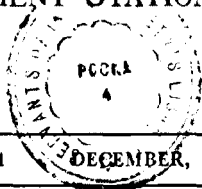


Inspection of Agricultural
Lime Products.

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Inspection of Agricultural Lime Products

By H. D. Haskins and H. R. DeRose

This is the twentieth report on the inspection of agricultural lime products in Massachusetts. It gives the composition of the various products which have been sold, supplemented by comparative costs of units of effective oxides present. Definitions are given for the various lime products used in agriculture.

Massachusetts State College

Amherst, Mass.

INSPECTION OF AGRICULTURAL LIME PRODUCTS FOR THE SEASON OF 1931

By H. D. Haskins, Official Chemist, assisted by H. R. DeRose.

Manufacturers and Brands.

During 1931, seventeen firms registered for sale in Massachusetts twenty-five brands of agricultural lime and one of gypsum or land plaster. The products are grouped as follows:

Hydrated or slaked lime	12
Ground limestone	13

	25
Gypsum	1

The drawing of samples took place during the months of April, May and June in widely scattered localities in the State by the same sampling agents who drew the official fertilizer samples. Ten per cent of the sacks present were sampled by means of a tube which secured a core the entire length of the package. At least ten bags were sampled provided that number was present. It is believed, therefore, that the analyses which follow fairly represent the lime products which were sold in Massachusetts for agricultural purposes during the year. All of the products registered were analyzed, and it is believed that the list includes all of the lime products that were actually sold for application to the soil, with the exception of some of the local lime by-products such as gas-house lime which are exempt from registration.

Variations and Deficiencies in the Composition of Lime Products.

In Table I, devoted to hydrated limes, no serious deficiencies are shown. Two cases were noted where slight deficiencies in calcium oxide occurred. An overrun of magnesium oxide, however, more than made up for the calcium shortage, so that the neutralizing effect of the product was not impaired and there was no commercial shortage.

In Table II, devoted to ground limestone, no serious deficiencies are shown. The efficiency of some of the products could be materially improved, however, by finer grinding, as the rapidity with which ground limestone becomes available in the soil depends in a large degree upon the fineness of the product. As illustrating this point, Hartwell¹, former director of the Rhode Island Experiment Station, found that unsifted ground limestone (of which 56 per cent was finer and 44 per cent coarser than 80 mesh, 31 per cent was coarser than 40 mesh, and 12 per cent coarser than 20 mesh) was about 80 per cent as effective on mangels and carrots as was slaked lime used in amounts to furnish the same quantity of calcium and magnesium oxides as the limestone. On the other hand, that portion of the same limestone ground to pass an 80-mesh sieve showed an average effectiveness of 102 as compared with hydrated lime at 100.

Lime Definitions.

The following definitions of lime products used in agriculture were adopted as official by the Association of Official Agricultural Chemists at their meeting in November, 1931.

¹ Circular, Extension News Service, R. I. State College, Vol. 1, No. 6, Nov. 1914.

Quicklime, burned lime, caustic lime, lump lime, unslaked lime, are liming materials that have a high content of calcium oxide, with magnesium oxide, produced by heating suitable carbonates until substantially all the carbon dioxide has been eliminated.

Hydrated or slaked lime is the product obtained by treating quicklime with sufficient water or steam to combine with its oxides.

Air-slaked lime is the product obtained by exposing quicklime or hydrated lime to the atmosphere until partially carbonated.

Ground limestone is the product obtained by grinding calcareous or dolomitic limestone. Not less than seventy-five per cent (75%) shall pass a 100-mesh sieve. It shall contain calcium and magnesium carbonates equivalent to not less than ninety per cent (90%) of calcium carbonate.

Ground shell lime is the product obtained by grinding the shells of mollusks. Not less than seventy-five per cent (75%) shall pass a 100-mesh sieve. It shall contain calcium and magnesium carbonates equivalent to not less than eighty per cent (80%) of calcium carbonate.

Marl, ground shell marl, is the product obtained by grinding natural deposits of shell marl. Not less than seventy-five per cent (75%) shall pass a 100-mesh sieve. It shall contain calcium and magnesium carbonates equivalent to not less than eighty per cent (80%) of calcium carbonate.

Waste lime, by-product lime, is any industrial waste or by-product containing calcium or calcium and magnesium in forms that will neutralize acids. It may be designated by the prefixation of the name of the industry or process by which it is produced, i.e., gas-house lime, tanners' lime, acetylene lime-waste, lime-kiln ashes, calcium silicate, etc.

Gypsum, land plaster, or crude calcium sulfate, are products consisting chiefly of calcium sulfate. They may contain twenty per cent (20%) of combined water. (They do not neutralize acid soils.)

Explanation of Tables of Analyses.

Table I, "Proportion of total oxides as carbonates." The data furnished in this column are calculated from an actual determination of carbon dioxide (CO_2). Calcium or magnesium not in the form of carbonate is present either as hydrated lime (water- or air-slaked) or as burned lime (caustic or unslaked). It should be understood that all of the products listed in this table have at some time been burned, and the proportion of oxides present as carbonates indicates to what extent the product has absorbed carbonic acid from the air.

"Pounds of effective oxides in one ton" represents the sum of the calcium and magnesium oxides in one ton of the lime product, assuming that both ingredients from this source will become readily available.

The calculations found in column "Cost of 100 pounds of effective oxides" are based on prices furnished by the producers.

Table II, "Pounds of effective oxides in one ton." In securing these data the degree of fineness to which the limestone has been ground is taken into consideration. On those products which are finely ground so that all of the material will pass through a 20-mesh sieve, it is assumed that all of the calcium and magnesium oxides will become available in the soil within a five-year period. On those products which will not wholly pass a 20-mesh sieve, it is assumed that the oxides in that portion which is coarser than 20-mesh will be only 50 per cent effective during the same period.

Under "Mechanical analysis" the figures represent in round numbers the percentage of product that would pass the various meshed sieves mentioned.

In both tables the figures in parenthesis following the brand name show the number of samples collected and analyzed.

Table I. Hydrated or Slaked Lime

NAME OF MANUFACTURER AND BRAND.	CALCIUM OXIDE (CaO).		MAGNESIUM OXIDE (MgO).		Proportion of Total Oxides as Carbonates.	Pounds of Effective Oxides in One Ton.	Cost of 100 Pounds of Effective Oxides, Basis Car Lots, Paper Sacks, F.O.B. Plant, Sight Draft with Bill of Lading.
	Found.	Guaranteed.	Found.	Guaranteed.			
Howard D. Brewer, 45 Arctic St., Worcester, Mass. (a)							
Producto Agricultural Hydrated Lime (1)	71.32	60.00	2.00	1.00	1/9	1466	\$0.51
Producto Agricultural Lime (2)	64.44	60.00	5.69	1.00	1/5	1403	.36
Burton K. Harris, P. O. Box 23, Sayleeville, R. I.							
Dexter Agricultural Lime (2)	60.60	60.00	22.47	20.00	1/18	1459	.71
Hoosac Valley Lime Co., Inc., Adams, Mass.							
Adams Land Lime (1)	57.01	58.00	1.84	.50	1/2	1177	.50
Lawrence Portland Cement Co., Thomaston, Maine (b)							
Dragon Mainrok Agricultural Hydrated Lime (2)	68.75	60.00	1.56	.50	3/7	1406	.49
Lee Lime Corporation, Lee, Mass.							
Agricultural Hydrated Lime (3)	47.50	46.00	30.83	30.00	1/20	1567	.53
Miller Lime Products Corporation, West Stockbridge, Mass.							
Agra Land Lime (Hydrate) (2)	51.48	46.00	10.19	8.00	1/2	1233	.60
New England Lime Co., Pittsfield, Mass., (c)							
Agricultural Hydrated Lime (Canaan) (1)	40.55	40.00	23.18	15.00	1/5	1875	.51
Agricultural Hydrated Lime (Adams) (2)	65.71	65.00	1.25	1.00	1/3	1339	.52
Rockland and Rockport Lime Corporation, 3 Warren St., Winchester, Mass., (b)							
R-R Land Lime (5)	60.55	60.00	3.23	.50	1/4	1276	.47
United States Gypsum Co., 300 West Adams St., Chicago, Ill., (d)							
U. S. G. Agricultural Lime (Farnams) (3)	63.96	60.00	2.03	.00	1/2	1320	.49
U. S. G. Agricultural Hydrated Lime (Farnams) (3)	69.51	70.00	1.98	.00	1/9	1430	.63

a Plant at Winooski, Vermont.

b Plant at Rockland, Maine.

c Plants at Adams, Mass., and Canaan, Conn.

d Plants at Farnams, Mass., and Falls Village, Conn.

NAME OF MANUFACTURER AND BRAND.	CALCIUM OXIDE (CaO).		MAGNESIUM OXIDE (MgO).		CARBONATES OF LIME AND MAGNESIA.		Pounds of Effective Oxides in One Ton.	Cost of 100 Pounds of Effective Oxides (a)	MECHANICAL ANALYSIS (b, c, d, e, f, g)					
	Found.	Guar- anteed.	Found.	Guar- anteed.	Found.	Guar- anteed.			Finer than 100-mesh.	Between 100 and 80-mesh.	Between 80 and 60-mesh.	Between 60 and 40-mesh.	Between 40 and 20-mesh.	Coarser than 20-mesh
American Agricultural Chemical Co., North Weymouth, Mass. (b) Fine Ground Limestone (3)	81.29	80.00	20.88	19.00	98.36	93.29	1032	\$0.44	51.04	3.72	14.67	16.84	13.79	0
Howard D. Brewer, 45 Arctic St., Worcester, Mass. (c) Producto Agricultural Limestone (1)	50.78	44.00	1.98	.50	94.76	90.00	1036	.43	65.69	1.40	5.60	6.89	16.80	3.62
Connecticut Agstone Co., 307 Main St., Danbury, Conn. Phoenix Brand Limestone (3)	35.87	35.00	4.01	1.00	71.51 ^d	75.00	775	.52	67.74	1.51	7.71	7.20	12.60	3.24
Dominion Lime Co., East Angus, Quebec, Canada Dudwell Brand Agricultural Lime- stone (2)	61.08	62.00	1.98	.50	95.29	94.00	1048	.82	63.40	1.10	4.28	8.44	20.28	2.50
Grangers Manufacturing Co., West Stockbridge, Mass. Grangers Agricultural Limestone (5)	40.88	35.00	7.08	1.00	86.76	90.00	948	.45	92.88	2.14	3.34	.94	.70	0
Hosac Marble Co., North Adams, Mass. Ground Limestone (3)	53.51	53.63	.71	1.00	96.97	97.00	1084	.43	95.86	1.31	2.83	0	0	0
Ground Limestone (1)	53.28	53.63	.65	1.00	96.44	97.00	1079	.43	94.10	2.80	2.93	.44	.28	0
Hosac Valley Lime Co., Inc., Adams, Mass. Adams Agricultural Limestone (2)	53.10	50.00	.84	.75	98.52	97.00	999	.88	81.68	1.82	7.64	7.81	36.32	14.83
Miller Lime Products Corporation, West Stockbridge, Mass. Monarque Agricultural Limestone (3)	42.09	35.00	8.72	6.00	93.35	90.00	1016	.88	69.58	2.90	7.36	8.44	11.72	0
New England Lime Co., Pittsfield, Mass. (e) Agricultural Ground Limestone (4)	53.40	45.00	.94	.50	97.26	80.00	1087	.41	67.34	3.18	10.70	9.42	9.36	0
Pownal Lime Co., North Wey- mouth, Mass. (f) Pownal Agricultural Limestone (7)	44.12	46.00	5.43	5.00	90.09	90.00	991	.45	82.50	1.16	3.80	5.54	7.00	0
Donald U. Smith, Ashley Falls, Mass. Ashley White Agricultural Lime- stone (2)	81.02	30.00	20.47	19.00	98.17	93.29	1030	.39	52.38	4.58	14.20	20.04	8.80	0
Solvay Process Co., Syracuse, N.Y. Solvay Pulverized Limestones (1)	46.96	46.50	8.26	1.50	90.62	86.14	1004	.46	74.24	1.85	3.90	8.40	6.61	0
United States Gypsum Co., 300 West Adams St., Chicago, Ill. (g)	80.97	29.00	20.28	20.00	97.68	95.00	1025	.44	48.98	5.70	23.25	18.68	3.89	0

a Basis car lots, in paper sacks, f. o. b. plant, sight draft with bill of lading.

b Plant at Ashley Falls, Mass.

c Plant at Winooski, Vt.

d There was 26.76% of material insoluble in dilute hydrochloric acid.

e Plant at Adams, Mass.

f Plant at North Pownal, Vt.

g Plant at Falls Village, Conn.

Table III. Gypsum or Land Plaster.

Name of Manufacturer and Brand.	Calcium Oxide (CaO).		Calcium Sulfate (CaSO ₄).		Calcium and Magnesium Carbonates (CaCO ₃ - MgCO ₃). Found.
	Found.	Guar- anteed.	Found.	Guar- anteed.	
United States Gypsum Co., 300 West Adams St., Chicago, Ill. Agricultural Gypsum	32.94	30.00	70.59	64.50	8 73

Note: — The small amount of calcium and magnesium carbonates present in gypsum would neutralize sour soils: the calcium sulfate would not be effective for this purpose.