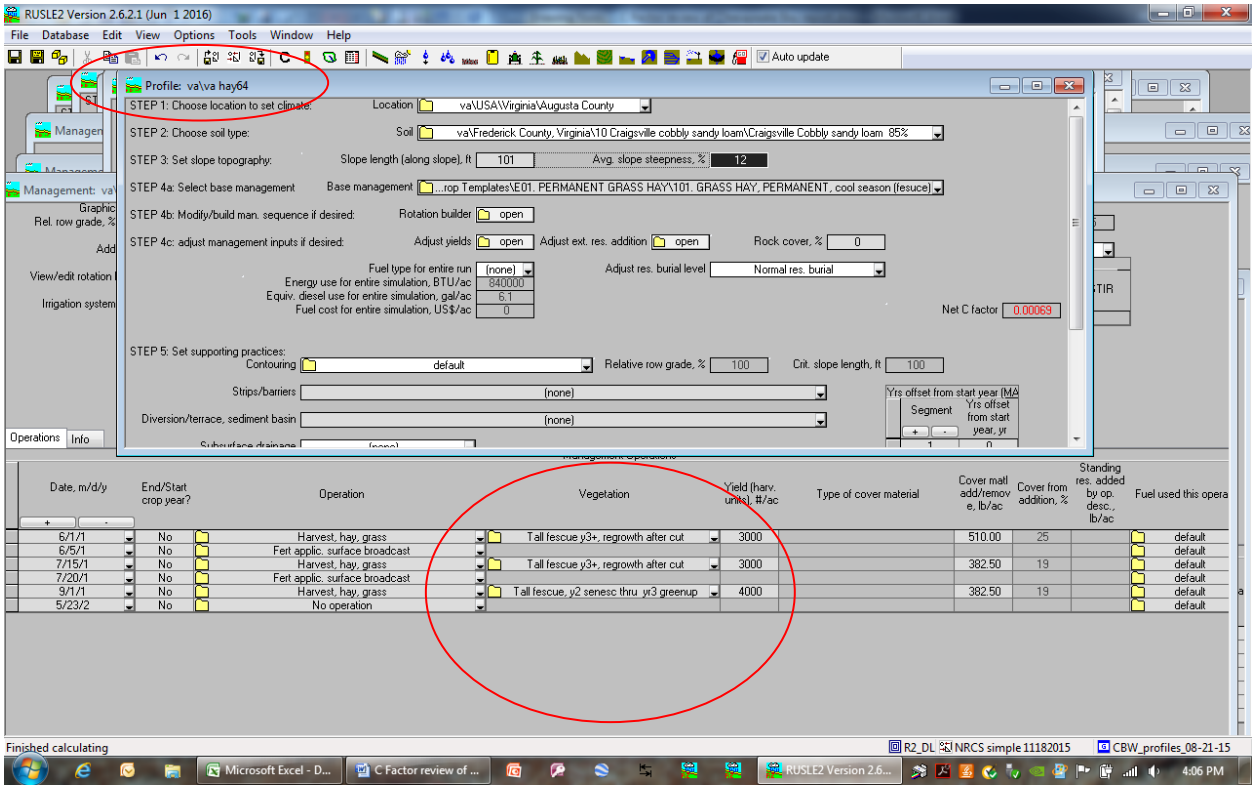
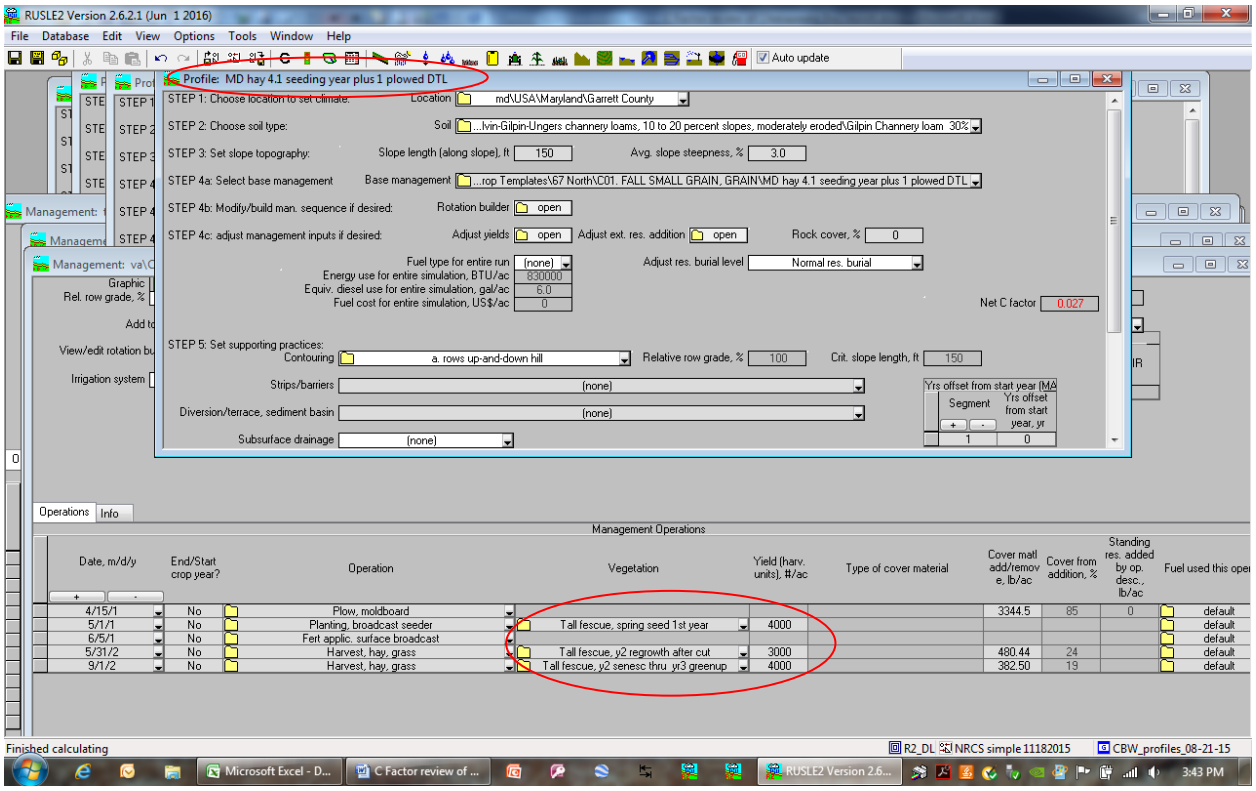
10/1/1 No Harvest, hay, grass Tall fescue, y2 senesc thru yr3 greenup 4000 382.50 19 default
3/30/2 No No operation default
Finished calculating
R2_DL
NRCS simple 11182015
CBW_profiles_08-21-15
Microsoft Excel - D...
C Factor review of ...
RUSLE2 Version 2.6...
4:03 PM

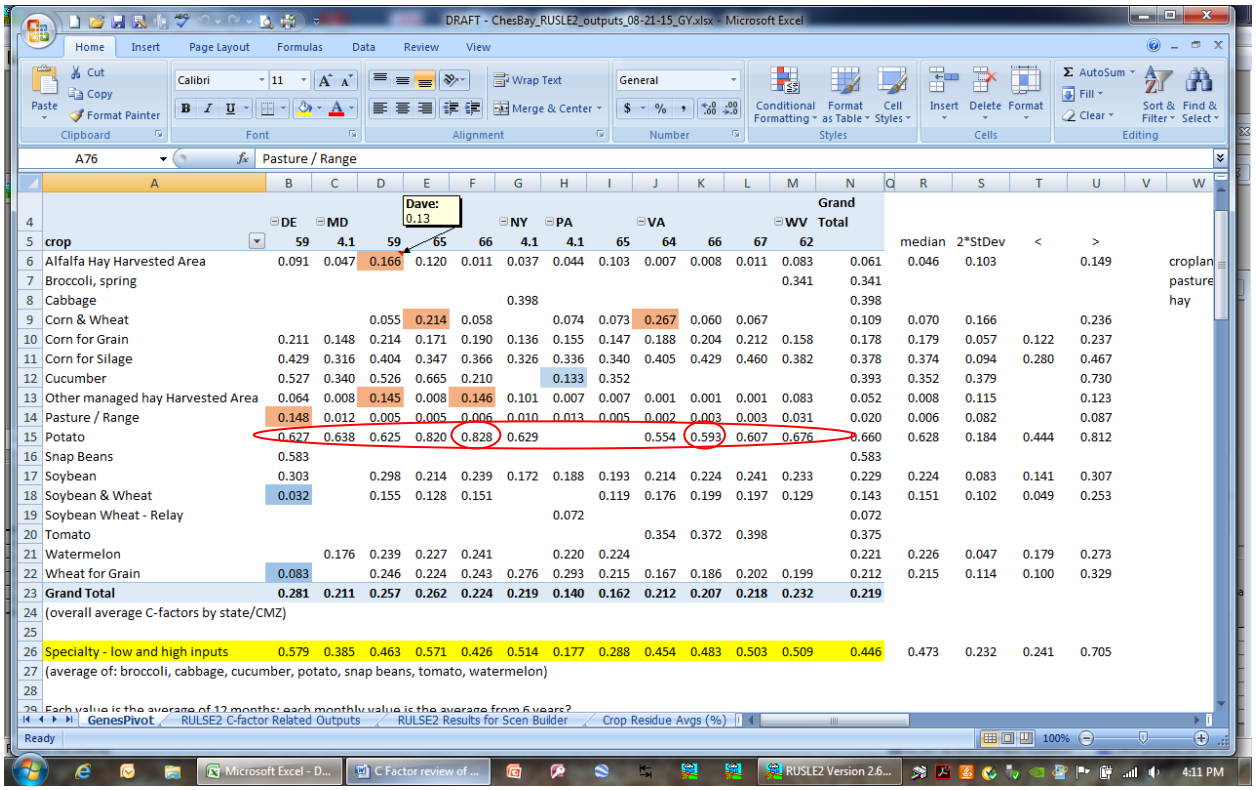

RUSLE2 Version 2.6.2.1 (Jun 1 2016)
File Database Edit View Options Tools Window Help
Auto update
Profile: va\va hay64
STEP 1: Choose location to set climate:
Location
va\USA\Virginia\Augusta County
STEP 2: Choose soil type:
Soil
va\Frederick County, Virginia\10 Craigsville cobbly sandy loam\Craigsville Cobbly sandy loam 85%
STEP 3: Set slope topography:
Slope length (along slope), ft
101
Avg. slope steepness, %
12
STEP 4a: Select base management
Base management
...rop Templates\E01. PERMANENT GRASS HAY\101. GRASS HAY, PERMANENT, cool season (fesuce)
STEP 4b: Modify/build man. sequence if desired:
Rotation builder
open
STEP 4c: adjust management inputs if desired:
Adjust yields
open
Adjust ext. res. addition
open
Rock cover, %
0
Fuel type for entire run
(none)
Energy use for entire simulation, BTU/ac
840000
Equiv. diesel use for entire simulation, gal/ac
6.1
Fuel cost for entire simulation, US$/ac
0
Adjust res. burial level
Normal res. burial
Net C factor
0.00069
STEP 5: Set supporting practices:
Contouring
default
Relative row grade, %
100
Crit. slope length, ft
100
Strips/barriers
(none)
Diversion/terrace, sediment basin
(none)
Yrs offset from start year (MA
Segment
Yrs offset from start year, yr
Operations
Info
Date, m/d/y
End/Start crop year?
Operation
Vegetation
Yield (harv. units), #/ac
Type of cover material
Cover matl add/remove, lb/ac
Cover from addition, %
Standing res. added by op. desc., lb/ac
Fuel used this opera
6/1/1 No Harvest, hay, grass Tall fescue y3+, regrowth after cut 3000 510.00 25 default
6/5/1 No Fert applic. surface broadcast default
7/15/1 No Harvest, hay, grass Tall fescue y3+, regrowth after cut 3000 382.50 19 default
7/20/1 No Fert applic. surface broadcast default
9/1/1 No Harvest, hay, grass Tall fescue, y2 senesc thru yr3 greenup 4000 382.50 19 default
5/23/2 No No operation default
Finished calculating
R2_DL
NRCS simple 11182015
CBW_profiles_08-21-15
Microsoft Excel - D...
C Factor review of ...
RUSLE2 Version 2.6...
4:06 PM

A more realistic establishment file for Tall fescue would delay harvest until year 2 to allow the stand to more fully establish over winter and would likely have only two cuts per year thereafter. See corrected file below:



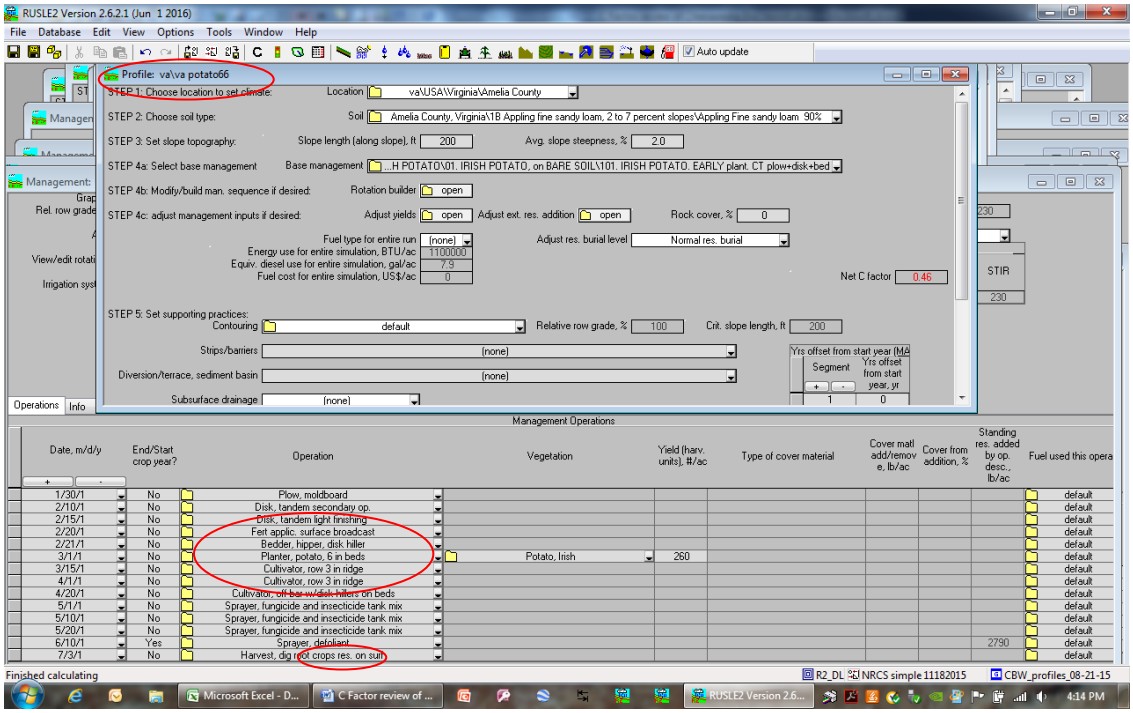
I recommend that decisions be made to revise all the Other Hay management scenarios using a species common to all areas such as Tall fescue and use proper vegetation files in the correct order and modeled for at least a two year period.

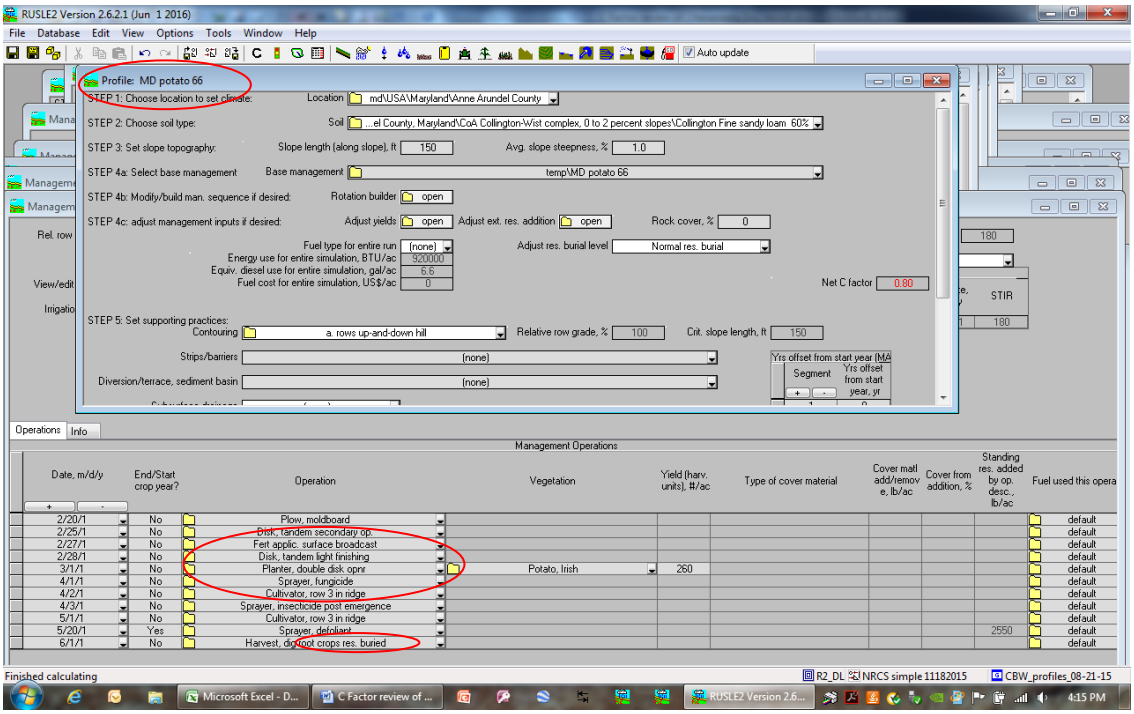
Potato



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Q	R	S	T	U	V	W
4		DE	MD		Dave: 0.13		NY	PA		VA			WV	Grand Total							
5	crop	59	4.1	59	65	66	4.1	4.1	65	64	66	67	62			median	2*StDev	<	>		
6	Alfalfa Hay Harvested Area	0.091	0.047	0.166	0.120	0.011	0.037	0.044	0.103	0.007	0.008	0.011	0.083	0.061		0.046	0.103		0.149		croplan
7	Broccoli, spring												0.341	0.341							pasture
8	Cabbage						0.398							0.398							hay
9	Corn & Wheat			0.055	0.214	0.058		0.074	0.073	0.267	0.060	0.067		0.109		0.070	0.166		0.236		
10	Corn for Grain	0.211	0.148	0.214	0.171	0.190	0.136	0.155	0.147	0.188	0.204	0.212	0.158	0.178		0.179	0.057	0.122	0.237		
11	Corn for Silage	0.429	0.316	0.404	0.347	0.366	0.326	0.336	0.340	0.405	0.429	0.460	0.382	0.378		0.374	0.094	0.280	0.467		
12	Cucumber	0.527	0.340	0.526	0.665	0.210		0.133	0.352					0.393		0.352	0.379		0.730		
13	Other managed hay Harvested Area	0.064	0.008	0.145	0.008	0.146	0.101	0.007	0.007	0.001	0.001	0.001	0.083	0.052		0.008	0.115		0.123		
14	Pasture / Range	0.148	0.012	0.005	0.005	0.006	0.010	0.013	0.005	0.002	0.003	0.003	0.031	0.020		0.006	0.082		0.087		
15	Potato	0.627	0.638	0.625	0.820	0.828	0.629			0.554	0.593	0.607	0.676	0.660		0.628	0.184	0.444	0.812		
16	Snap Beans	0.583												0.583							
17	Soybean	0.303		0.298	0.214	0.239	0.172	0.188	0.193	0.214	0.224	0.241	0.233	0.229		0.224	0.083	0.141	0.307		
18	Soybean & Wheat	0.032		0.155	0.128	0.151			0.119	0.176	0.199	0.197	0.129	0.143		0.151	0.102	0.049	0.253		
19	Soybean Wheat - Relay							0.072						0.072							
20	Tomato									0.354	0.372	0.398		0.375							
21	Watermelon		0.176	0.239	0.227	0.241		0.220	0.224					0.221		0.226	0.047	0.179	0.273		
22	Wheat for Grain	0.083		0.246	0.224	0.243	0.276	0.293	0.215	0.167	0.186	0.202	0.199	0.212		0.215	0.114	0.100	0.329		
23	**Grand Total**	**0.281**	**0.211**	**0.257**	**0.262**	**0.224**	**0.219**	**0.140**	**0.162**	**0.212**	**0.207**	**0.218**	**0.232**	**0.219**							
24	(overall average C-factors by state/CMZ)																				
25																					
26	Specialty - low and high inputs	0.579	0.385	0.463	0.571	0.426	0.514	0.177	0.288	0.454	0.483	0.503	0.509	0.446		0.473	0.232	0.241	0.705		
27	(average of: broccoli, cabbage, cucumber, potato, snap beans, tomato, watermelon)																				
28																					
29	Each value is the average of 12 months; each monthly value is the average from 6 years?																				

There is high variability in this crop group even within the same CMZ. Although the yields are the same, the systems are significantly different with the VA 66 potato scenario planted on raised beds with extra tillage and harvested with **residues left** on the surface while the MD 66 Potato scenario was flat planted and harvested with **residues buried**. See below:

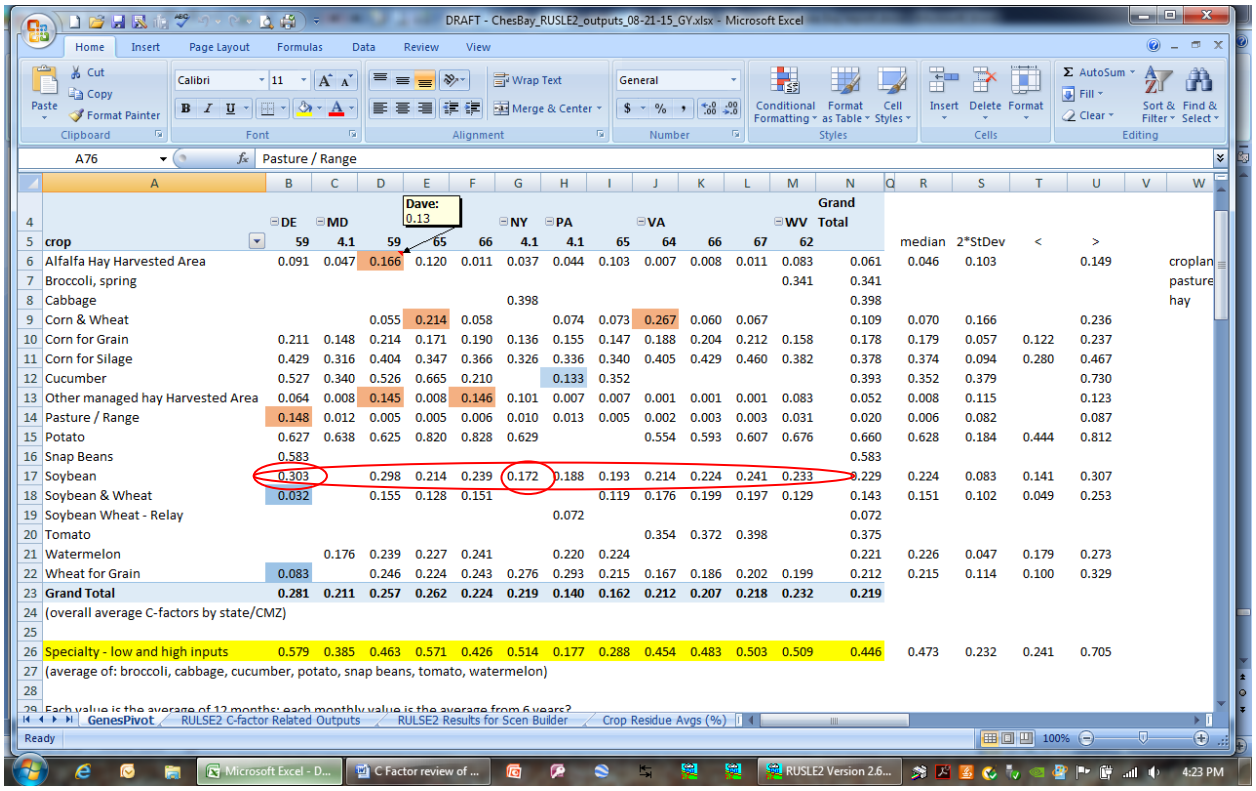




I recommend a common planting and harvesting system be decided upon and all the potato files revised accordingly and re run.

Soybeans

While the comparison table shows some moderate difference across the group I found the soybean file representing the highest Net C factor and the file representing the lowest Net C factor to both be reasonable but differ in the harvest operations and thus differ in the amount of flat residue at harvest. Normal differences in Net C factors across the region are caused by differences in planting dates, differences in varieties, row spacing and in yields.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Q	R	S	T	U	V	W
4		DE	MD				NY	PA		VA			WV	Grand Total							
5	crop	59	4.1	59	65	66	4.1	4.1	65	64	66	67	62			median	2*StDev	<	>		
6	Alfalfa Hay Harvested Area	0.091	0.047	0.166	0.120	0.011	0.037	0.044	0.103	0.007	0.008	0.011	0.083	0.061		0.046	0.103		0.149		croplan
7	Broccoli, spring												0.341	0.341							pasture
8	Cabbage						0.398							0.398							hay
9	Corn & Wheat			0.055	0.214	0.058		0.074	0.073	0.267	0.060	0.067		0.109		0.070	0.166		0.236		
10	Corn for Grain	0.211	0.148	0.214	0.171	0.190	0.136	0.155	0.147	0.188	0.204	0.212	0.158	0.178		0.179	0.057	0.122	0.237		
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14	Pasture / Range	0.148	0.012	0.005	0.005	0.006	0.010	0.013	0.005	0.002	0.003	0.003	0.031	0.020		0.006	0.082		0.087		
15	Potato	0.627	0.638	0.625	0.820	0.828	0.629			0.554	0.593	0.607	0.676	0.660		0.628	0.184	0.444	0.812		
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17	Soybean	0.303		0.298	0.214	0.239	0.172	0.188	0.193	0.214	0.224	0.241	0.233	0.229		0.224	0.083	0.141	0.307		
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23	**Grand Total**	**0.281**	**0.211**	**0.257**	**0.262**	**0.224**	**0.219**	**0.140**	**0.162**	**0.212**	**0.207**	**0.218**	**0.232**	**0.219**							
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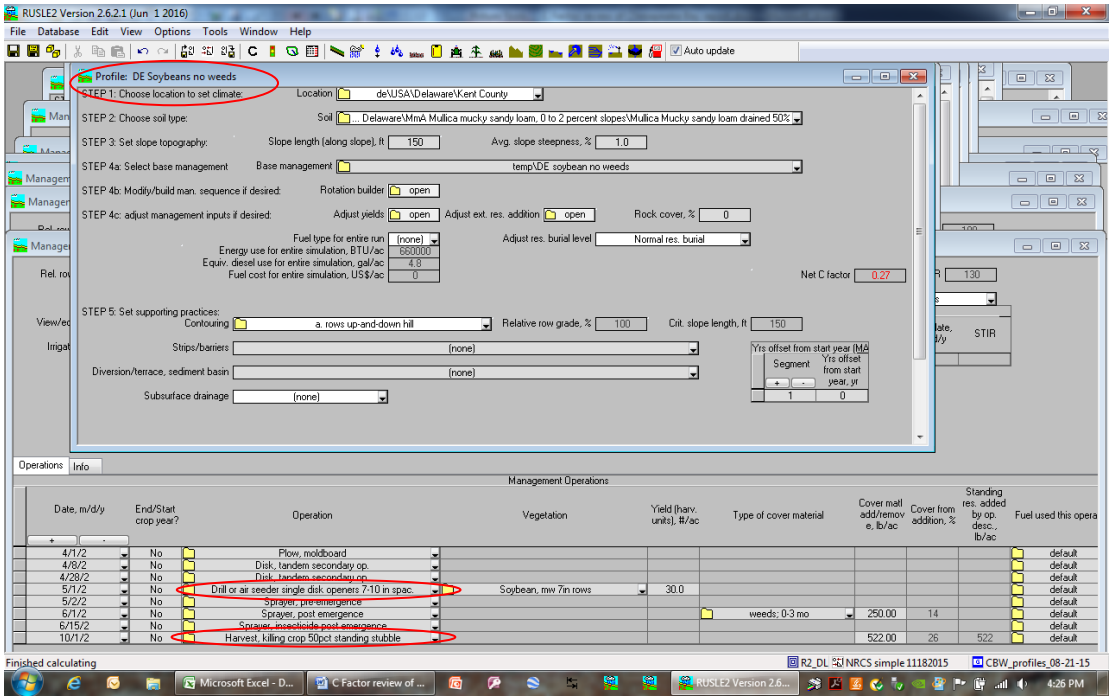
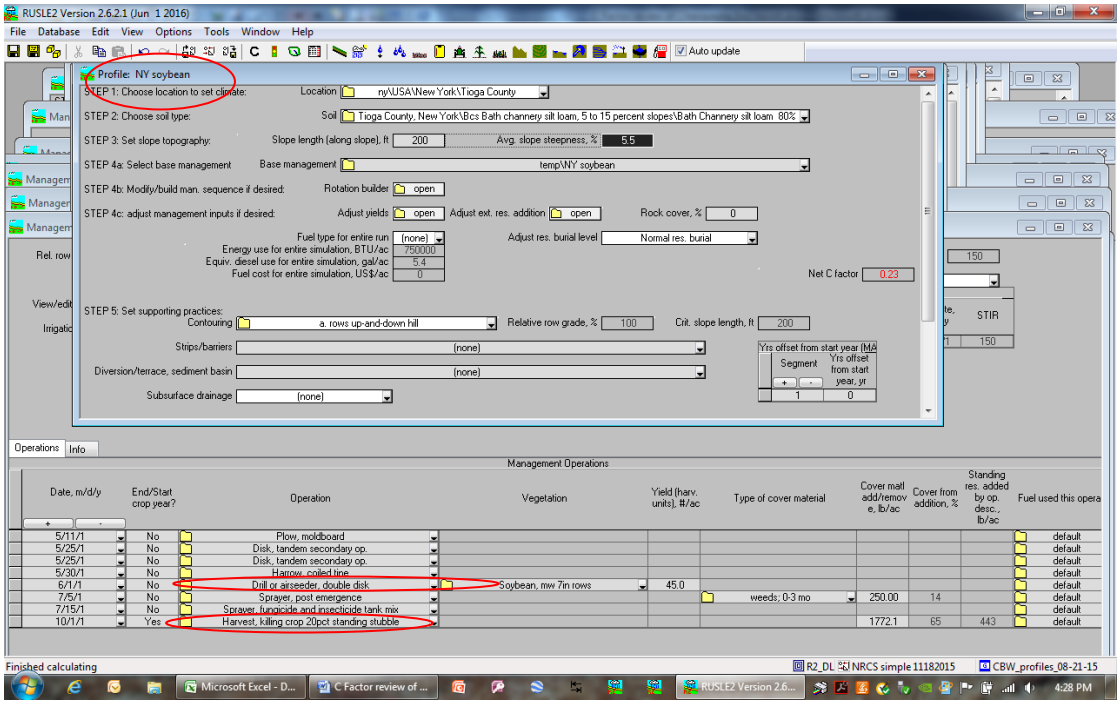
28																					
29	Each value is the average of 12 months; each monthly value is the average from 6 years?																				

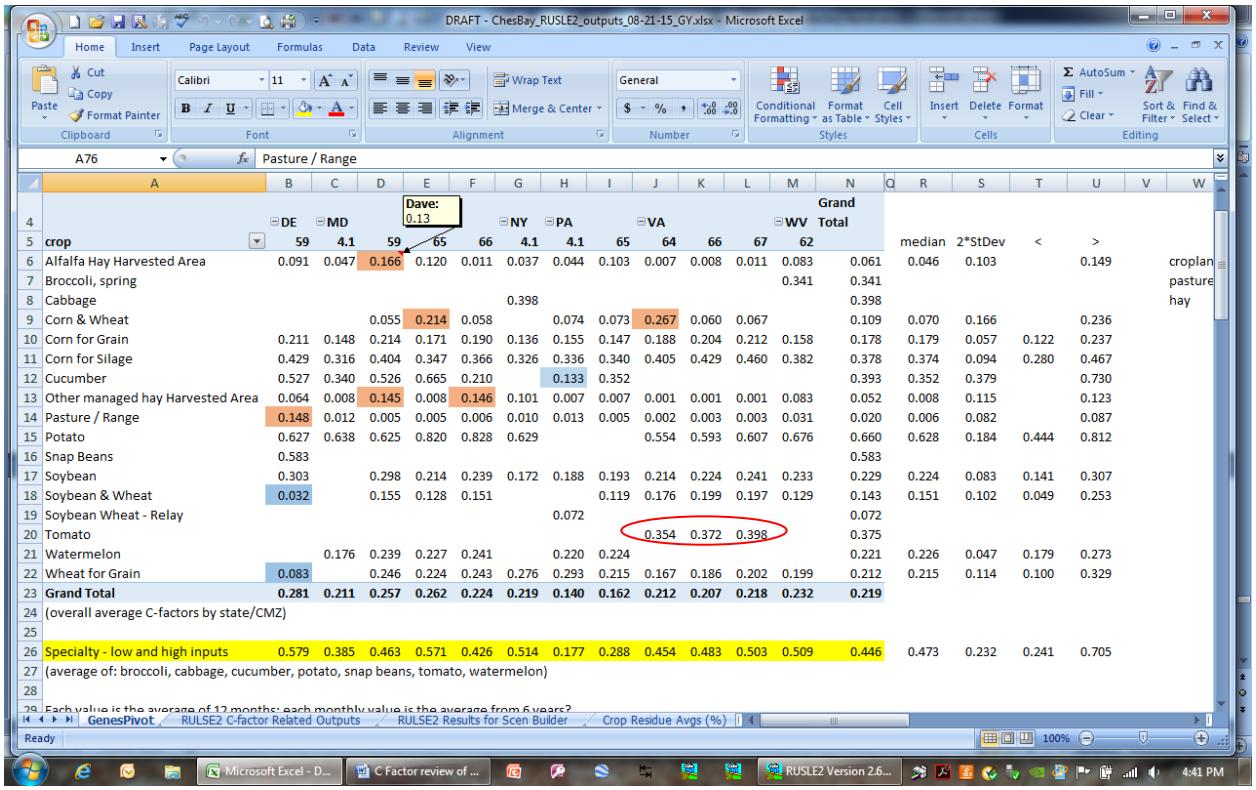


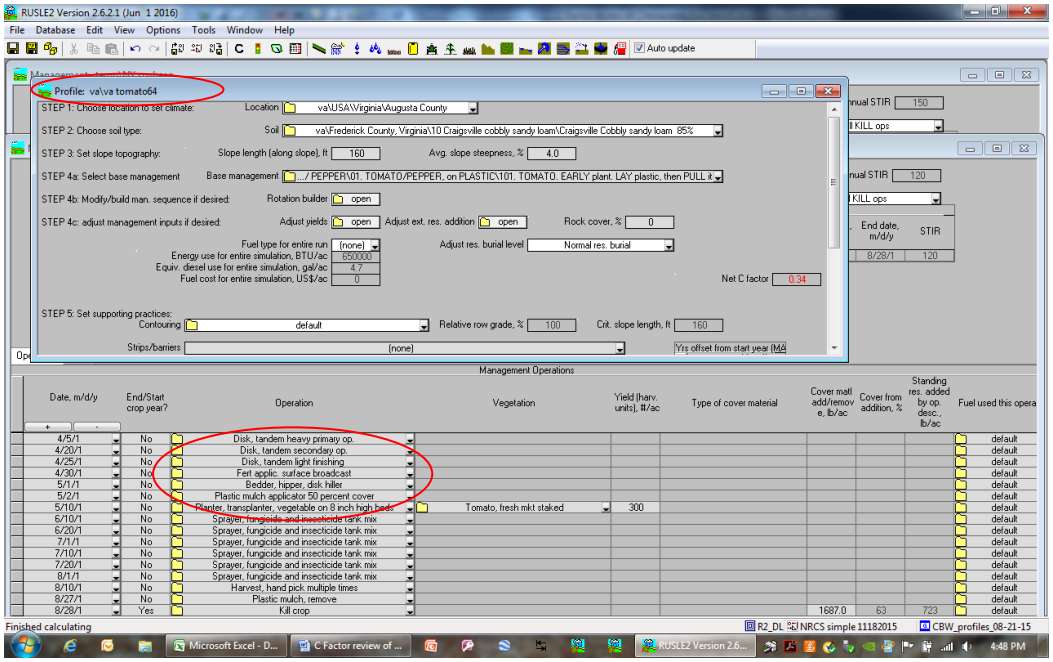


If any revisions are made, further defining a common harvest stubble height to be modeled across the region is recommended. The no plow scenarios should use correct planting operations for no-tilled soybeans.

Tomato

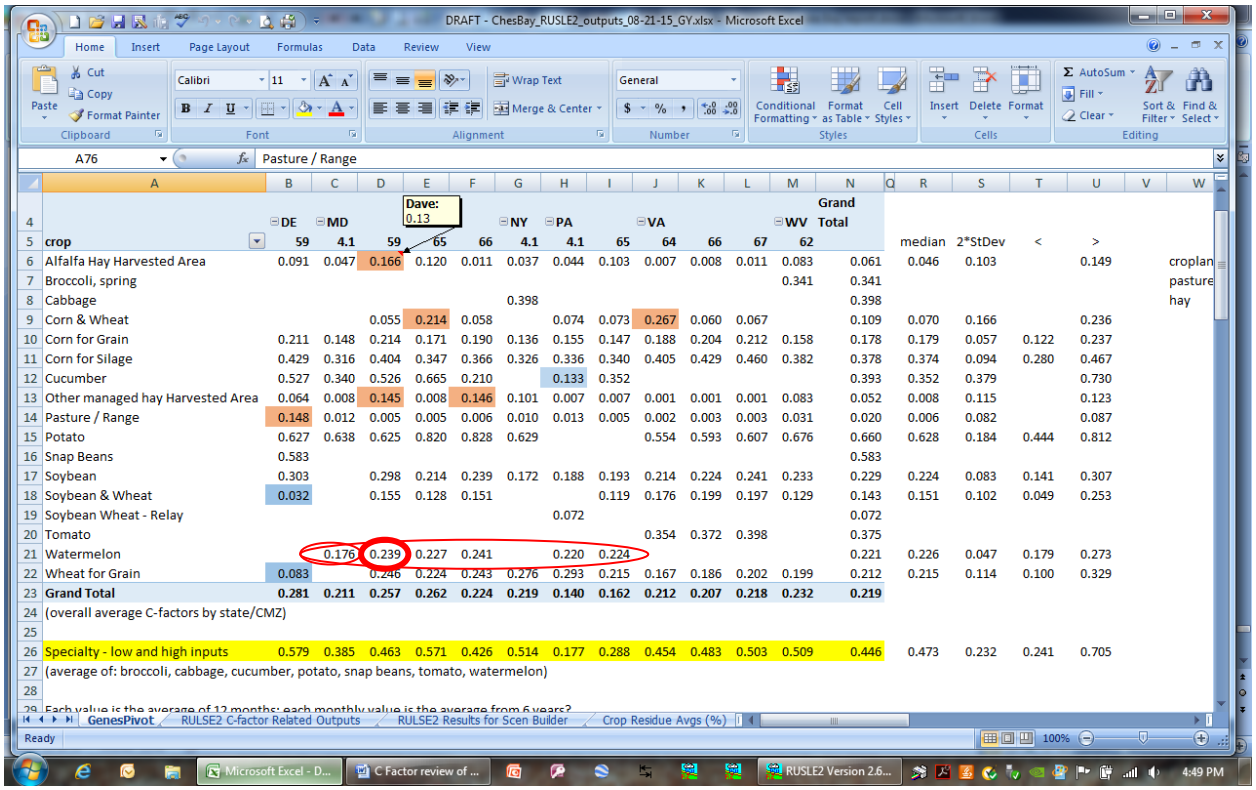
These were confined to VA CMZs and the management files appear to be well constructed although they utilized several tandem disk operations and are on raised beds with plastic mulch instead of low cover conditions such as a plow tillage scenario.





Watermelon

This is a fairly tight comparison. The files represent a similar tillage system but there are differences in planting dates across the region as expected. However the MD 4.1 Watermelon file is built for **pumpkins.** This is a different crop with different harvest date than watermelon. Corresponding yields are different therefore residue amounts are different. I recommend this file be corrected to bring the lower Net C factor more in line with the others.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Q	R	S	T	U	V	W
4		DE	MD				NY	PA		VA			WV	Grand Total							
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6	Alfalfa Hay Harvested Area	0.091	0.047	0.166	0.120	0.011	0.037	0.044	0.103	0.007	0.008	0.011	0.083	0.061		0.046	0.103		0.149		croplan
7	Broccoli, spring												0.341	0.341							pasture
8	Cabbage						0.398							0.398							hay
9	Corn & Wheat			0.055	0.214	0.058		0.074	0.073	0.267	0.060	0.067		0.109		0.070	0.166		0.236		
10	Corn for Grain	0.211	0.148	0.214	0.171	0.190	0.136	0.155	0.147	0.188	0.204	0.212	0.158	0.178		0.179	0.057	0.122	0.237		
11	Corn for Silage	0.429	0.316	0.404	0.347	0.366	0.326	0.336	0.340	0.405	0.429	0.460	0.382	0.378		0.374	0.094	0.280	0.467		
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14	Pasture / Range	0.148	0.012	0.005	0.005	0.006	0.010	0.013	0.005	0.002	0.003	0.003	0.031	0.020		0.006	0.082		0.087		
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17	Soybean	0.303		0.298	0.214	0.239	0.172	0.188	0.193	0.214	0.224	0.241	0.233	0.229		0.224	0.083	0.141	0.307		
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21	Watermelon		0.176	0.239	0.227	0.241		0.220	0.224					0.221		0.226	0.047	0.179	0.273		
22	Wheat for Grain	0.083		0.246	0.224	0.243	0.276	0.293	0.215	0.167	0.186	0.202	0.199	0.212		0.215	0.114	0.100	0.329		
23	**Grand Total**	**0.281**	**0.211**	**0.257**	**0.262**	**0.224**	**0.219**	**0.140**	**0.162**	**0.212**	**0.207**	**0.218**	**0.232**	**0.219**							
24	(overall average C-factors by state/CMZ)																				
25																					
26	Specialty - low and high inputs	0.579	0.385	0.463	0.571	0.426	0.514	0.177	0.288	0.454	0.483	0.503	0.509	0.446		0.473	0.232	0.241	0.705		
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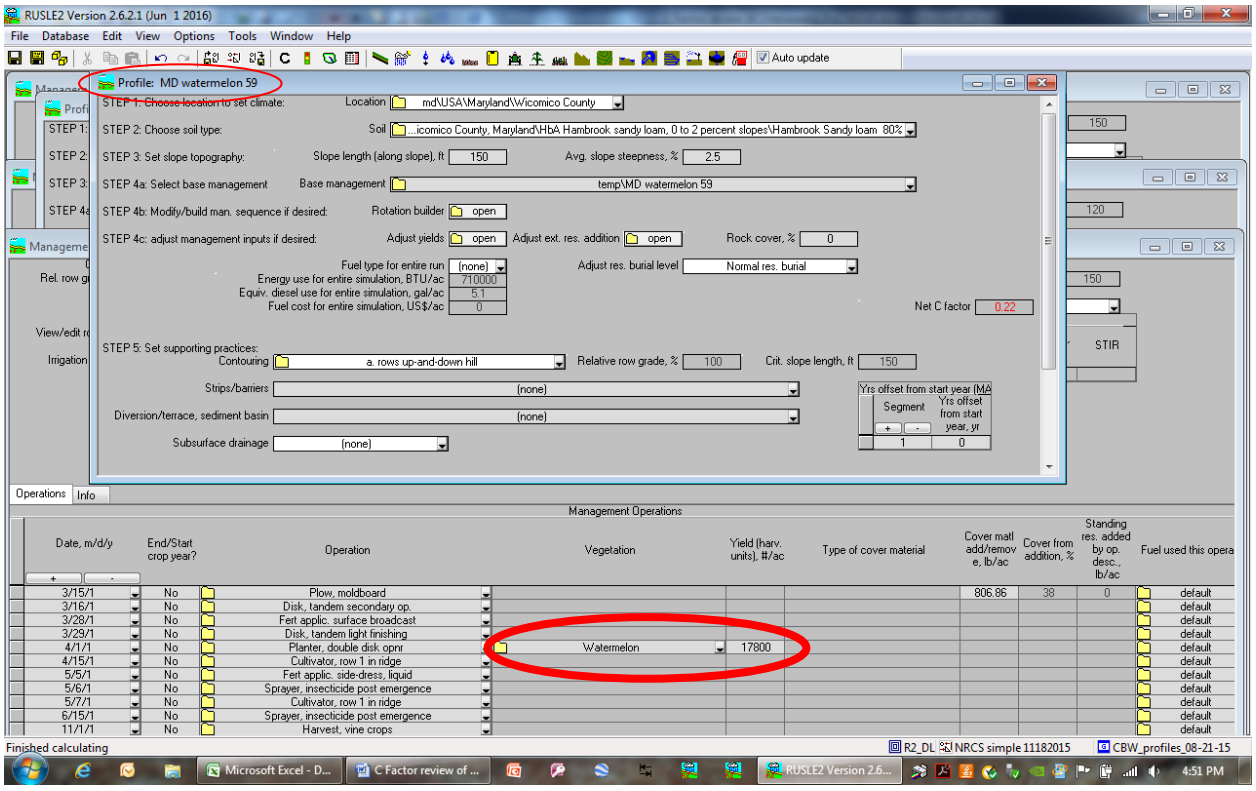
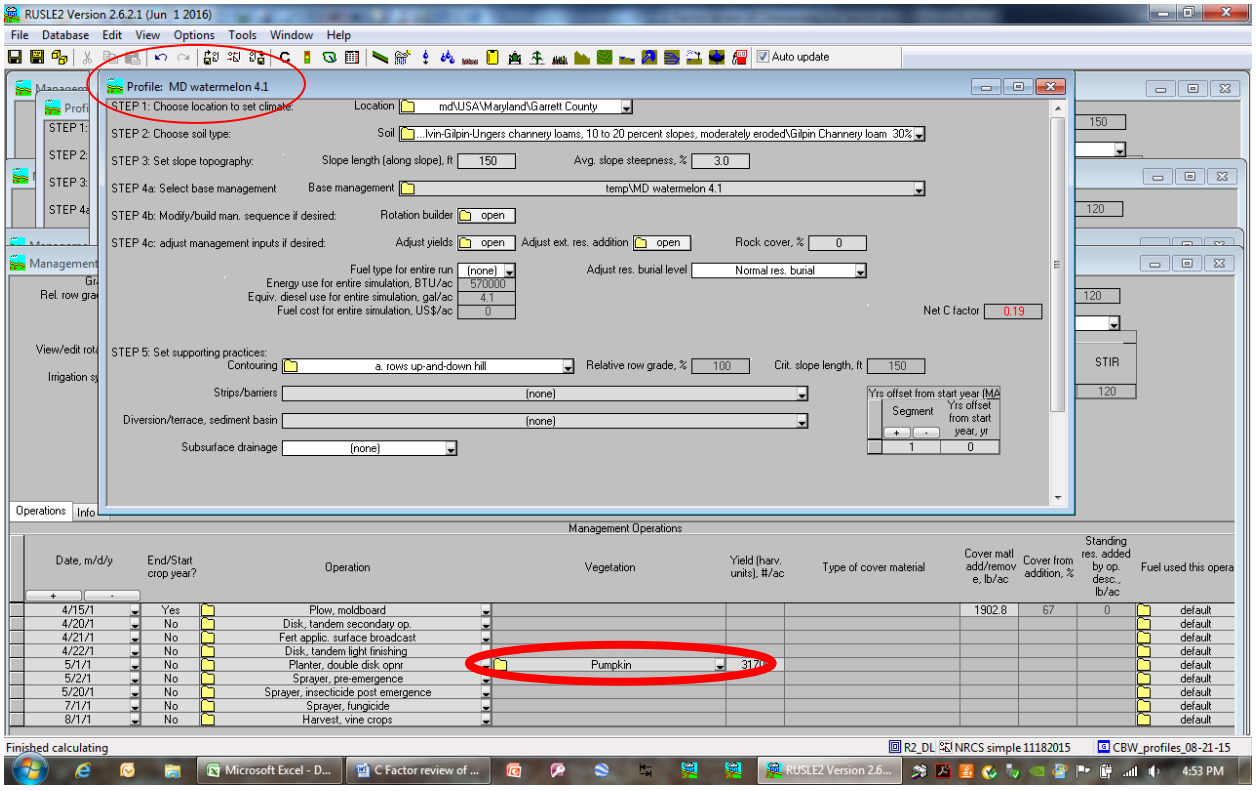
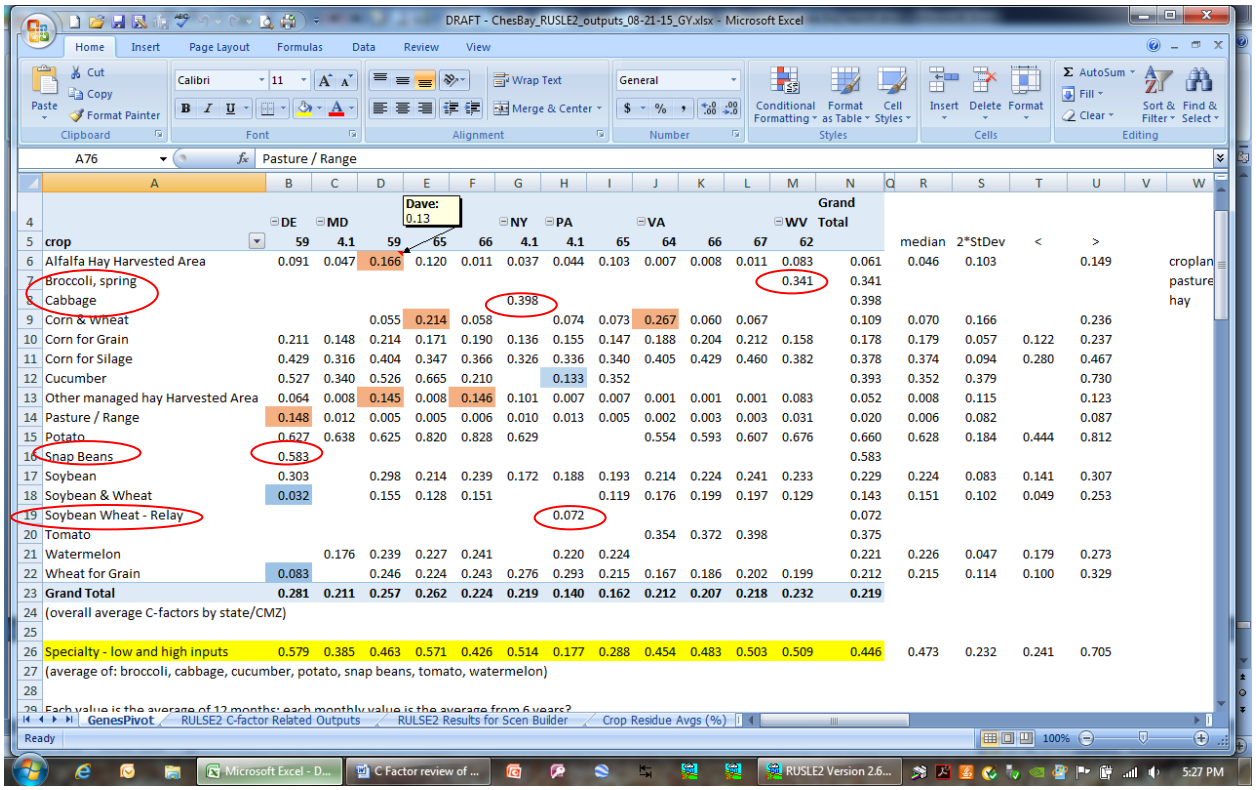
28																					
29	Each value is the average of 12 months: each monthly value is the average from 6 years?																				


RUSLE2 Version 2.6.2.1 (Jun 1 2016)
File Database Edit View Options Tools Window Help
Profile: MD watermelon 59
STEP 1: Choose location to set climate:
Location md\USA\Maryland\Wicomico County
STEP 2: Choose soil type:
Soil ...icomico County, Maryland\HbA Hambrook sandy loam, 0 to 2 percent slopes\Hambrook Sandy loam 80%
STEP 3: Set slope topography:
Slope length (along slope), ft 150
Avg. slope steepness, % 2.5
STEP 4a: Select base management
Base management temp\MD watermelon 59
STEP 4b: Modify/build man. sequence if desired:
Rotation builder open
STEP 4c: adjust management inputs if desired:
Adjust yields open
Adjust ext. res. addition open
Rock cover, % 0
Fuel type for entire run (none)
Energy use for entire simulation, BTU/ac 710000
Equiv. diesel use for entire simulation, gal/ac 5.1
Fuel cost for entire simulation, US$/ac 0
Adjust res. burial level Normal res. burial
Net C factor 0.22
STEP 5: Set supporting practices:
Contouring a. rows up-and-down hill
Relative row grade, % 100
Crit. slope length, ft 150
Strips/barriers (none)
Diversion/terrace, sediment basin (none)
Subsurface drainage (none)
Yrs offset from start year (MA
Segment
Yrs offset from start year, yr
1 0
Operations Info
Management Operations
Date, m/d/y
End/Start crop year?
Operation
Vegetation
Yield (harv. units), #/ac
Type of cover material
Cover matl add/remove, lb/ac
Cover from addition, %
Standing res. added by op. desc., lb/ac
Fuel used this opera
3/15/1 No Plow, moldboard 806.86 38 0 default
3/16/1 No Disk, tandem secondary op. default
3/28/1 No Fert applic. surface broadcast default
3/29/1 No Disk, tandem light finishing default
4/1/1 No Planter, double disk opnr Watermelon 17800 default
4/15/1 No Cultivator, row 1 in ridge default
5/5/1 No Fert applic. side-dress, liquid default
5/6/1 No Sprayer, insecticide post emergence default
5/7/1 No Cultivator, row 1 in ridge default
6/15/1 No Sprayer, insecticide post emergence default
11/1/1 No Harvest, vine crops default
Finished calculating
R2_DL NRCS simple 11182015
CBW_profiles_08-21-15
Microsoft Excel - D...
C Factor review of ...
RUSLE2 Version 2.6...
4:51 PM


RUSLE2 Version 2.6.2.1 (Jun 1 2016)
File Database Edit View Options Tools Window Help
Profile: MD watermelon 4.1
STEP 1: Choose location to set climate:
Location md\USA\Maryland\Garrett County
STEP 2: Choose soil type:
Soil ...lvin-Gilpin-Ungers channery loams, 10 to 20 percent slopes, moderately eroded\Gilpin Channery loam 30%
STEP 3: Set slope topography:
Slope length (along slope), ft 150
Avg. slope steepness, % 3.0
STEP 4a: Select base management
Base management temp\MD watermelon 4.1
STEP 4b: Modify/build man. sequence if desired:
Rotation builder open
STEP 4c: adjust management inputs if desired:
Adjust yields open
Adjust ext. res. addition open
Rock cover, % 0
Fuel type for entire run (none)
Energy use for entire simulation, BTU/ac 570000
Equiv. diesel use for entire simulation, gal/ac 4.1
Fuel cost for entire simulation, US$/ac 0
Adjust res. burial level Normal res. burial
Net C factor 0.19
STEP 5: Set supporting practices:
Contouring a. rows up-and-down hill
Relative row grade, % 100
Crit. slope length, ft 150
Strips/barriers (none)
Diversion/terrace, sediment basin (none)
Subsurface drainage (none)
Yrs offset from start year (MA
Segment
Yrs offset from start year, yr
1 0
Operations Info
Management Operations
Date, m/d/y
End/Start crop year?
Operation
Vegetation
Yield (harv. units), #/ac
Type of cover material
Cover matl add/remove, lb/ac
Cover from addition, %
Standing res. added by op. desc., lb/ac
Fuel used this opera
4/15/1 Yes Plow, moldboard 1902.8 67 0 default
4/20/1 No Disk, tandem secondary op. default
4/21/1 No Fert applic. surface broadcast default
4/22/1 No Disk, tandem light finishing default
5/1/1 No Planter, double disk opnr Pumpkin 3170 default
5/2/1 No Sprayer, pre-emergence default
5/20/1 No Sprayer, insecticide post emergence default
7/1/1 No Sprayer, fungicide default
8/1/1 No Harvest, vine crops default
Finished calculating
R2_DL NRCS simple 11182015
CBW_profiles_08-21-15
Microsoft Excel - D...
C Factor review of ...
RUSLE2 Version 2.6...
4:53 PM

Minor crops

I did not review these minor crops since they contained only single examples with no other choice to compare.



DRAFT - ChesBay_RUSLE2_outputs_08-21-15_GY.xlsx - Microsoft Excel

Dave: 0.13

crop	DE 59	MD 4.1	59	65	66	NY 4.1	PA 4.1	65	VA 64	66	67	WV 62	Grand Total	median	2*StDev	<	>	
Alfalfa Hay Harvested Area	0.091	0.047	0.166	0.120	0.011	0.037	0.044	0.103	0.007	0.008	0.011	0.083	0.061	0.046	0.103		0.149	croplan
Broccoli, spring												0.341	0.341					pasture
Cabbage						0.398							0.398					hay
Corn & Wheat			0.055	0.214	0.058		0.074	0.073	0.267	0.060	0.067		0.109	0.070	0.166		0.236	
Corn for Grain	0.211	0.148	0.214	0.171	0.190	0.136	0.155	0.147	0.188	0.204	0.212	0.158	0.178	0.179	0.057	0.122	0.237	
Corn for Silage	0.429	0.316	0.404	0.347	0.366	0.326	0.336	0.340	0.405	0.429	0.460	0.382	0.378	0.374	0.094	0.280	0.467	
Cucumber	0.527	0.340	0.526	0.665	0.210		0.133	0.352					0.393	0.352	0.379		0.730	
Other managed hay Harvested Area	0.064	0.008	0.145	0.008	0.146	0.101	0.007	0.007	0.001	0.001	0.001	0.083	0.052	0.008	0.115		0.123	
Pasture / Range	0.148	0.012	0.005	0.005	0.006	0.010	0.013	0.005	0.002	0.003	0.003	0.031	0.020	0.006	0.082		0.087	
Potato	0.627	0.638	0.625	0.820	0.828	0.629			0.554	0.593	0.607	0.676	0.660	0.628	0.184	0.444	0.812	
Snap Beans	0.583												0.583					
Soybean	0.303		0.298	0.214	0.239	0.172	0.188	0.193	0.214	0.224	0.241	0.233	0.229	0.224	0.083	0.141	0.307	
Soybean & Wheat	0.032		0.155	0.128	0.151			0.119	0.176	0.199	0.197	0.129	0.143	0.151	0.102	0.049	0.253	
Soybean Wheat - Relay							0.072						0.072					
Tomato									0.354	0.372	0.398		0.375					
Watermelon		0.176	0.239	0.227	0.241		0.220	0.224					0.221	0.226	0.047	0.179	0.273	
Wheat for Grain	0.083		0.246	0.224	0.243	0.276	0.293	0.215	0.167	0.186	0.202	0.199	0.212	0.215	0.114	0.100	0.329	
Grand Total	**0.281**	**0.211**	**0.257**	**0.262**	**0.224**	**0.219**	**0.140**	**0.162**	**0.212**	**0.207**	**0.218**	**0.232**	**0.219**					
(overall average C-factors by state/CMZ)																		
Specialty - low and high inputs	0.579	0.385	0.463	0.571	0.426	0.514	0.177	0.288	0.454	0.483	0.503	0.509	0.446	0.473	0.232	0.241	0.705	
(average of: broccoli, cabbage, cucumber, potato, snap beans, tomato, watermelon)																		

Each value is the average of 12 months; each monthly value is the average from 6 years?

GenesPivot | RULSE2 C-factor Related Outputs | RULSE2 Results for Scen Builder | Crop Residue Avgs (%)

Ready

Microsoft Excel - D... | C Factor review of ... | RUSLE2 Version 2.6... | 5:27 PM

Conclusions and Comments

The take home message is that there are numerous inconsistencies in the management files for most crop types because they have errors in them and often don't represent the same general system within the crop group when compared across state and CMZ boundaries. In some cases such as with the Corn and Wheat and with the Soybeans and Wheat double crop files they are generally all built incorrectly because the harvest date for wheat is too early for grain harvest.

I recommend developing more specific descriptions of the crop group covering what species is harvested as is in the case of pastures and other hay crop groups. The descriptions for all the grain crops should specify whether crop residues are also harvested or not.

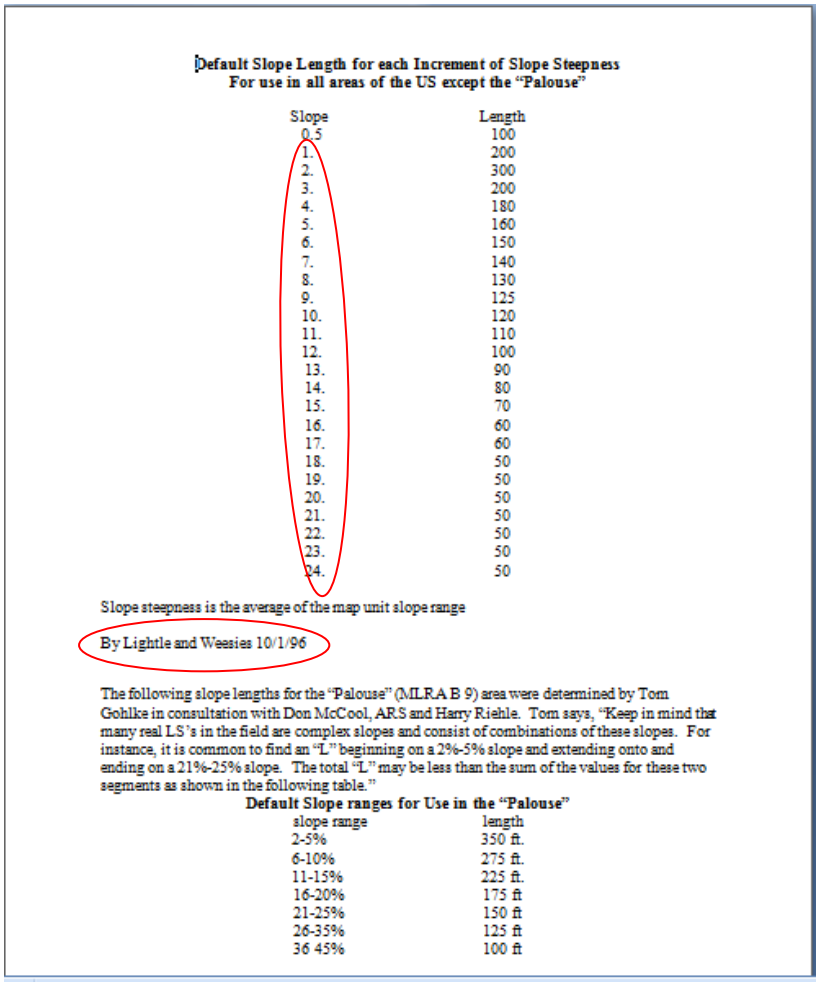
The details and internal relationships are very complex when it comes to how these files are supposed to be built in order to run correctly and produce reasonable outputs. Therefore I recommend that revisions be done by a well trained RUSLE2 user with experience in building RUSLE2 managements and a thorough knowledge of cropping systems, tillage systems, crops and field operations and the databases and how the internal operations processes and vegetations growth curves work in RUSLE2.

In RUSLE2, all the details of tillage operations, planting systems, harvest operations and other soil disturbing operations contain processes and values representing the soil roughness created, the depth and amount of previous crop residues buried and resurfaced and etc. The vegetation files include crop growth curves for crops planted, the canopy and root development, biomass grown and amount of yield harvested and amount of residue produced. The calculations involve daily changes in the amounts in the various pools of residue produced for each crop in the cropping system. This is all accounted for in the RUSLE2 management descriptions formerly known as C factors in USLE and RUSLE1.

In my effort to determine whether the Corn-wheat and Soybean-wheat scenarios were to represent 2 grain crops, 1 grain crop and one cover crop or 1 grain crop and one forage crop, I had correspondence from Olivia Devereux in which she stated that "*No cover crops are modeled. Cover crops are a BMP and we need data for a no-BMP system. The cover crop BMP is accounted for outside of these RUSLE-generated data.*"

I am concerned that, in the study, by modeling cover crop effects separately outside the cropping system and separate from the Net C factor, this approach may not capture the daily changes in roughness, cover and canopy interrelationships that cover crops have with other crops being grown in the cropping system and tillage system. The cover crop benefit to erosion and sediment deposition depends heavily on when the cover crop cover occupies part of the crop interval in relation to the distribution of erosive rains and whether the cover crop residue is killed and left on the surface, plowed under or grazed or removed as forage and how the kind, amount and composition of that plant material affects the erosion processes in the grain crop that follows it. There is no accurate "one size fits all" coefficient to represent a cover crop, since the benefit depends on the specific situation and whether it is correctly modeled on a daily basis as part of the management file that results in the Net C factor.

In Appendix D the default slope length vs. slope grade table which I co-authored and created in 1996 is incomplete because the slope grade increments above 0.5 are missing. This is the correct table:



Default Slope Length for each Increment of Slope Steepness
For use in all areas of the US except the "Palouse"

Slope	Length
0.5	100
1.	200
2.	300
3.	200
4.	180
5.	160
6.	150
7.	140
8.	130
9.	125
10.	120
11.	110
12.	100
13.	90
14.	80
15.	70
16.	60
17.	60
18.	50
19.	50
20.	50
21.	50
22.	50
23.	50
24.	50

Slope steepness is the average of the map unit slope range

By Lightle and Weesies 10/1/96

The following slope lengths for the "Palouse" (MLRA B 9) area were determined by Tom Gohlke in consultation with Don McCool, ARS and Harry Riehle. Tom says, "Keep in mind that many real LS's in the field are complex slopes and consist of combinations of these slopes. For instance, it is common to find an "L" beginning on a 2%-5% slope and extending onto and ending on a 21%-25% slope. The total "L" may be less than the sum of the values for these two segments as shown in the following table."

Default Slope ranges for Use in the "Palouse"

slope range	length
2-5%	350 ft.
6-10%	275 ft.
11-15%	225 ft.
16-20%	175 ft
21-25%	150 ft
26-35%	125 ft
36 45%	100 ft

I appreciate the opportunity to review these RUSLE2 files, in order to provide some insight into the variability between files within the same crop groups and to make suggestions for improvement. I would be happy to be involved further in training those who might make revisions or assist in making revisions through another contract.

David T. Lightle

Erosion Model Consultant