Agricultural scenario
JRODOS calculations

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The model

- FDMT = Terrestrial food chain and dose in (J)RODOS
  - Model description: [Müller et al, 2006]
  - Based on ECOSYS ([Müller and Pröhl, 1993])
  - Radioecological regions
- Main input
  - Time-integrated activity concentration in air (near ground)
  - Activity deposited by precipitation per unit ground area
  - Amount of precipitation
  - Date of deposition
- Transfer to feedstuff and foodstuff
  - Deposition to plant leaves and soil
  - Translocation, root uptake
  - Transfer to animal products (through feedstuff + inhalation)
  - Food processing (incl. storage)

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Parameters used for the exercises

- Most model parameters: FDMT database
  - Default parameters for Central Europe
- Soil to plant transfer factors
  - IAEA TECDOC 1616
- Leaching
  - C.F. Base & R.D. Sharp, A proposal for estimation of soil leaching and leaching constants for use in assessments models, *Journal of Environmental Quality* 12, pp. 17-28, 1983.
  - Assumed infiltration rate: 100 mm/year

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Other radioecological parameters

- Harvest time
  - Grass: 1.5-31.10
  - Winter wheat: 5.8
  - Potatoes: 15.8-24.9
  - Leafy vegetables: all year round (no growth during winter time)
  - Fruit vegetables: 1.8-15.10
  - Root vegetables: 1.8-31.10

Processes considered

Plant type	External contamination	Contamination of stored products
Grass	Weathering Growth dilution explicitly Translocation into/from root zone	No storage; available all year round
Hay	Weathering Growth dilution explicitly Translocation into/from root zone	Average of harvest period. 2 harvest periods, with weights 0.7 and 0.3, respectively.
Maize, beet leaves	Weathering, growth dilution implicitely (through the yield at harvest)	Stored products have the activity of the last day of the harvest period.
Leafy vegetables	Weathering, growth dilution implicitely (through the yield at harvest)	No storage; available all year round. Growth is not considered during winter time.
Cereals, potatoes, beet, fruit, berries	Translocation	Stored products have the activity of the last day of the harvest period.
Root vegetables, fruit vegetables		Stored products have the average contamination over the whole harvest period.

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Exercises

- Two types of soil: clay and sandy
- Two release times: May 1st and November 20th
- Three radionuclides: Sr-90, Cs-137, I-131
- Dry and wet deposition
- Output
  - Activity concentration [Bq/kg] in several plant and animal products in the first 2 years
    - Maximal and average daily activity concentrations
  - Ingestion doses for the first and second year for adults and 1 year old child (European diet- default RODOS diet)

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  - Ingestion dose from various food products for adult and 1 year old child (Belgian diet)

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Results
Maximal activity concentrations

	Cow's milk	Beef	Pork	Chicken	Lamb	FruitVegs	LeafyVegs	RootVegs	Winter Wheat	Potatoes	GrassInt
Clay May											
Sr	**8.47E+01**	3.26E+00	1.09E-02	8.78E-02	3.69E+00	1.11E+00	**1.46E+03**	3.64E-01	4.63E-01	2.28E-01	1.33E+03
Cs	**1.36E+02**	**1.79E+02**	4.32E+01	3.25E+00	**1.27E+03**	4.24E+01	**1.46E+03**	3.18E+01	9.84E+00	5.86E-02	1.33E+03
I	**1.61E+02**	2.16E+00	7.05E-04	1.68E-03	2.36E+00	3.14E-02	**1.64E+03**	2.16E-02	4.21E-03	1.96E-07	2.00E+03
ClayNov											
Sr	**9.85E-01**	8.37E-02	1.40E-02	1.13E-01	5.88E-02	3.88E-02	**1.87E+03**	1.68E-01	2.08E-01	1.03E-01	2.94E+03
Cs	3.67E+00	**8.31E+00**	2.90E+00	4.05E+00	**3.20E+01**	1.05E-02	**1.87E+03**	1.72E-02	3.57E-02	2.60E-02	2.94E+03
I	**6.87E-01**	2.52E-03	1.06E-03	2.52E-03	2.01E-03	1.47E-12	**2.45E+03**	2.59E-13	9.82E-13	1.64E-13	8.08E+03
Sandy May											
Sr	**8.56E+01**	3.30E+00	1.10E-02	8.87E-02	3.73E+00	1.51E+00	**1.47E+03**	9.52E-01	8.21E-01	3.76E-01	1.35E+03
Cs	**1.37E+02**	**1.80E+02**	4.38E+01	3.33E+00	**1.29E+03**	4.28E+01	**1.47E+03**	3.22E+01	1.01E+01	1.68E-01	1.35E+03
I	**1.70E+02**	2.27E+00	7.42E-04	1.77E-03	2.48E+00	3.03E-02	**1.72E+03**	2.27E-02	4.44E-03	5.32E-06	2.10E+03
SandyNov											
Sr	**1.82E+00**	2.27E-01	1.41E-02	1.14E-01	1.57E-01	2.11E-01	**1.89E+03**	4.24E-01	3.67E-01	1.69E-01	2.97E+03
Cs	3.74E+00	9.04E+00	2.93E+00	4.08E+00	**3.31E+01**	1.64E-02	**1.89E+03**	3.13E-02	1.06E-01	7.44E-02	2.97E+03
I	**7.25E-01**	2.66E-03	1.12E-03	2.66E-03	2.13E-03	1.53E-12	**2.59E+03**	6.77E-13	4.14E-12	4.41E-12	8.53E+03

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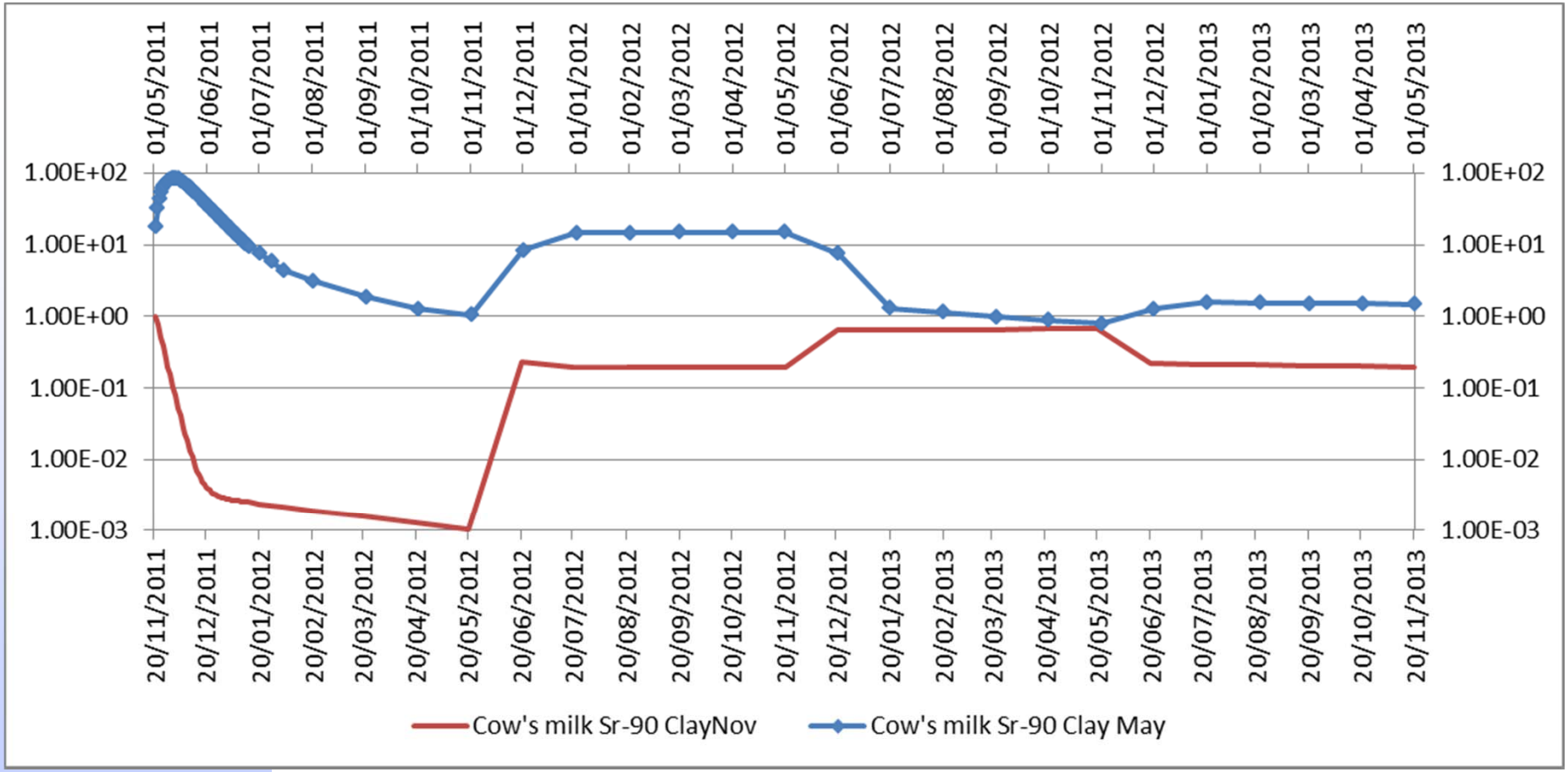
Results
Seasonal variations (some examples)



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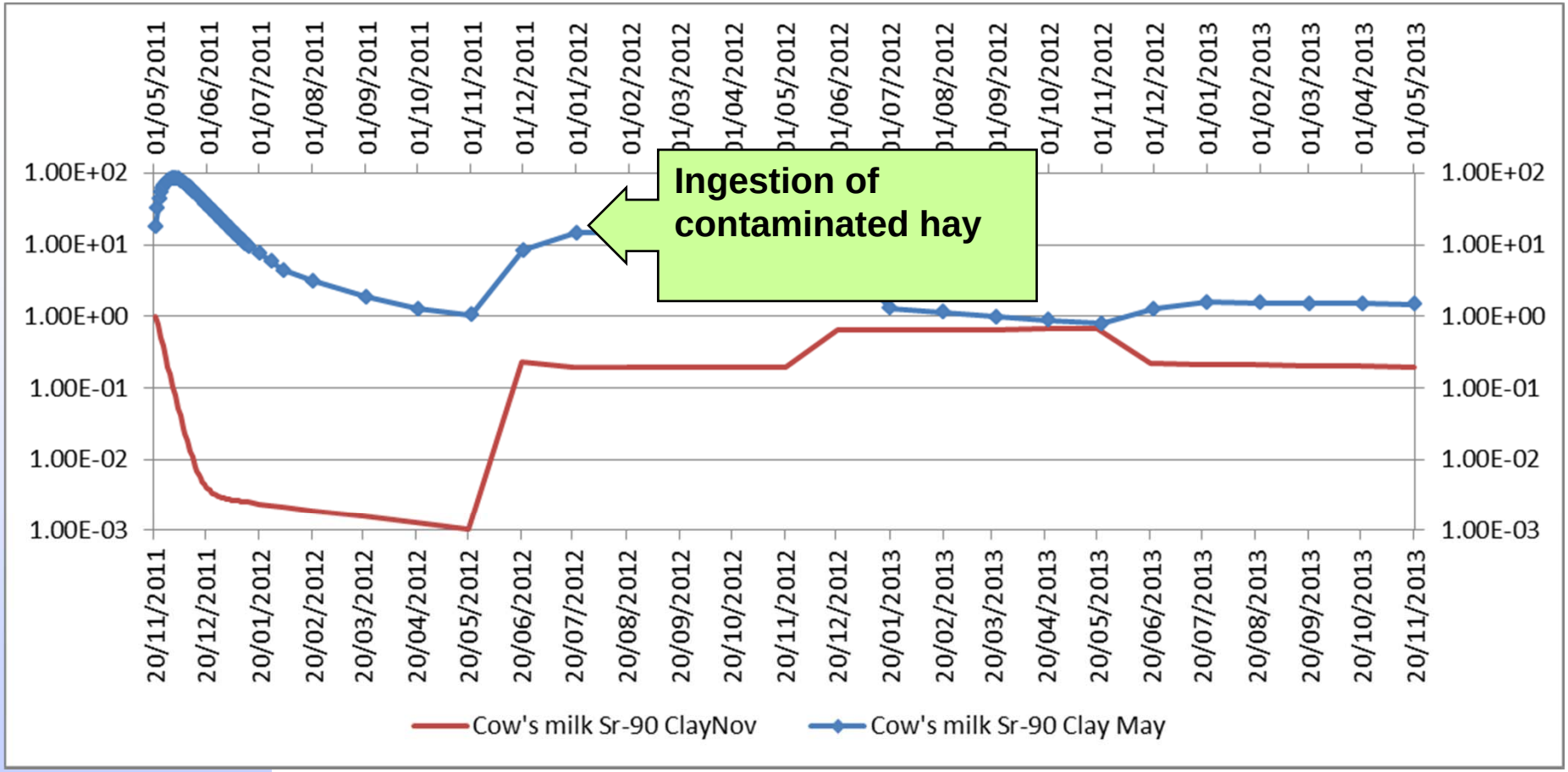

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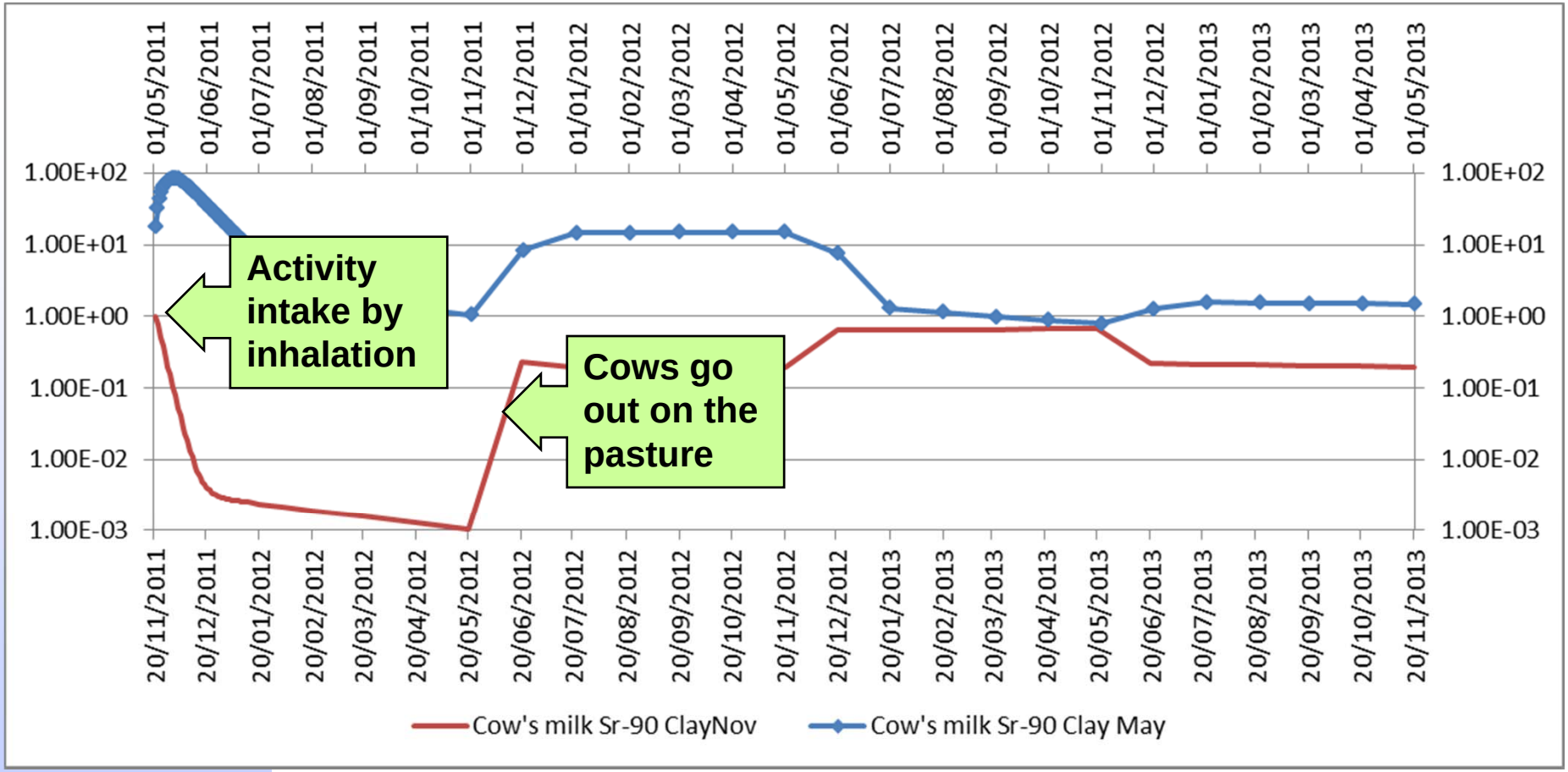
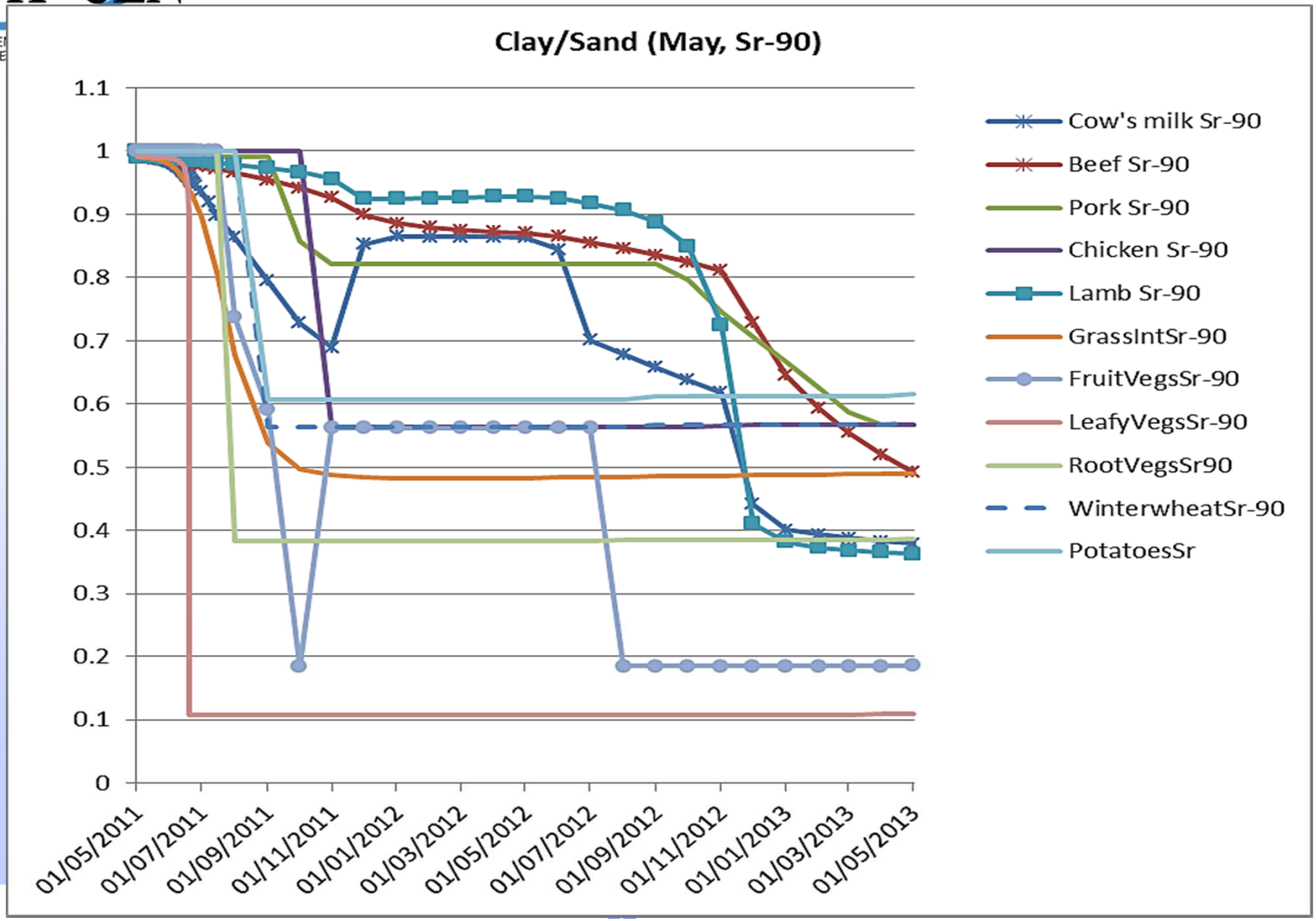


Average concentrations in food products in first and second year

AVERAGE Year 1	Cow's milk	Beef	Pork	Chicken	Lamb	Fruit Vegs	LeafyVegs	RootVegs	Winter Wheat	Potatoes
Clay May										
Sr	1.42E+01	1.60E+00	5.39E-03	2.05E-03	2.08E+00	3.91E-01	6.51E+01	2.85E-01	3.44E-01	1.70E-01
Cs	2.60E+01	7.65E+01	2.54E+01	1.92E+00	5.46E+02	1.99E+01	6.50E+01	1.93E+01	7.31E+00	4.36E-02
I	5.62E+00	1.51E-01	2.19E-05	5.18E-05	1.74E-01	1.53E-03	3.06E+01	1.08E-03	3.53E-04	1.87E-08
Clay November										
Sr	1.14E-01	1.14E-02	1.55E-03	1.96E-03	8.82E-03	1.29E-02	1.74E+02	5.56E-02	6.91E-02	3.41E-02
Cs	9.74E-01	2.98E+00	3.75E-01	2.73E-01	1.14E+01	3.46E-03	1.74E+02	5.67E-03	1.19E-02	8.60E-03
I	2.89E-03	7.82E-05	3.28E-05	7.76E-05	6.25E-05	1.32E-13	5.62E+01	2.32E-14	8.34E-14	1.53E-14

AVERAGE Year 2	Cow's milk	Beef	Pork	Chicken	Lamb	FruitVegs	LeafyVegs	RootVegs	Winter Wheat	Potatoes
Clay May										
Sr	1.78E+00	6.41E-01	4.79E-03	1.02E-03	4.92E-01	1.48E-01	8.97E-02	3.41E-01	4.36E-01	2.15E-01
Cs	1.40E+00	1.13E+01	1.96E+01	1.53E+00	5.62E+01	4.17E+00	2.49E-02	4.00E+00	2.46E+00	5.35E-02
Clay November										
Sr	4.31E-01	5.93E-02	9.14E-04	4.72E-04	3.74E-02	3.76E-02	4.15E-02	1.62E-01	2.01E-01	9.95E-02
Cs	1.32E+00	4.60E+00	4.01E-02	1.16E-02	1.62E+01	9.95E-03	1.15E-02	1.63E-02	3.41E-02	2.47E-02

Results
Ratio of activity concentrations clay vs. sandy



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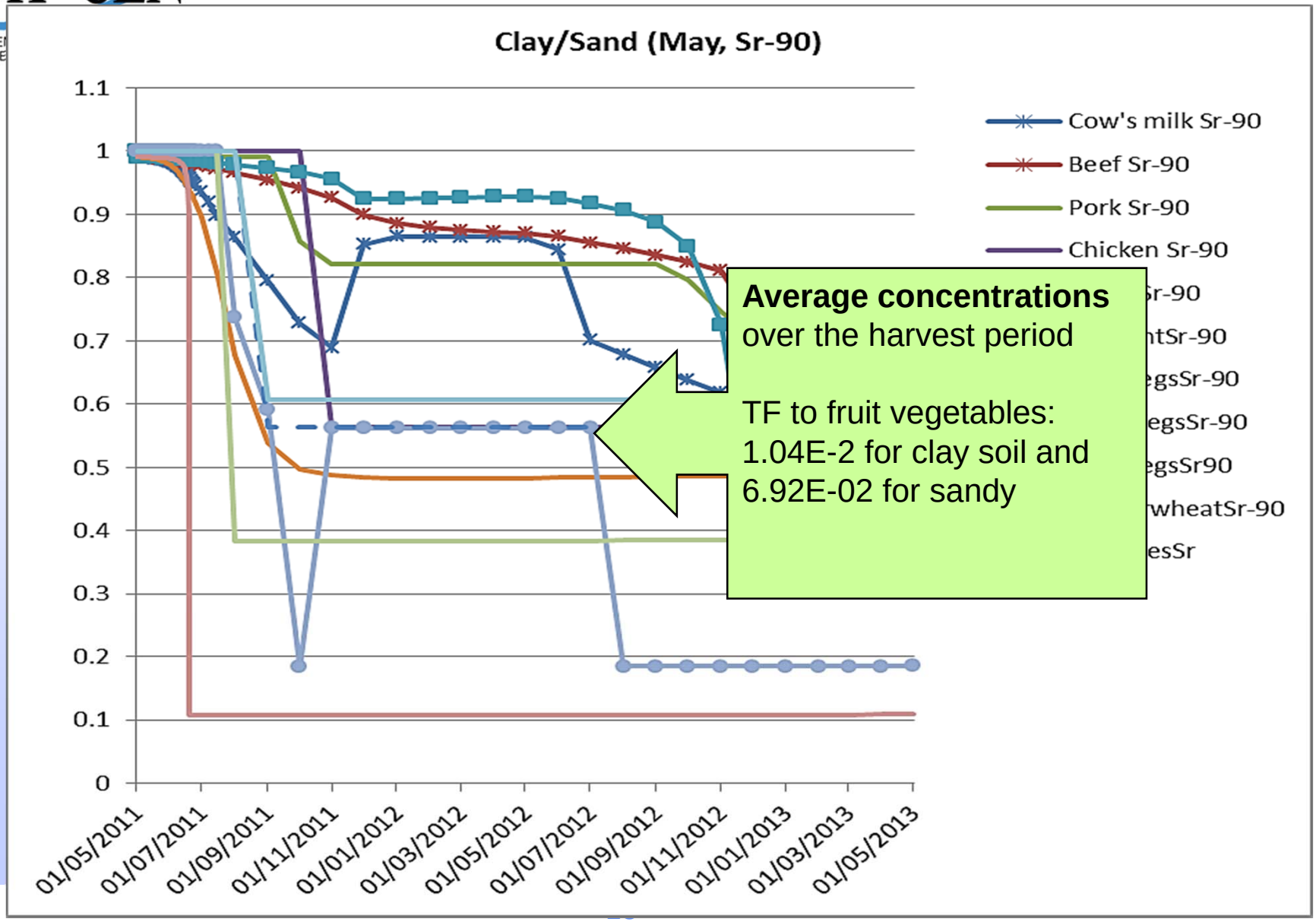

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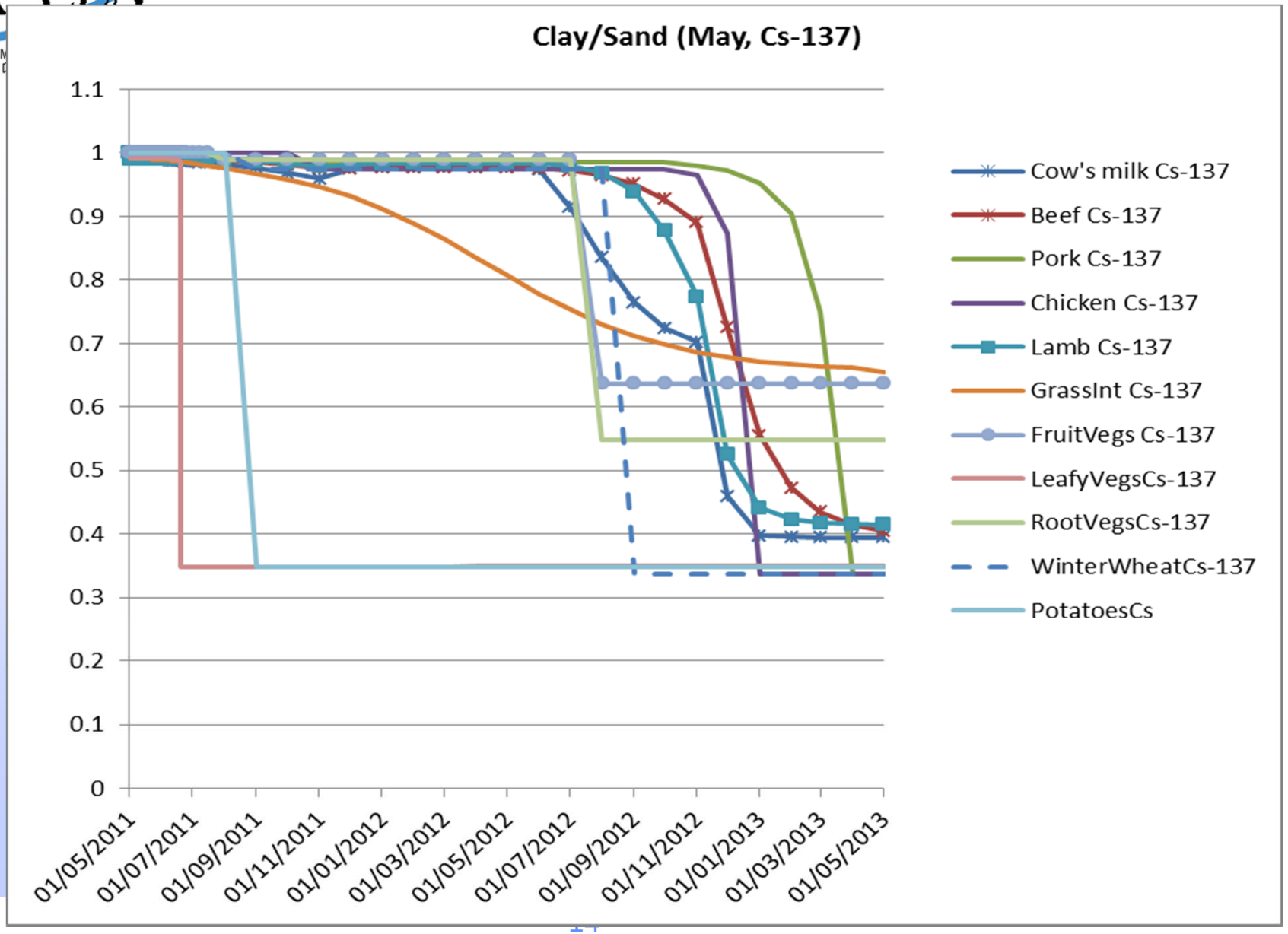

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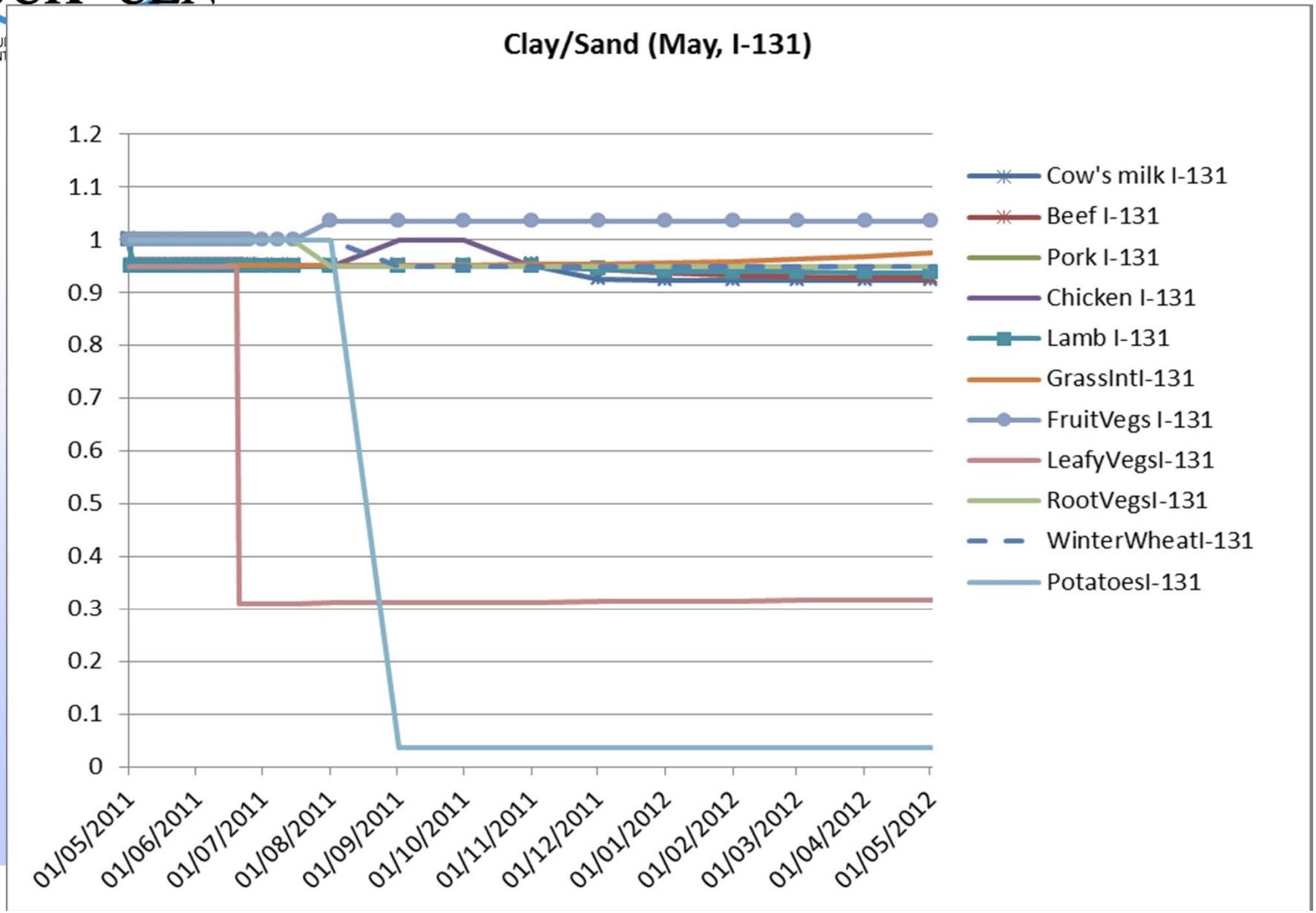

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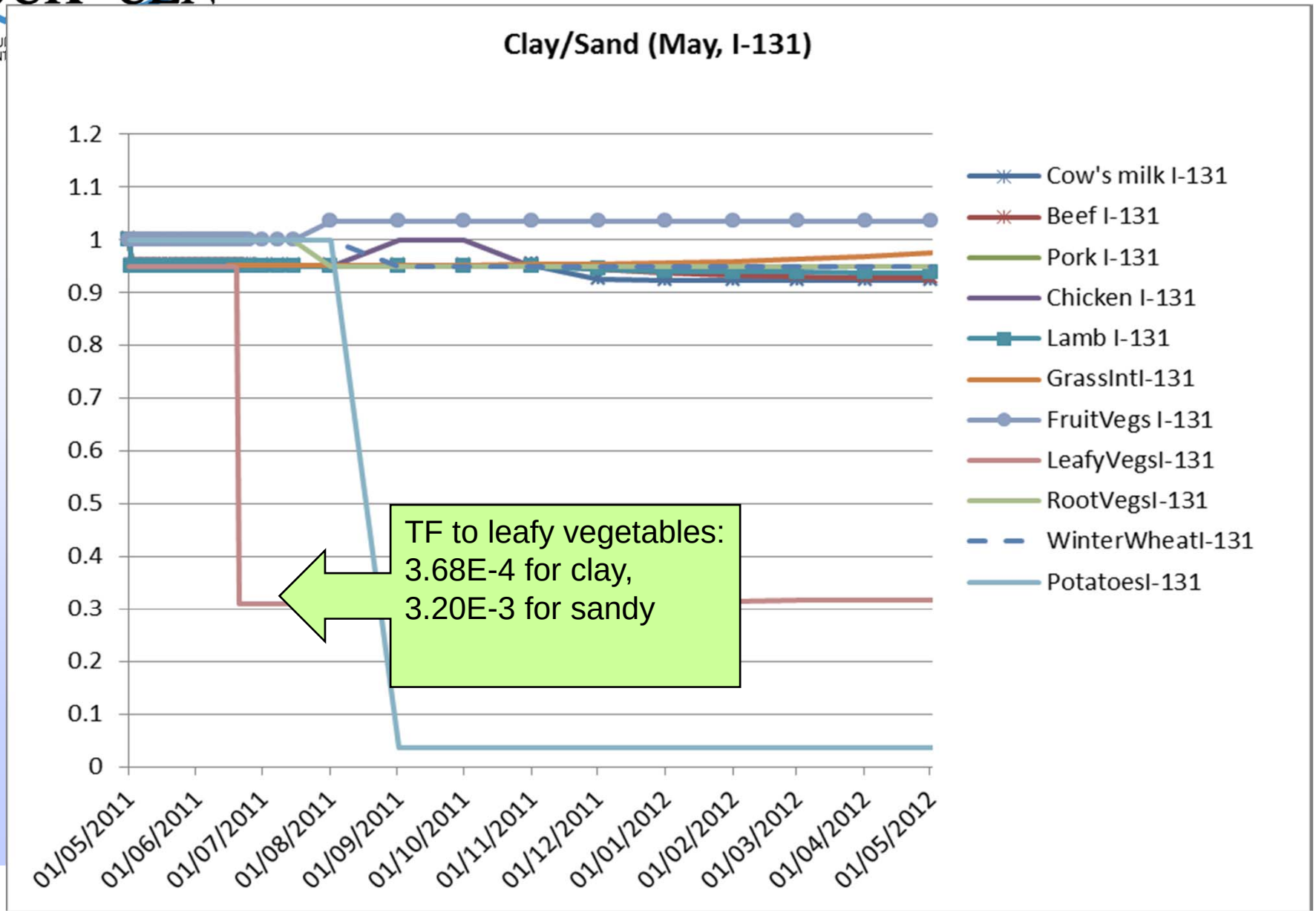

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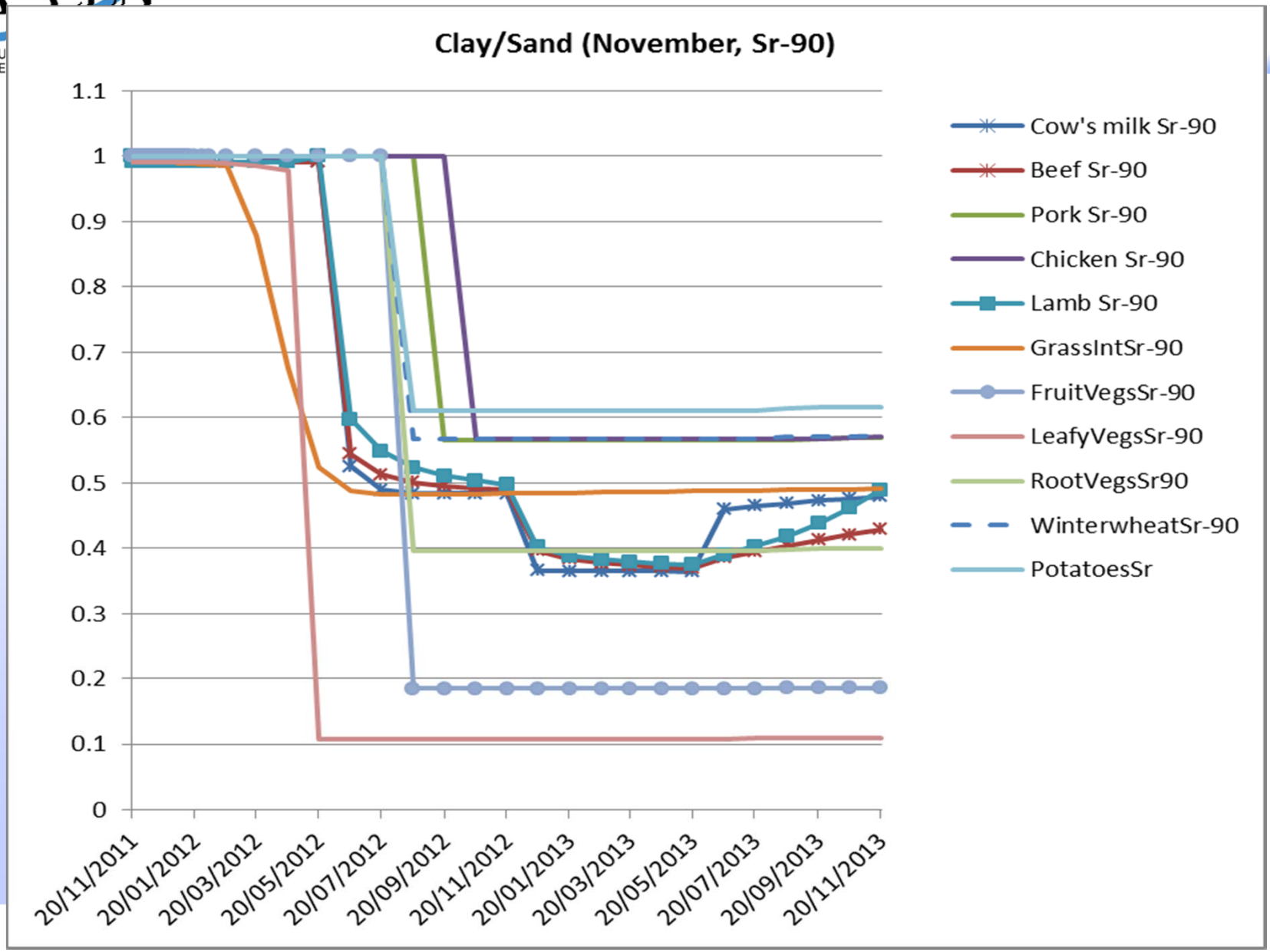

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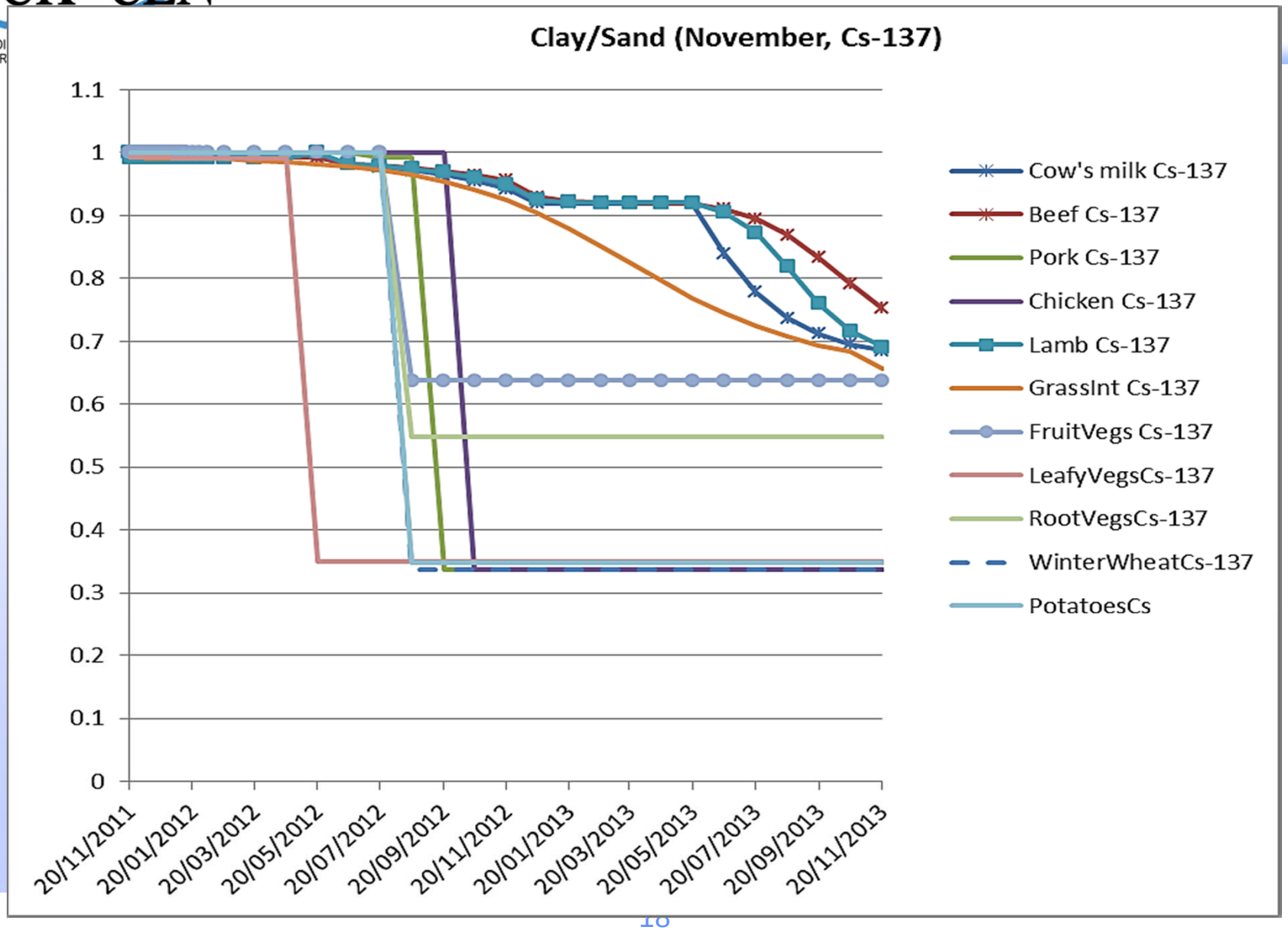
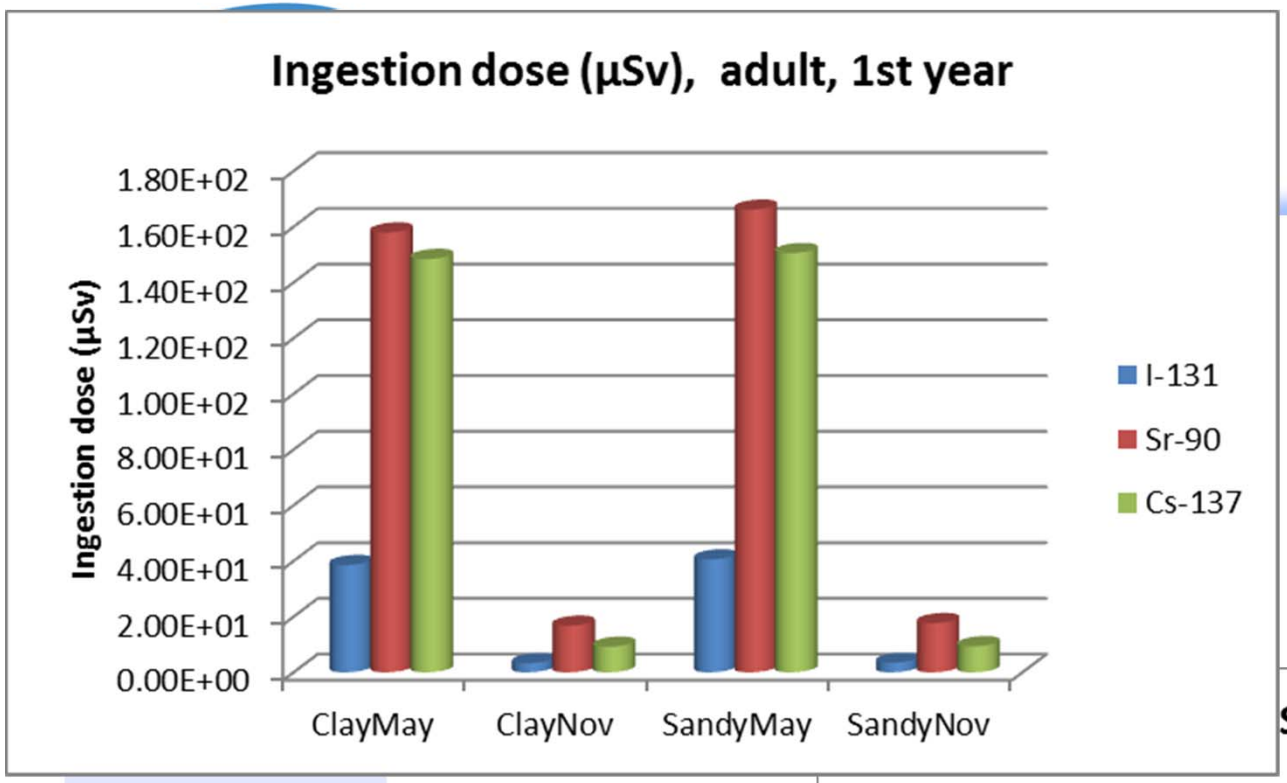
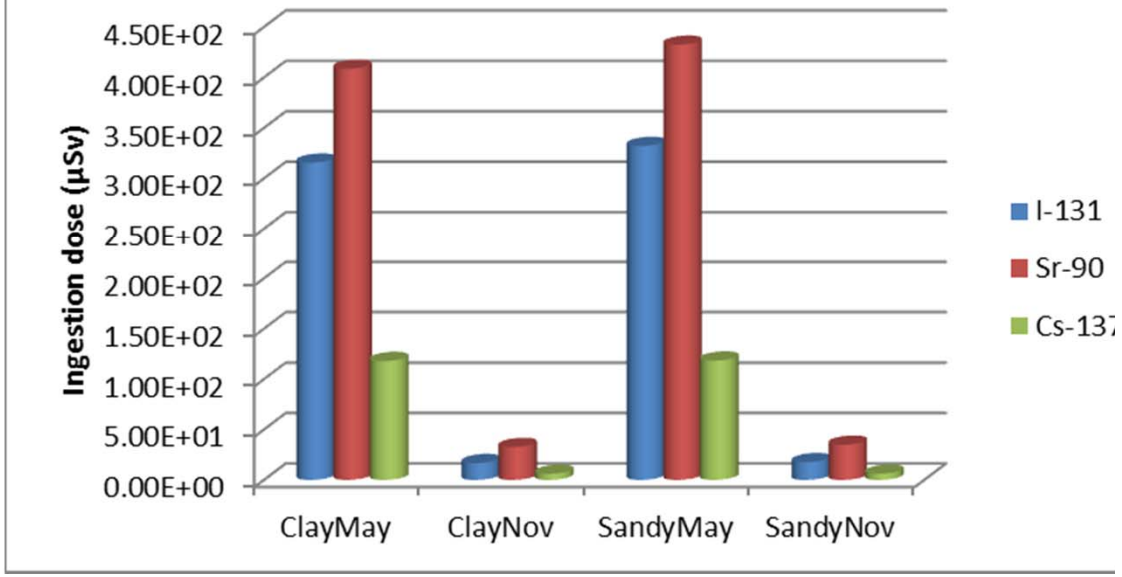
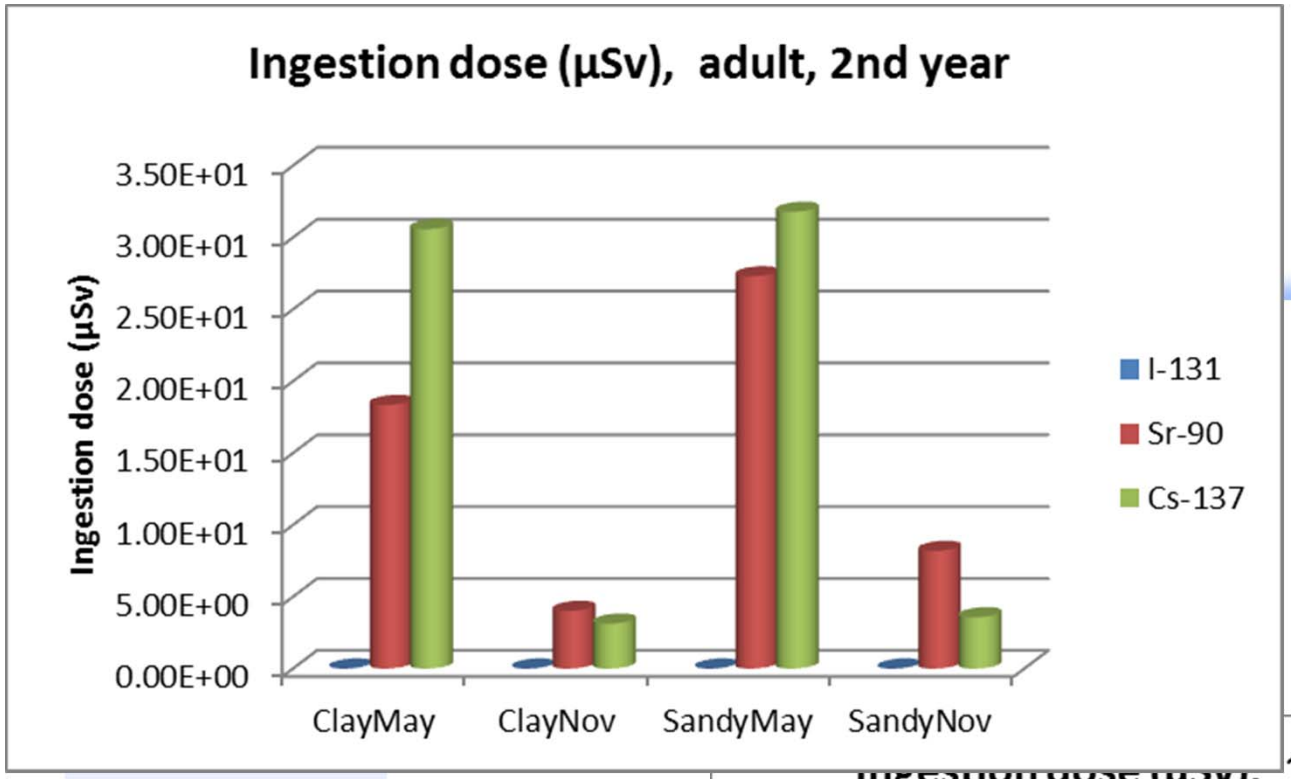




RODOS (Central European) diet

Sv), 1-year old child, 1st year





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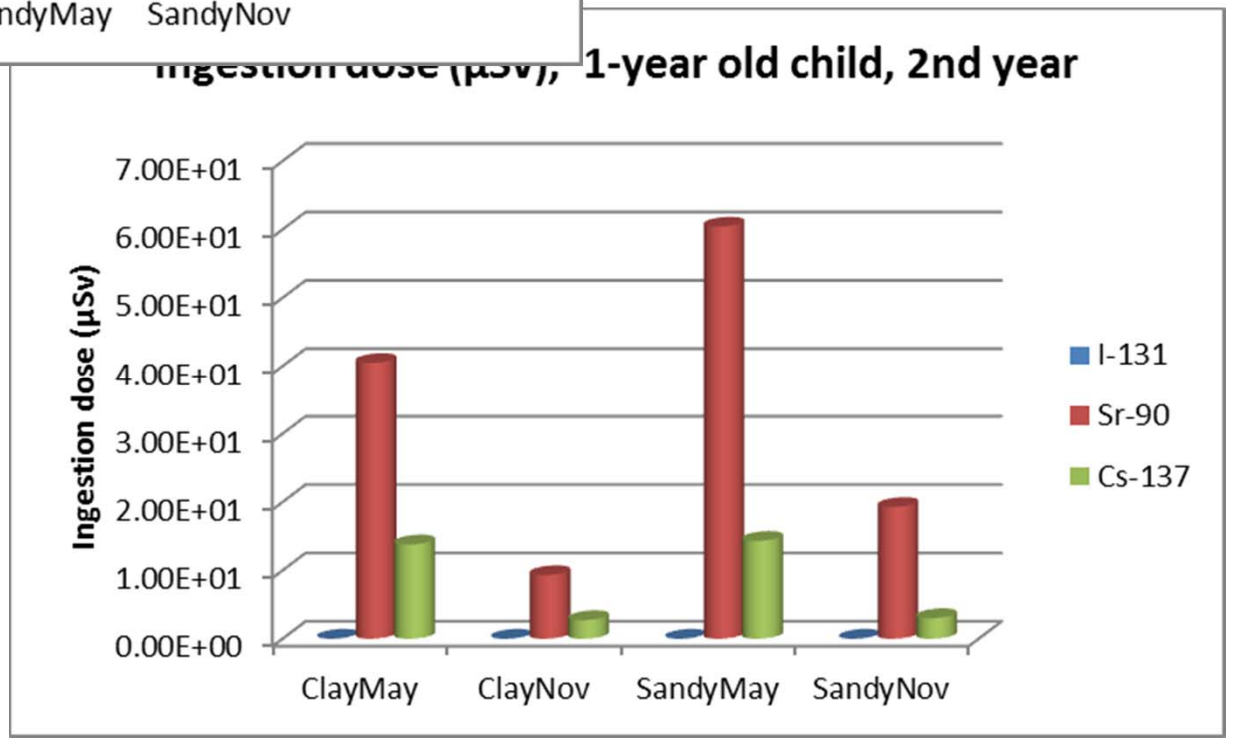

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Rain vs. no rain

- For the same ground deposition all values smaller with rain (20 mm/h): from 2 (potatoes) to 30 times (grass) lower