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Fluid Lime

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Fluid lime is a suspension mixture of fine limestone or other liming agents in water (Crop Protection Handbook, 2005). Fluid lime has also been called "liquid lime" or "suspension lime". It is often used on high value crops, nursery and greenhouse crops, and intensive landscape situations. The higher cost of this product compared to dry, ground limestone often makes the cost prohibitive on field crops.

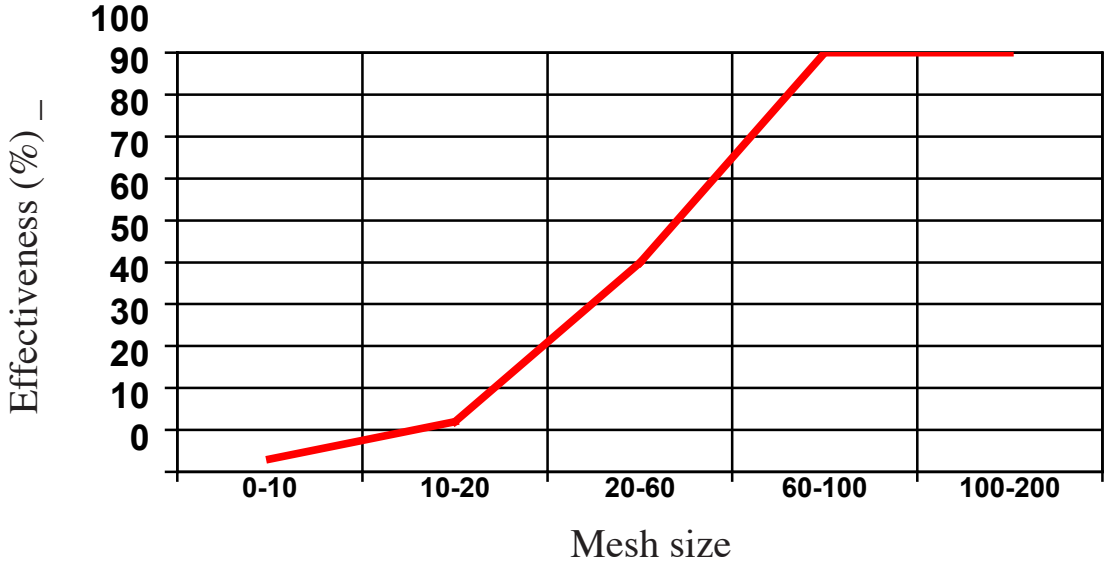
A fluid lime is commonly a 50/50 mixture of very finely ground limestone and water. About 93% of the limestone will pass a 200-mesh sieve (200 wires to the inch). A suspending agent is added such as 0.5% clay and dispersed with either tetrasodium pyrophosphate (TSP) or sodium tripolyphosphate (STP). Liquid urea-ammonium nitrate (UAN solution) may be used as the suspending fluid adding a valuable fertilizer component to the suspension.

Minimum quality, dry, ground limestone sold in Alabama is not 100% effective because it contains many course particles of limestone that will not react in the soil (Fig. 1). Dry, agricultural limestone sold in Alabama must be ground such that 90% would pass a 10-mesh sieve and 50% would pass a 60-mesh sieve. The limestone must be at least 90% calcium carbonate equivalent. Therefore, minimum quality, ground limestone is only about 63% effective. This is calculated in making limestone recommendations by the Auburn University Soil Testing Laboratory. On the other hand, the lime in most fluid lime is 100% effective but since 50% of the suspension is water, then the product has only a 50% net effectiveness on a weight basis. Therefore, if a soil test report recommended 1 ton of ground limestone per acre, you would have to apply as much as 1.26 tons of typical fluid lime to achieve the same change in soil pH (63% effective $^{\text{dry lime}}$/ 50% effective $^{\text{fluid lime}}$).

Then, what is the advantage of fluid lime over ground limestone? The main advantage is that is can be very uniformly applied using liquid-handling equipment. Because it is composed of very fine particles, it reacts rapidly, often within hours and days instead of weeks and months as with courser, dry limestone. Nurseries and greenhouse growers use it where they can apply it to potting mixes with water. The smaller particles may physically move downward in the potting mix. Golf course managers may appreciate the uniformity it produces on golf greens.

Table 1. Calculating net effectiveness of ground limestone.			
Particle size	Permitted by law	Effectiveness	Net effectiveness
<10 mesh (>2.5 mm)	10%	0	0
10-60 mesh (0.4 - 2.5 mm)	40%	50%	20%
>60 mesh (<0.4 mm)	50%	100%	50%
		TOTAL=	70%
Minimum calcium carbonate equivalent = 90% Therefore, 90% x 70% = 63% net effectiveness for minimum quality, ground limestone.			

Figure 1. Relative effectiveness of ground limestone in neutralizing soil acidity (Adams, 1959).



A Comparison of Liming Materials

A greenhouse study was conducted to compare the effectiveness of several soil liming materials when used at different rates and methods of application on correcting potential pH problems in a typical, greenhouse potting mix. Three fluid limes were included in the study. Each material was applied at a rate based upon the calculated, effective neutralizing value of the product. For example, a commercial, ground, dolomitic limestone and a pelleted limestone was assumed to have an effective neutralizing value of 63%. Reagent-grade calcium hydroxide was assumed to have a value of 135% calcium carbonate equivalency. The fluid limes were adjusted based upon the calcium carbonate equivalency of each product. Each product was either mixed with an unlimed potting mix before potting, applied to the surface, or drenched into the mix as plants were watered. The potting mix was based on a Cornell Peat-lite Mix with ½ sphagnum peat and ½ horticultural perlite. A standard lime rate (x rate) was based on a lime buffer curve using reagent-grade calcium hydroxide. Each product was applied at rates of ½ x, 1x, 2x, and 4x rates. The pH of the potting mix was measured after marigolds were grown for 6 weeks. Only the 1x and 2x rates are reported in Table 2.

The fact that plants were grown and fertilized for 6 weeks accounts for the fact that we rarely achieved our target soil pH of 6.0 to 6.5 (Table 2). Nevertheless, the fluid limes appear just as effective as other sources when surface applied or drenched into the soil. The ground, dolomitic limestone was the most effective source when mixed with the potting soil prior to planting.

Table 2. Comparison of liming materials, rates, and method of application of the pH of a potting mix after growing marigolds for 6 weeks.

		Rate applied	
Liming material	Method of application	1x	2x
		----------soil pH_w----------	
No lime	--	4.5	4.5
Hydrated lime	drenched	4.6	5.9
	Mixed	4.9	5.9
Dolomitic limestone	Surface applied	4.8	5.3
	Mixed	5.9	6.6
Pelleted limestone	Surface applied	4.7	5.2
	Mixed	5.3	6.1
Fluid lime #1	Drenched	5.2	6.2
Fluid lime #2	Drenched	4.9	5.4
Fluid lime #3	Drenched	5.0	5.8
$LSD_{P<0.05}$		*0.2*	*0.2*

The commercial fluid lime products were (in no order) pHast-Cal-Pro®, Cal Flow®, and Limestone F®.

Summary

In most cases, farmers and homeowners cannot afford the added cost of using fluid lime in place of the less expensive dry, ground limestone. The advantage of a high cost, fast-acting, uniformly applied product is not necessary in most landscape and field operations. However, it does appear to work as well as other materials when surface applied or drenched into a potting mix. Regardless of what liming material is used in the field or in the greenhouse, growers must keep in mind that how effective it is depends on how much actual lime is applied, the particle size, the effective calcium carbonate equivalency, and how well the product is mixed or incorporated into the soil.

References

Adams, F. 1959. Fineness of lime – a key to quality. Highlights of Agric. Res. vol. 6. Ala. Agric. Exp. Sta. Ala. Auburn, AL.

Crop Protection Handbook. 2005. Meister Media Worldwide. Willoughby, OH.

Acknowledgements

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