extent. One examined by the writer contained 9.37 per cent. of this element.

In our experiments in water, sand and soil cultures covering a great many trials we found that magnesia in a soluble form in very small amounts was, in the absence of lime, very toxic to plants. By the addition of lime in a soluble form in amount equal to or in slight excess of the magnesia the poisonous effect of the latter was eliminated. The plant was even enabled to withstand any bad effects from a greatly increased amount of magnesia, provided the lime was also increased in an equal or greater degree.

While the addition of other salts to the magnesia in the culture solutions variously affected the toxicity, in no case as far as tested did it have any degree of action comparable with that of the lime salts.

In sand cultures in which the lime and magnesium salts were applied as nitrates the plants made the better growth where the lime was slightly in excess of the magnesia. With lime greatly in excess there was apparently a starvation of the plant, it making a straggling growth for awhile. With the magnesium in excess the plant soon succumbed, and in moderate excess made a slow and unwholesome growth.

In soil cultures in which magnesium carbonate had been added, calcium carbonate was not efficient in overcoming the noxious influence of the magnesia. This was undoubtedly due to the less solubility of the calcium carbonate in comparison with the magnesium carbonate. By the addition of calcium sulphate the toxicity of the magnesia was readily overcome.

In the practical application of lime for its physiological effect the process could be more intelligently carried on where the amount of soluble magnesia and lime already present, *i. e.*, the portion immediately available to plants, is known. However, the danger lies in under- rather than in over-liming. In a soil containing CaO 0.144 per cent. and MgO 0.144 per cent. soluble in 1.115 per cent. of hydrochloric acid the addition of 0.8 per cent. of gypsum, and again of 0.8 per cent. of gypsum and 0.2 per cent. of magnesium carbonate, produced plants similar to those in the natural soil. With the addition of gypsum 0.2 per cent. and magnesium carbonate 0.68 per cent. the plants made a very slow and spindling growth, too much so for profitable crops.

In liming soils for the physiological effect the sulphate is, among the more soluble forms, the best available. Where a large amount is to be added on account of a high magnesia content of the soil it is better to add small portions yearly, as has been pointed out. However, the process should be repeated until the lime content of the soil is made to equal the total magnesia content.

As stated by Wheeler in his work on Rhode Island soils, calcium carbonate is the best form of lime for overcoming an acid reaction. In applying it for this or any other purpose care should be taken that magnesian limestone be not used unless the soil is also deficient in magnesia. Again in the continued application of crude potash salts the lime and magnesian content of the soil should be known. In case there is a deficiency of lime in the soil the addition of gypsum should also be made in some excess of the magnesia contained in the fertilizers.

D. W. May.

U. S. Department of Agriculture.

QUOTATIONS.

INDUSTRY AND RESEARCH.

Lord George Hamilton has written to Sir Alfred Hickman, M.P., ex-president of the British Iron Trade Association, explaining why certain contracts were placed by Indian railway companies with American firms. In the course of his remarks he says: "You seem to think that orders have only gone abroad because those who gave them did not understand their business. I wish that it were so. The competition we have to face is founded on something much more formidable and substantial. Chemical research, concentration of capital, thorough technical education, improved industrial organization have made in recent years greater advance in America than here; it is with the product of these combinations and not with the assumed stupidity of Indian officials that the British engineer has to contend." Sir Alfred

Hickman replies in a long letter, which appeared in the *Times*, but his remarks refer more to alleged imperfections in American work and the value of protection than to the cause of competition. He asks what evidence exists of 'superior chemical research, technical education, etc.,' and says, "I deny the 'chemical research'" mentioned by Lord George Hamilton. Apparently Sir Alfred Hickman attaches no importance to such reports as those prepared for the University of Birmingham and the Manchester Technical Education Committee as to the position of technical education in the United States; and he can scarcely be familiar with American scientific and technical publications or he would not 'deny the chemical research' with so free a mind. It seems pretty clear, however, that the India Office official who wrote Lord George Hamilton's letter to Sir Alfred Hickman was not the one who expressed views about the chemistry at Coopers Hill and aided the efforts which have strangled the technical education of the officers of the Indian Public Works Department.—*Nature.*

CURRENT NOTES ON METEOROLOGY.

CANNON-FIRING TO PREVENT DAMAGE BY HAIL.

A MOST unfortunate report was recently made to the State Department by the United States Consul at Lyons, France. According to the summary of the report published in the daily papers, the consul states that great success has attended the experiment of firing cannon as a means of protecting orchards and vineyards from damage by hail, and goes on to say that cannon firing is now to be used in order to prevent or to lessen injury by frost. As Consular Reports are official documents, and are looked upon by most persons as authoritative, many inquiries naturally came in to the Department of Agriculture, in Washington, as to when the United States Government intended to adopt, or to experiment with, some such method of protection. It therefore became necessary that some official answer should be made to these inquiries, and by direction of the Secretary of Agriculture, the Chief of the Weather Bureau recently issued a statement to the press in which he says that it is his conviction that "we have here to do with a popular delusion as remarkable as the belief in the effect of the moon on the weather. * * * The great processes going on in the atmosphere are conducted on too large a scale to warrant any man or nation in attempting to control them. * * * After the experience that this country has had during the past ten years with rain-makers, I am loth to believe that the bombardment of hailstorms will ever be practiced, or even attempted, in the United States, much less encouraged by the intelligent portion of the community. Every effort should be made to counteract the spread of the Italian delusion which has been imported into this country."

On this recently much-debated question as to the possibility of preventing hail by means of cannonading, Van der Linden, in *Ciel et Terre* for May 16 sums up the discussion about as follows: "We see, on the one side, many who believe in the new method; on the other side, sceptics and those who are opposed to the method are calling for clearly established facts before they commit themselves, one way or the other. Under the circumstances, it seems wisest to await further developments before forming an opinion."

CLIMATE OF MANILA.

METEOROLOGICAL data lately published by the Jesuit Observatory, at Manila, are based on pressure, temperature and humidity observations made during the years 1883–1898, and rainfall observations during 1865–1898. The normal temperatures, relative humidities and rainfall for each month follow:

	Temperature. Fahr.	Relative Humidity. Per cent.	Rainfall. Inches.
Jan.	77.0	77.7	1.193
Feb.	77.7	74.1	0.413
March	80.4	71.7	0.736
April	82.9	70.9	1.142
May	83.3	76.9	4.197
June	82.0	81.5	9.622
July	80.8	84.9	14.567
Aug.	80.8	84.4	13.866
Sept.	80.4	85.6	14.925
Oct.	80.4	82.6	7.536
Nov.	79.0	81.6	5.126
Dec.	77.4	80.7	2.134