

AGRICULTURAL WASTE MANAGEMENT
Marshall County, Kansas

The nature of the soil is also important in the application of organic wastes and wastewater to land as fertilizers and irrigation; it is also important when the soil is used as a medium for treatment and disposal of these wastes. Favorable soil properties are required to prevent environmental damage.

The use of organic wastes and wastewater as production resources will result in energy conservation, prevent the waste of these important resources, and prevent problems associated with their disposal. Where disposal is the goal, and a maximum amount is disposed in a minimum area to hold costs to a minimum, risk of environmental damage is the principal constraint. Where the reuse goal is pursued, and a minimum amount is applied to a maximum area to obtain the greatest benefit, environmental damage is unlikely.

Interpretations developed for waste management may include ratings for (1) manure and food processing wastes; (2) municipal sewage sludge; (3) irrigation use of wastewater; or (4) treatment of wastewater by the slow rate process, overland flow process, or rapid infiltration process. If available, these should be located in this subsection.

Soil properties are important considerations in areas where soils are used as sites for the treatment and disposal of organic waste and wastewater. Selection of soils with properties that favor waste management can help to prevent environmental damage.

The Ag-Waste tables show the degree and kind of soil limitations affecting the treatment of agricultural waste, including municipal and food-processing wastewater and effluent from lagoons or storage ponds. Municipal wastewater is the waste stream from a municipality. It contains domestic waste and may contain industrial waste. It may have received primary or secondary treatment. It is rarely untreated sewage. Food-processing wastewater results from the preparation of fruits, vegetables, milk, cheese, and meats for public consumption. In places it is high in content of sodium and chloride. In the context of these tables, the effluent in lagoons and storage ponds is from facilities used to treat or store food-processing wastewater or domestic or animal waste. Domestic and food-processing wastewater is very dilute, and the effluent from the facilities that treat or store it commonly is very low in content of carbonaceous and nitrogenous material; the content of nitrogen commonly ranges from 10 to 30 milligrams per liter. The wastewater from animal waste treatment lagoons or storage ponds, however, has much higher concentrations of these materials, mainly because the manure has not been diluted as much as the domestic waste. The content of nitrogen in this wastewater generally ranges from 50 to 2,000 milligrams per liter. When wastewater is applied, checks should be made to ensure that nitrogen, phosphorus, heavy metals, and salts are not added in excessive amounts.

The ratings in the tables are for waste management systems that not only dispose of and treat organic waste or wastewater but also are beneficial to crops (application of manure and food-processing waste, application of sewage sludge, and disposal of wastewater by irrigation) and for waste management systems that are designed only for the purpose of wastewater disposal and treatment (overland flow of wastewater, rapid infiltration of wastewater, and slow rate treatment of wastewater).

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect agricultural waste management. Not limited indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. Slightly limited indicates that the soil has features that are generally favorable for the specified use. The limitations are minor and can be easily overcome. Good performance and low maintenance can be expected. Somewhat limited indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. Very limited indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.00 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Application of manure and food-processing waste not only disposes of waste material but also can improve crop production by increasing the supply of nutrients in the soils where the material is applied. Manure is the excrement of livestock and poultry, and food-processing waste is damaged fruit and vegetables and the peelings, stems, leaves, pits, and soil particles removed in food preparation. The manure and food-processing waste are either solid, slurry, or liquid. Their nitrogen content varies. A high content of nitrogen limits the application rate. Toxic or otherwise dangerous wastes, such as those mixed with the lye used in food processing, are not considered in the ratings.

The ratings are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the waste is applied, and the method by which the waste is applied. The properties that affect absorption include permeability, depth to a water table, ponding, the sodium adsorption ratio, depth to bedrock or a cemented pan, and available water capacity. The properties that affect plant growth and microbial activity include reaction, the sodium adsorption ratio, salinity, and bulk density. The wind erodibility group, the soil erodibility factor K, and slope are considered in estimating the likelihood that wind erosion or water erosion will transport the waste material from the application site. Stones, cobbles, a water table, ponding, and flooding can hinder the application of waste. Permanently frozen soils are unsuitable for waste treatment.

Application of sewage sludge not only disposes of waste material but also can improve crop production by increasing the supply of nutrients in the soils where the material is applied. In the context of this table, sewage sludge is the residual product of the treatment of municipal sewage. The solid component consists mainly of cell mass, primarily bacteria cells that developed during secondary treatment and have incorporated soluble organics into their own bodies. The sludge has small amounts of sand, silt, and other solid debris. The content of nitrogen varies. Some sludge has constituents that are toxic to plants or hazardous to the food chain, such as heavy metals and exotic organic compounds, and should be analyzed chemically prior to use.

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The content of water in the sludge ranges from about 98 percent to less than 40 percent. The sludge is considered liquid if it is more than about 90 percent water, slurry if it is about 50 to 90 percent water, and solid if it is less than about 50 percent water.

The ratings in the table are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the sludge is applied, and the method by which the sludge is applied. The properties that affect absorption, plant growth, and microbial activity include permeability, depth to a water table, ponding, the sodium adsorption ratio, depth to bedrock or a cemented pan, available water capacity, reaction, salinity, and bulk density. The wind erodibility group, the soil erodibility factor K, and slope are considered in estimating the likelihood that wind erosion or water erosion will transport the waste material from the application site. Stones, cobbles, a water table, ponding, and flooding can hinder the application of sludge. Permanently frozen soils are unsuitable for waste treatment.

Disposal of wastewater by irrigation not only disposes of municipal wastewater and wastewater from food-processing plants, lagoons, and storage ponds but also can improve crop production by increasing the amount of water available to crops. The ratings in the table are based on the soil properties that affect the design, construction, management, and performance of the irrigation system. The properties that affect design and management include the sodium adsorption ratio, depth to a water table, ponding, available water capacity, permeability, slope, and flooding. The properties that affect construction include stones, cobbles, depth to bedrock or a cemented pan, depth to a water table, and ponding.

The properties that affect performance include depth to bedrock or a cemented pan, bulk density, the sodium adsorption ratio, salinity, reaction, and the cation-exchange capacity, which is used to estimate the capacity of a soil to adsorb heavy metals. Permanently frozen soils are not suitable for disposal of wastewater by irrigation.

See the National Soil Handbook, September 1992, Part 620, for criteria used in rating soils for sanitary facilities and waste management.

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Map symbol and soil name	Pct of map unit	Application of manure and food- processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
131BS: Burchard-----	63	Somewhat limited Restricted permeability	0.30	Somewhat limited Restricted permeability	0.22	Very limited Too steep for surface application	1.00
		Slope	0.00	Slope	0.00	Restricted permeability	0.22
						Too steep for sprinkler application	0.10
Steinauer-----	27	Somewhat limited Restricted permeability	0.30	Somewhat limited Restricted permeability	0.22	Very limited Too steep for surface application	1.00
		Slope	0.16	Slope	0.16	Too steep for sprinkler application	0.39
						Restricted permeability	0.22
149BF: Benfield-----	70	Very limited Restricted permeability	1.00	Very limited Restricted permeability	1.00	Very limited Restricted permeability	1.00
		Depth to bedrock	0.46	Depth to bedrock	0.46	Too steep for surface application	1.00
		Droughty	0.11	Droughty	0.11	Depth to bedrock	0.46
		Slope	0.04	Slope	0.04	Too steep for sprinkler application	0.22
						Droughty	0.11
Florence-----	15	Somewhat limited Droughty	0.84	Somewhat limited Droughty	0.84	Very limited Too steep for surface application	1.00
		Restricted permeability	0.30	Restricted permeability	0.22	Droughty	0.84
		Slope	0.04	Slope	0.04	Restricted permeability	0.22
						Too steep for sprinkler application	0.22
149CS: Cline-----	70	Very limited Restricted permeability	1.00	Very limited Restricted permeability	1.00	Very limited Restricted permeability	1.00
		Slope	0.84	Slope	0.84	Too steep for surface application	1.00
		Depth to bedrock	0.80	Depth to bedrock	0.80	Too steep for sprinkler application	0.89
		Droughty	0.49	Droughty	0.49	Depth to bedrock	0.80
						Droughty	0.49
Sogn-----	15	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock	1.00	Very limited Depth to bedrock	1.00
		Droughty	1.00	Droughty	1.00	Droughty	1.00
		Slope	0.84	Slope	0.84	Too steep for surface application	1.00
		Runoff limitation	0.40			Too steep for sprinkler application	0.89
149PS: Paxico-----	90	Very limited Flooding	1.00	Very limited Flooding	1.00	Very limited Flooding	1.00
		Depth to saturated zone	0.95	Depth to saturated zone	0.95	Depth to saturated zone	0.95
		Filtering capacity	0.00	Filtering capacity	0.00	Filtering capacity	0.00
149WB: Wabash-----	90	Very limited Restricted permeability	1.00	Very limited Restricted permeability	1.00	Very limited Restricted permeability	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Flooding	0.60	Flooding	1.00	Flooding	0.60
		Runoff limitation	0.40				

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Map symbol and soil name	Pct of map unit	Application of manure and food- processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
201CR: Crete-----	99	Somewhat limited Restricted permeability Too acid	0.89 0.11	Somewhat limited Restricted permeability Too acid	0.78 0.42	Somewhat limited Restricted permeability Too acid	0.78 0.42
201CS: Crete-----	95	Somewhat limited Restricted permeability Too acid	0.89 0.11	Somewhat limited Restricted permeability Too acid	0.78 0.42	Somewhat limited Restricted permeability Too acid	0.78 0.42
201CT: Crete-----	100	Very limited Restricted permeability Too acid	1.00 0.11	Very limited Restricted permeability Too acid	1.00 0.42	Very limited Restricted permeability Too acid Too steep for surface application	1.00 0.42 0.31
201CX: Crete, eroded-----	90	Somewhat limited Restricted permeability Too acid	0.89 0.11	Somewhat limited Restricted permeability Too acid	0.78 0.42	Somewhat limited Restricted permeability Too acid Too steep for surface application	0.78 0.42 0.31
201EU: Eudora-----	94	Somewhat limited Flooding	0.60	Very limited Flooding	1.00	Somewhat limited Flooding	0.60
201HO: Hobbs-----	85	Somewhat limited Flooding	0.60	Very limited Flooding	1.00	Somewhat limited Flooding	0.60
201KS: Kipson-----	70	Very limited Depth to bedrock Slope	1.00 1.00	Very limited Depth to bedrock Slope	1.00 1.00	Very limited Depth to bedrock Too steep for surface application	1.00 1.00
Sogn-----	15	Droughty	0.96	Droughty	0.96	Too steep for sprinkler application	1.00
		Runoff limitation	0.40			Droughty	0.96
		Very limited Depth to bedrock Droughty	1.00 0.99	Very limited Depth to bedrock Droughty	1.00 0.99	Very limited Depth to bedrock Too steep for surface application	1.00 1.00
201MC: Mayberry-----	85	Runoff limitation Slope	0.40 0.16	Slope	0.16	Droughty Too steep for sprinkler application	0.99 0.39
		Very limited Depth to saturated zone Restricted permeability Runoff limitation	1.00 1.00 0.40	Very limited Depth to saturated zone Restricted permeability Too acid	1.00 1.00 0.14	Very limited Depth to saturated zone Restricted permeability Too steep for surface application Too acid	1.00 1.00 0.31 0.14
		Too acid	0.03				
201MH: Morrell-----	90	Somewhat limited Restricted permeability Too acid	0.30 0.02	Somewhat limited Restricted permeability Too acid	0.22 0.07	Somewhat limited Too steep for surface application Restricted permeability Too acid	0.31 0.22 0.07
600BF: Benfield-----	45	Very limited Restricted permeability Slope	1.00 0.84	Very limited Restricted permeability Slope	1.00 0.84	Very limited Restricted permeability Too steep for surface application	1.00 1.00

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Map symbol and soil name	Pct of map unit	Application of manure and food- processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Florence-----	30	Depth to bedrock	0.10	Depth to bedrock	0.10	Too steep for sprinkler application	0.89
		Very limited		Very limited		Depth to bedrock	0.10
		Droughty	1.00	Droughty	1.00	Very limited	
		Depth to bedrock	0.46	Depth to bedrock	0.46	Droughty	1.00
						Too steep for surface application	1.00
		Restricted permeability	0.30	Restricted permeability	0.22	Depth to bedrock	0.46
600CS: Cline-----	50	Slope	0.16	Slope	0.16	Too steep for sprinkler application	0.39
						Restricted permeability	0.22
		Very limited		Very limited		Very limited	
		Restricted permeability	1.00	Restricted permeability	1.00	Restricted permeability	1.00
		Slope	0.84	Slope	0.84	Too steep for surface application	1.00
		Depth to bedrock	0.46	Depth to bedrock	0.46	Too steep for sprinkler application	0.89
Sogn-----	30	Droughty	0.08	Droughty	0.08	Depth to bedrock	0.46
		Very limited		Very limited		Droughty	0.08
		Depth to bedrock	1.00	Droughty	1.00	Very limited	
		Droughty	1.00	Depth to bedrock	1.00	Droughty	1.00
		Runoff limitation	0.40			Depth to bedrock	1.00
						Too steep for surface application	0.91
600MA: Mayberry-----	85	Too steep for surface application				Too steep for sprinkler application	0.02
		Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Restricted permeability	1.00	Restricted permeability	1.00	Restricted permeability	1.00
		Runoff limitation	0.40	Too acid	0.14	Too acid	0.14
AED: Arents, Earthen Dam-	100	Too acid	0.03			Too steep for surface application	0.08
		Not rated		Not rated		Not rated	
Ea: Eudora-----	90			Somewhat limited Flooding	0.40	Not limited	
		Not limited					
Ga: Geary-----	100	Somewhat limited		Somewhat limited		Somewhat limited	
		Too acid	0.03	Too acid	0.14	Too steep for surface application	0.31
						Too acid	0.14
Ka: Kennebec-----	95	Somewhat limited		Very limited		Somewhat limited	
		Flooding	0.60	Flooding	1.00	Flooding	0.60
		Depth to saturated zone	0.09	Depth to saturated zone	0.09	Depth to saturated zone	0.09
Kb: Kennebec-----	90	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
Kc: Kipson-----	70	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	1.00	Slope	1.00	Too steep for surface application	1.00
						Too steep for sprinkler application	1.00
		Droughty	0.93	Droughty	0.93		

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Map symbol and soil name	Pct of map unit	Application of manure and food- processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Sogn-----	15	Runoff limitation Very limited Depth to bedrock Droughty Runoff limitation	0.40 1.00 1.00 0.40	Very limited Depth to bedrock Droughty Slope	1.00 1.00 0.00	Droughty Very limited Depth to bedrock Droughty Too steep for surface application Too steep for sprinkler application	0.93 1.00 1.00 1.00 0.10
La: Ladysmith-----	100	Very limited Restricted permeability Runoff limitation	1.00 0.40	Very limited Restricted permeability	1.00	Very limited Restricted permeability	1.00
Ma: Morrill-----	85	Somewhat limited Restricted permeability Too acid	0.30 0.02	Somewhat limited Restricted permeability Too acid	0.22 0.07	Somewhat limited Restricted permeability Too acid Too steep for surface application	0.22 0.07 0.00
Mb: Morrill-----	85	Somewhat limited Restricted permeability Too acid	0.30 0.02	Somewhat limited Restricted permeability Too acid	0.22 0.07	Somewhat limited Too steep for surface application Restricted permeability Too acid Too steep for sprinkler application	0.66 0.22 0.07 0.00
Mc: Morrill, eroded----	85	Somewhat limited Restricted permeability Too acid	0.30 0.02	Somewhat limited Restricted permeability Too acid	0.22 0.07	Somewhat limited Too steep for surface application Restricted permeability Too acid Too steep for sprinkler application	0.66 0.22 0.07 0.00
Me: Muir-----	80	Not limited		Somewhat limited Flooding	0.40	Not limited	
Na: Nodaway-----	85	Somewhat limited Flooding	0.60	Very limited Flooding	1.00	Somewhat limited Flooding	0.60
Oa: Olmitz-----	88	Not limited		Not limited		Somewhat limited Too steep for surface application	0.00
Ob: Ortello-----	91	Very limited Filtering capacity	1.00	Very limited Filtering capacity	1.00	Very limited Filtering capacity Too steep for surface application Too steep for sprinkler application	1.00 0.91 0.02
Pa: Pawnee-----	88	Very limited Restricted permeability Depth to saturated zone Runoff limitation	1.00 1.00 0.40	Very limited Restricted permeability Depth to saturated zone	1.00 1.00	Very limited Restricted permeability Depth to saturated zone Too steep for surface application	1.00 1.00 0.00
Pb: Pawnee-----	88	Very limited		Very limited		Very limited	

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Map symbol and soil name	Pct of map unit	Application of manure and food- processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
Pc: Pawnee, eroded-----	88	Restricted permeability	1.00	Restricted permeability	1.00	Restricted permeability	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Runoff limitation	0.40			Too steep for surface application	0.66
						Too steep for sprinkler application	0.00
		Very limited Restricted permeability	1.00	Very limited Restricted permeability	1.00	Very limited Restricted permeability	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
Pd: Pits-----	100	Runoff limitation	0.40			Too steep for surface application	0.66
						Too steep for sprinkler application	0.00
Sa: Shelby-----	91	Not rated		Not rated		Not rated	
		Somewhat limited Restricted permeability	0.30	Somewhat limited Restricted permeability	0.22	Very limited Too steep for surface application	1.00
		Too acid	0.02	Too acid	0.07	Restricted permeability	0.22
		Slope	0.00	Slope	0.00	Too steep for sprinkler application	0.10
Sb: Steinauer-----	85					Too steep for sprinkler application	0.07
		Too acid		Too acid		Too acid	
		Slope		Slope			
Sc: Steinauer-----	60	Very limited Slope	1.00	Very limited Slope	1.00	Very limited Too steep for surface application	1.00
		Restricted permeability	0.30	Restricted permeability	0.22	Too steep for surface application	1.00
						Too steep for sprinkler application	0.22
						Restricted permeability	0.22
		Somewhat limited Slope	0.63	Somewhat limited Slope	0.63	Very limited Too steep for surface application	1.00
		Restricted permeability	0.30	Restricted permeability	0.22	Too steep for sprinkler application	0.77
Shelby-----	25					Too steep for sprinkler application	0.22
		Somewhat limited Slope	0.63	Somewhat limited Slope	0.63	Restricted permeability	0.22
		Restricted permeability	0.30	Restricted permeability	0.22	Very limited Too steep for surface application	1.00
		Too acid	0.02	Too acid	0.07	Too steep for sprinkler application	0.77
Ta: Tully-----	88					Restricted permeability	0.22
		Very limited Restricted permeability	1.00	Very limited Restricted permeability	1.00	Too steep for surface application	0.07
Tb: Tully, eroded-----	88	Very limited		Very limited		Very limited Restricted permeability	1.00
						Too steep for surface application	0.31

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		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
W: Water-----	100	Restricted permeability	1.00	Restricted permeability	1.00	Restricted permeability Too steep for surface application	1.00 0.31
		Not rated		Not rated		Not rated	
Wa: Wabash-----	85	Very limited		Very limited		Very limited	
		Restricted permeability	1.00	Restricted permeability	1.00	Restricted permeability	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Flooding	0.60	Flooding	1.00	Flooding	0.60
Wb: Wymore-----	88	Runoff limitation	0.40				
		Very limited		Very limited		Very limited	
		Restricted permeability	1.00	Restricted permeability	1.00	Restricted permeability	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
Wc: Wymore, eroded-----	85	Runoff limitation	0.40	Too acid	0.14	Too acid	0.14
		Too acid	0.03			Too steep for surface application	0.00
		Very limited		Very limited		Very limited	
		Restricted permeability	1.00	Restricted permeability	1.00	Restricted permeability	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Runoff limitation	0.40	Too acid	0.14	Too steep for surface application	0.31
		Too acid	0.03			Too acid	0.14

