hydrate (in presence of H_2SO_4), two chloralides have been obtained after careful recrystallisations. Thus, *d*-tartaric, racemic and lactic acids have each given two chloralides.

Chloralides of	Melting Points
d-tartaric acid	..(i) 162° and (ii) 175°
Racemic acid	..(i) 160° and (ii) 215°
Lactic acid (Merck's)	..(i) 62° and (ii) B. P. 212°

Lactic acid chloralides are being carefully studied.

This line of investigation will greatly help to remove the discrepancies that are found with regard to the melting points of the chloralides already recorded in literature: some of them may be due to cis-trans-isomers.

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The Structure of Singly Ionised Selenium.

IN continuation of the work of the writers on Se III* the analysis of the spectrum of singly ionised selenium has been completed. The source employed was the ordinary discharge tube, wherein pure powdered selenium was heated. The very extreme ultraviolet region, the vacuum spark between aluminium poles tipped with metallic selenium served as a convenient source in addition to the discharge through capillary tubes.

This spectrum was observed to be similar in many respects to the spectrum of As I.† The intervals 5s $^4P_1$—$^4P_2$, and 5s $^4P_2$—$^4P_3$ are found to be 1483·5 and 1920·9 respectively. Adopting a value of 5s $^4P_3$= 76320 calculated from appropriate series members the absolute values of the various energy states characteristic of Se II could be obtained. Some of these are:

$$5s\ ^2P_2=73638$$
$$5p\ ^4D_3=58932$$
$$5p\ ^4P_3=56602$$
$$5p\ ^4S_2=55692$$

The intervals of 5p $^4D_4$ terms are 412·7, 1356·4 and 1730·6 while the 5p ^4P term intervals are 3728·1 and 1621·2. A full report of the results obtained will be published shortly in the *Proceedings of the Royal Society of London.*

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* *Curr. Sci.*, **1**, June 1932.

† A. S. Rao, *Proc. Phys. Soc.*, **44**, 594, 1932.

Spectrum of Ce III.

MR. DABHOLKAR, in a note published in the February issue of *Current Science*, has made some observations on my work on the regularities in the spectrum of doubly ionised cerium. The error pointed out by him regarding the classification of the line λ 2238·69 is only a case of misprint. If he would be kind enough to look into my paper again, he would notice that the combination A—*k* is to be replaced by 5d² $^3F_2$—*k*. The fact that 44655·1 is given as one of the term values should have made the change clear. It may be pointed out here that the frequency differences in my analysis of Ce III lines were mostly found to be correct to within ·1 frequency units. The analysis explains practically all the strong lines and there can be no doubt about the genuineness of the terms which have been discovered. The fixing of J and K values of the terms in a spectrum like that of Ce III can, for obvious reasons, hardly be expected to indicate anything more than a personal opinion, and it is therefore needless to enter into a discussion of this aspect of the matter here.

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Oxidising Agents as Fertilisers.

IT has been shown in a previous communication[1] that improved growth of seedlings can be obtained by treating soils, manured or otherwise, with different oxidising agents. As the results were of much scientific interest and, at the same time, indicated possibilities of extended practical application, further work was carried out growing different plants in pots as well as plots, and studying the influence of various treatments on general growth and yield of crop.

[1] *Nature*, **132**, 1001, 1933.

It was observed that vigorous oxidising agents like potassium permanganate or hydrogen peroxide were effective when applied either before the organic manure or at the same time with it: they tended to depress the yield if applied as top dressings 2–3 weeks after sowing. On the other hand, milder agents like the oxides of iron or manganese produced the most favourable effects when applied, as top dressings, at least a fortnight after sowing or transplanting as the case may be. In all the cases, the improvements were noted to be all-round, shoot height, leaf area, tillering and grain formation being favoured by the treatment. The following are some of the results obtained:—

TABLE I.

POT EXPERIMENTS.

Treatment	Yield in Grams			
	Ragi (*Eleucine coracana*)		French beans (*Phraseolus vulgaris*)	
	Grain	Straw	Pods	Stem and root
Pot Experiments.				
Soil (30 lbs.) + Seed-cake (30·0 g.) + Super (3·0 g.) + Potassium nitrate (2·0 g.) + Potassium sulphate (1·5 g.) (*Control*) ..	296·4	115·7	67·4	22·0
Control + Fe_2O_3 (30·0 g.) applied as top dressing	343·7	124·5	102·8	26·8
Control + MnO_2 (7·5 g.)	345·2	116·4	104·0	28·2
Control + H_2O_2 (50 c.c. of 6 per cent.) ..	319·6	120·3	80·7	24·1
Control + $KMnO_4$ (3·0 g.) (applied before sowing)	398·4	146·9	72·7	23·5
In Small Plots (484 sq. ft. in each case).				
Unmanured (*Control*)	1430·5	1550·9	..	..
Unmanured + oxidising agents $KMnO_4$ (at 100 lbs. per acre)	2066·9	1786·0	..	..
Fertilised with farmyard manure alone (3 tons per acre) (*Control*)	2181·3	2100·4	..	..
Fertilised with $KMnO_4$ (100 lbs. per acre) (applied together with the farmyard manure)	2870·0	2797·0	..	..
Fertilised with $KMnO_4$ (100 lbs. per acre) applied in stages after the farmyard manure	2306·9	2313·5	..	..

The above observations have been supported by a number of other results so that it may be concluded that whether any manure is applied or not, treatment of the soil with oxidising agents leads to beneficial results.

The practical significance of some of the foregoing observations would be realised when it is stated that in many countries, tropical as well as temperate, there are vast tracts of land which are rich in iron or manganese—particularly the former—and contain high percentages of the corresponding oxides so that one has only to grind up rocks containing them and apply them to land in the desired proportion. Since it has been observed that even soils which are naturally rich in iron respond favourably to the treatments, it may be inferred that all soils would give increased yields as the result of applications of top dressings of iron or manganese oxides.

The quantities of available mineral oxides —particularly that of iron—are far in excess of the requirements of metallurgical industries, so that there is no fear of shortage of raw material for the latter. There are also vast supplies of low grade minerals which are unsuitable for other purposes and which could, with advantage, be utilised as fertilisers. The results of the present enquiry should also prove of value to the synthetic fertiliser industry by leading to the production of a new type of fertiliser which, in addition to supplying the mineral or nitrogen requirements of the plant, also facilitate the oxidation changes in the soil.

The fertilising action of different oxidising agents raises a fundamental question as to how they react with the soil and what effect they have on soil microflora and microfauna. As already observed, there is increased oxidation of organic matter resulting in greater evolution of carbon dioxide from the soil. This oxidation cannot, however, be correlated with microbiological activity which is prominent only immediately after the application of organic manure. The beneficial effect is best observed, at any rate, in the case of metallic oxides, only under conditions when micro-organisms are not actively functioning so that the oxidation changes observed in presence of the former would appear to be largely due to purely non-biological reactions.

A further question of practical importance which arises in this connection is as to whether it is desirable to adopt any system of fertilising which would lead to the rapid depletion of organic matter from the soil, whether it is not more important to devise means to conserve Carbon and Nitrogen in the soil rather than hasten their destruction. The observations of the present authors as also those of other workers in the field have shown that most cultivated soils, particularly in the tropics, have very poor retentive power for organic matter and that they get rapidly depleted irrespective of the quantities of organic manures applied to them. Owing to the favourable climatic and other conditions, the decomposition goes on practically all round the year so that the added manure possesses very little residual value. In the light of the above, it would appear to be more profitable to hasten the decomposition of organic matter during the lifetime of the crop for which it is applied and thus obtain the benefit of the increased yield rather than lose the unused residue after harvest and during periods of fallow. The quickened decomposition would only help to hasten the normal cycle of Carbon and Nitrogen in nature so that the foregoing observations would suggest the possibilities of a new system of fertiliser practice which would take advantage of the processes occurring in nature rather than devise means to oppose them. Further work is already in progress to extend the above and related observations, but it is also hoped that other workers would verify our findings and thus help towards further elucidation of their practical significance.

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The Valence Angle of Oxygen in Dimethyl Oxide and Ethylene Oxide.

The modes of vibration of a symmetric, non-linear triatomic molecule of the type XY_2 have been worked out by Bjerrum, Dennison and others. The three fundamental frequencies in its vibration spectrum are shown by these authors to be functions of the valence angle of the atom X, and of the binding forces between X and Y, and between Y and Y. From a knowledge of the vibration spectrum of the molecule, we can, therefore, calculate the valence angle of X and the binding forces between the atoms.

The valence angle of oxygen in dimethyl oxide $\begin{matrix}CH_3\\CH_3\end{matrix}\!\!>O$ calculated in this manner from its fundamental Raman frequencies 1102, 416 and 921 cm.$^{-1}$, is found to be about 102°. This is very near the tetrahedral angle of 109·5° usually supposed in theoretical discussions to represent the valence angles. On the other hand, in the heterocyclic compound ethylene oxide $\begin{matrix}CH_2\\|\\CH_2\end{matrix}\!\!>O$ if we calculate the valence angle in the same manner, it comes out much smaller. The principal Raman frequencies of this compound, as measured by me, are 865, 810 and 1151 cm.$^{-1}$, and they give for the angle a value of only 64°. The smaller value in this compound is evidently due to the presence of a chemical bond between its two carbon atoms, which is absent in dimethyl oxide; the bond will naturally bring the