

*V. R. Snowden  
Chemist*

Los Angeles, Cal. Aug. 14th, 1911.

Messrs. Olmsted Brothers, Landscape Architects,  
Panama-California Exposition,  
San Diego, Calif.

Gentlemen:-

Replying to your letter of 11th. inst. I beg to advise that answering your questions by number:

1. When the reaction of a soil is stated as "bleaches litmus" it is not necessarily acid, and in the case of your number 5 it is very faintly alkaline after the indicator shall have been some time in contact with the clear aqueous extract, in which the bleaching agent appears to be insoluble or has become oxidized through aeration during filtration. The bleaching is so prompt and pronounced when the paper is applied directly to the moist soil that it was difficult to detect the alkalinity in the usual way.

I attribute this bleaching action to a lack of oxidation in the soil and this will be promoted by the lime carbonate which should be added to numbers 4, 5 and 6. Lime carbonate has no oxidizing action but it produces an environment favorable to the development of the nitrous and nitric as well as the humifying bacteria, all of which are indirect agents of oxidation.

2. There is no objection whatever to the use of superphosphate in those soils, assuming that the superphosphate is properly made. There should of course be no free acid in it. It necessarily has an

acid reaction, but this does not always mean that it contains free acid.

The only objection there could be to the finely ground bone is its slowness of action. When you use readily available nitrogen and potash your plants will have an unbalanced ration if bone meal is used for the source of phosphoric acid. Their development will then be limited by a deficiency of the latter, and by the time this becomes available from the bone, the nitrogen will have suffered serious loss through oxidation of organic matter and leaching. Besides this, you probably wish to force the plant development and growth as much as is consistent with thrift and vigor, and in that case I would advise the use of all available plant foods.

It would be perfectly permissible to use the fine bone meal in conjunction with the superphosphate, so that it will furnish a supply of phosphoric acid that will respond to later demands that will be made upon it.

My experience with San Diego soils is limited to laboratory work on a few samples in addition to what I have done on your samples.

3. In a soil where there is "black" alkali or an excess of "white" alkali the use of nitrate of soda will tend to increase them if no action is taken to prevent this. Where lime sulphate is used in sufficient quantity (or superphosphate, which always contains it) in conjunction with the nitrate of soda the "black" alkali cannot form; and where leaching of the "white" alkali is practiced there is no need to fear the use of nitrate of soda, which possesses a decided advantage in being not dependent on soil conditions to become available for plant nutrition. The humus found in your soils must contain con-



siderable nitrogen which will under favorable conditions, gradually become available.

There is no objection to the use of dried blood or tankage as a source of nitrogen excepting that they do not act until they shall have been decomposed and their nitrogen nitrified. Tankage is slow in action, its slowness being proportioned inversely to the amount of blood it contains. Blood is quicker but dependent upon conditions being favorable to nitrification. These may be used in conjunction with the more immediately available sources of nitrogen.

4. There is no objection to the use of sulphate of ammonia as a source of nitrogen excepting on acid soils; but this objection can be easily removed by the use of adequate amounts of carbonate of lime in conjunction. And this lime should be applied under such circumstance regardless of whether or not the sulphate of ammonia is used. Sulphate of ammonia possesses the advantage of not adding any saline residue to the soil, but this advantage is partly offset by the fact that its nitrogen must undergo nitrification.

Formula for fertilizer proposed for the different soils:

Your No. 1. North end of Nursery. North of trees.

Per acre annually.	Actual Potash.	Nitrogen.	Phosphoric Acid.
180# Potash Sulphate (50% Pot.)	90#	-----	-----
200# Dried Blood (13-1/2% Nit.)	-----	27#	5#
130# Ammonia Sulph. (20% Nit.)	-----	26#	-----
170# Nitrate Soda (15-1/2% N.)	-----	26-1/3#	-----
680# TOTALS	90#	79-1/3#	5#

In number 1 phosphoric acid is practically omitted because of the large content of this element of plant food. In number 3 nitrate of soda is omitted because of the large content of soluble mineral salts, and also because of the comparatively high percentage of nitric nitrogen.

In number 1 you have dried blood while in number 2 I have given you fine ground bone and in the others tankage, so that you might make some comparison between their action. Tankage is used more often because it furnishes both phosphoric acid and organic nitrogen.

The formulas are all necessarily empirical, i.e., based upon experience with other soils--and they cannot be considered as exact, since it is impossible to know all the conditions affecting their use. nevertheless I have endeavored to apportion the various plant food elements according to my idea of the needs of each of the soils as manifested in the analyses.

# I have almost forgotten to say that number 6 should have an additional application at the beginning, of say 75# nitrate of soda and 200# Superphosphate to give this soil something like an even start with the rest.

If you purpose making monthly applications of fertilizers you will of course divide the amounts named accordingly. The potash might be as well put on more at a time and less frequently, and this may be said also of the superphosphate.

On general principles the proportion of nitrate of soda to other sources of nitrogen should be larger in winter than in summer and vice versa.

I think I have covered all the ground, having given the quantities and forms of lime needed, in a previous communication.

O. Bros. 6.

Feeling a deep interest in your success, I am

Very truly yours,

R. R. Snowden,

Chemist & Soil Engineer.