

**“EFFECTIVE LIMING MATERIAL”
AN ADDITIONAL TERM TO HELP DESCRIBE LIMESTONE QUALITY**

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Background. Attempts to describe the quality of agricultural limestone include terms such as Ag-grade, superfine, calcium carbonate equivalent (CCE) and effective calcium carbonate equivalent (ECCE). Ag-grade usually refers to crushed limestone that has been screened as fine as its moisture content will allow. In this screening process, some of the particles are coarser than 8-mesh (2.36 mm) and a large percentage are finer than 100-mesh (0.15mm). Special handling is required to produce limestone that is described as superfine. In superfine limestone, only a fraction of the particles is larger than 2.36 mm and nearly all of the limestone is finer than 60-mesh (0.25 mm). The CCE of limestone is defined as the acid-neutralizing capacity of an agricultural liming material expressed as a weight percentage of calcium carbonate. The ECCE of agricultural limestones is a term used to rate the percentage effectiveness of limestone. All of these terms help describe limestone materials, but one additional term is needed to describe the amount of effective limestone in each ton. For this purpose, we propose the term "effective liming material" and represent this term by ELM.

Research Findings. The examples in Table 1 compare three limestones that vary in quality as represented by the ECCE value. The ELM of limestone is calculated directly from the ECCE as described in footnote 2 under Table 1. Essentially ELM equals ECCE multiplied by 20. ELM is an estimate of the amount of limestone in a ton that will effectively neutralize soil acidity.

A sample limestone recommendation presently reads, "Apply two tons of ECCE/acre". If available limestone has an ECCE lower than 100%, be sure that the amount applied is equivalent to two tons of ECCE 100% limestone. If the ECCE of the available limestone is 62, the rate of this limestone to apply would be 3.23 tons/acre $[(100 \div 62) \times 2 \text{ tons/acre}]$.

As implied in the paragraph above, limestone recommendations to correct soil acidity to a specific pH are currently based on 100% ECCE limestone. Calculation of effective liming material, or "ELM", offers an alternative way to calculate the rate of low ECCE limestone to apply to equal ECCE 100% limestone. A limestone that is described as ECCE 100% will contain 2000 lb. of ELM/ton of material. When the soil will be limed using low ECCE limestone, multiplication of ECCE by 20 will determine the pounds of ELM in that material as indicated in Table 1. When the recommended limestone rate is two tons of ELM/acre, $2 \text{ tons} \times (2000 \text{ lb/ton} \div \text{ELM}) =$ the adjusted rate of lower quality limestone to apply. If ELM is 1241 lb/ton, the calculation becomes: $2 \text{ tons/acre} \times (2000 \text{ lb/ton} \div 1241 \text{ lb/ton}) = 3.22 \text{ tons/acre}$.

Table 1. Calculation of effective liming material (ELM) per ton in limestones that are commonly applied to acid soils in Texas.

Limestone	Sieve Size	Limestone Fraction	Efficiency Factor	Efficiency Rating	CCE	ECCE ¹	ELM ²
	mesh	%		%	%	%	lb/ton
Coarse (high CCE)	>8	5.6	0	0			
	8-20	28.1	0.20	5.62			
	20-60	26.2	0.60	15.72			
	<100	40.1	1.00	<u>40.10</u>			
				61.44	101	62.05	1,241
Fine (med. CCE)	>8	0.2	0	0			
	8-20	0.8	0.20	.16			
	20-60	5.0	0.60	3.00			
	<100	94.0	1.00	<u>94.00</u>			
				97.16	83	80.64	1,613
Very fine (high CCE)	>8	0.1	0	0			
	8-20	0.2	0.20	0.04			
	20-60	0.5	0.60	0.30			
	<100	99.2	1.00	<u>99.20</u>			
				99.54	101	100.53	2,011

¹ (Sum of efficiency ratings ÷ 100) x CCE = ECCE;

² (ECCE ÷ 100) x 2000 = ELM
Or ECCE x 20 = ELM

The same factor can be used to determine the cost of the lower quality limestone relative to ECCE 100% limestone. Currently, ECCE 100% limestone applied in the field is about \$5.00 more/acre than ECCE 62% limestone. If the cost of ECCE 100% were \$33.00/acre spread in the field, application of 2 tons of this lime/acre would cost \$66.00. To obtain similar soil acidity neutralizing benefit from 62% ECCE limestone would, theoretically, cost \$28.00 x 3.22 = \$90.16/acre, or \$24.16 more per acre when using the lower quality limestone. The increased cost for application of the lower quality limestone is in freight and spreading charges to haul the 2,444 lb of ineffective rock in the 3.22 tons of 62% ECCE material applied/acre. If 40 acres are to be limed, the increased cost is \$966.40. This difference could be used to lime an additional 15 acres at the rate of two tons/acre if the ECCE 100% limestone were used on all acres.

The greatest benefit for adding ELM as a factor in describing lime quality is in being able to rapidly determine the pounds of effective lime in a ton of lesser quality limestone. Once this determination is made, the pounds of ELM/ton should be adjusted for moisture content to determine the correct rate to apply in the field.