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# Irrigation Technical Notes

## SOIL TEXTURE

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# Soil Texture and Water holding

The sand, silt, clay and organic components of the soil assist to define the soil texture and the ability of the soil to hold water. Worldwide, different definitions are used to define these soil characteristics which without some background knowledge can make the interpretation and use of available data mystifying.

This paper aims to document the different world wide approaches to soil texture and water holding capacity and relate them to an Australian Context.

### Soil Constitutes

Fractional sizes of the soil constitute and related descriptions are divided differently throughout the world. For Australia soil texture relates to the portions of sand (2 – 0.2mm), silt (0.02 – 0.002mm) and clay (<0.002mm). Gravels are larger than 2mm.

Other descriptions for soil particle size within Australia describe these frictions differently - Gravels >2mm, Very Coarse Sand 1-2mm, Coarse Sand 0.5 – 1mm, Medium Sand 0.25 – 0.5, Fine Sand 0.1 – 0.25, Very Fine Sand 0.05 – 0.1, Silt 0.002 – 0.05 and Clay <0.002.

In reality different authors use different fraction description due to the knowledge base or what they are communicating.

### Soil Texture Triangles

The three base soil constitutes (sand, silt and clay) are used on soil texture triangles to define texture classes on a

physical sense (or mechanical basis) as a percentage of each constitute. This is where terms like a “sandy clay” arise, or a soil with some sand but predominately clay particles.

The introduction of the term “LOAM” is required here. Loam is not a soil constitutes, but more of a descriptor where sand, silts and clays are combined together by soil formation processes. A very general concept of a LOAM is 40% - 40% - 20% of Clay, Silt and Sand.

Through the combination these constitutes and descriptor, based on either a mechanical or field assessment we can arrive at a number of soils “types” which we can generalise a number of other soil chemical or physical properties (eg the water holding capacity).

There are a numerous soil texture triangles relating to different countries or regions. Some countries even have 2 or more texture triangles.

Unfortunately a soil descriptor (eg silty loam) generally does not mean the same thing between country triangles or is called something else.

### Soil Texture and Water Holding Capacity

From the three basic sand, silt and clay constitutes of a soil, combining these on the texture triangle expanding to eleven constitutes to making field determinations (17 constitutes), add an extra soil descriptor, they combine to make a list of some thirty soil texture classes. Of these, I have only noted twenty one soil water holding estimates.

Although soil water holding capacities are not available for all soil descriptors, from experience, knowledge and interpreting the intent of the original author, estimates can be made. For example a light sandy clay loam could be similar to the water holding capacity of a sandy clay loam.

Other considerations when estimating the soil water capacity also include compaction, water repellancy, surface sealing or salinity and the continual observing of the plants growing to detect when the estimates could be modified. But as a basic beginning the use of soil texture to estimate the soil water holding

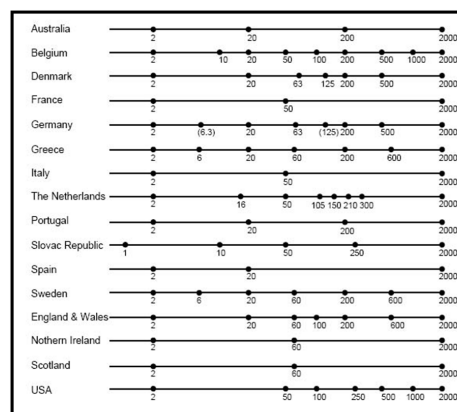


Chart 1: Comparison of different soil Fractions in micro meters  
 Reference: [http://en.wikipedia.org/wiki/Soil\\_texture](http://en.wikipedia.org/wiki/Soil_texture)

capacity this provides a tool to not only determine when to turn an irrigation system on - but also off.

	<b>FAO</b>	<b>Australian System</b>	<b>UK System</b>	<b>USDA system</b>
1	VF - Very fine	Cl - Clay	Cl - Clay	Cl - Clay
2	F - Fine	SiCl - Silty clay	SaCl - Sandy clay	SiCl - Silty Clay
3	M - Medium	SiClLo - Silt clay loam	SiCl - Silty clay	SaCl - Sandy Clay
4	MF - Medium fine	SiLo - Silty loam	ClLo - Clay loam	ClLo - Clay Loam
5	C - Coarse	ClLo - Clay loam	SiClLo - Silty clay loam	SiClLo - Silty Clay Loam
6		Lo - Loam	SaClLo - Sandy clay loam	SaClLo - Sandy Clay Loam
7		LoSa - Loamy sand	SaLo - Sandy loam	Lo - Loam
8		SaCl - Sandy clay	SaSiLo - Sandy silt loam	SiLo - Silty Loam
9		SaClLo - Sandy clay loam	SiLo - Silt loam	SaLo - Sandy Loam
10		SaLo - Sandy loam	LoSa - Loamy sand	Si - silt
11		Sa - Sand	Sa - Sand	LoSa - Loamy Sand
12				Sa - Sand

**Chart 2: Comparison of Texture triangles and soil descriptors**

Texture Triangle Descriptors Count	Field Texture Ribbon Count	Texture	Field Texture Ribbon Length	Mean Clay Content % (CSIR Bull 224)	AWC mm/m	AWC mm/cm	AWC %
1	1	Sandy clay	50 - 75mm	30.7%	142	1.42	14.2%
2	2	Sand	Nil	5.2%	150	1.5	15.0%
3	3	Sandy clay loam	25 - 40mm	21.5%	150	1.5	15.0%
4	4	Loamy sand	5mm		158	1.58	15.8%
5		Clay		53%	175	1.75	17.5%
6	5	Loam	25mm	20.1%	175	1.75	17.5%
7	6	Clay loam	40 - 50mm	31.1%	183	1.83	18.3%
8	7	Silty clay	50 - 75mm	36%	183	1.83	18.3%
9	8	Sandy loam	15 - 25mm	13.6%	192	1.92	19.2%
10	9	Silt clay loam	40 - 50mm	30.9%	192	1.92	19.2%
11		Silty loam		22%	200	2	20.0%
		Coarse Sand			83	0.83	8.3%
		Loamy Course Sand			108	1.08	10.8%
		Coarse Sandy Loam			125	1.25	12.5%
		Fine Sandy Loam			192	1.92	19.2%
	10	Silt Loam	25mm		192	1.92	19.2%
		Fine Sand			200	2	20.0%
		Loamy Fine Sand			217	2.17	21.7%
		Loamy Very Fine Sand			217	2.17	21.7%
		Very Fine Sandy Loam			217	2.17	21.7%
		Very Fine Sand			225	2.25	22.5%
	11	Clayey Sand	5 - 15mm				
	12	Heavy Clay	> 75mm	57%			
	13	Light Clay	50 - 75mm	40.9%			
	14	Light Medium Clay	75mm				
	15	Light Sandy Clay Loam	20 -25mm				
	16	Medium Clay	> 75mm	50%			
	17	Medium Heavy Clay	>75mm				
		Sandy					
		Self Mulching Clay					

**Chart 3:  
Comparisons  
Between Soil  
Descriptors  
Clay % and  
Water  
Holding  
Capacity**