INCREASING THE USEFULNESS OF MAPS

THE practice of making maps divided off into arbitrary regions indicated by A-1, 2, 3, 4; B-1, 2, 3, 4, etc., as a means of locating points, does not meet present needs. Who has not had to scan minutely over such an area on many occasions in search of some town, and after finding it spent additional time in determining its distance from some point of reference by the use of a scale of miles at the bottom of the map? Perhaps the point of reference is on a different map with a different scale of miles, or perhaps other regions on independent maps intervene, in which case the investigation becomes increasingly complex and inaccurate as well. Even if a single map is found which includes the two points in question, distances so measured are only approximate, and they are increasingly inaccurate if one of the points is near the edge of a map representing an area appreciable in comparison with the size of the earth, for the projection of spherical areas on plane surfaces necessarily involves distortion. In any case, knowing that a city is located in C-5 on a particular map gives no information concerning its position on another map or on the earth's surface.

Instead of listing cities and towns in such arbitrary regions, let their latitudes and longitudes be specified; then the simplest space interpolation immediately locates their positions on the map. Determination of approximate distances would be greatly facilitated. Each degree of latitude is almost 70 miles (more nearly 69 miles), and while the linear distance represented by a degree of longitude changes gradually with latitude, those values should be marked on the right and left borders alongside the numbers of the parallels. Not only would we be able to establish quickly approximate distances and directions without even finding the points on the map, but also remembering that each fifteen degrees of longitude represents an hour of difference in sun time, a simple mental calculation instantly establishes the probable difference in standard time between the two regions.

This reform would be advantageous to the tourist and would be an aid to scientific thinking on the part of the layman. Not the least important advantage would be to the grade-school student of geography whose interest would be greatly increased in studying positions of countries and cities with respect to his own position instead of with respect to some locality he has never visited and in which he has little interest. There is, of course, nothing to prevent the scientifically minded student from noting the approximate latitude and longtitude of the places he finds on a globe or map, since lines of latitude and longitude are shown on maps in geographies and encyclopedias in general use, but there is a tendency for one to think he has located a place when he has found it on a map without having made any determination of its absolute position on the earth's surface. Relatively few people are accustomed to making any use of latitude and longitude in the interpretation of maps.

The objection may be raised that it is less simple to list the position of a town as 42° 44′ N, 93° 17′ W than to write it merely as C–5. But obviously the N or S, E or W can be omitted from the individual listings, except for regions near the equator, prime meridian or 180 degrees longitude. Further simplification would be accomplished by recording the nearest tenth of a degree instead of minutes of angle. The illustration above would then appear as 42.7, 93.3 under columns headed, degrees north, degrees west. On the very largest scale maps of small areas, the use of hundredths of degrees might be warranted, but in that case hundreds, tens and possibly units of degrees need not be repeated.

It is true that the general public is not quick to welcome unfamiliar innovations, but most people have learned to interpolate in the use of measuring rods, and an increasingly large number are becoming familiar with the more difficult interpolations in using a slide rule. After a single use few persons would desire the present style of listing of points; but for the convenience of those who still preferred the graphical determination of distance, a scale of miles should be retained to supplement the proposed scheme.

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SPECIAL ARTICLES

MANGANESE DEFICIENCY FOR CITRUS IN CALIFORNIA

MANY investigators of plant physiology have shown that a deficiency of manganese causes abnormal development of plant foliage. Camp and Reuther[1] have described deficiency symptoms on orange and grapefruit trees in Florida soils, while Taylor and Burns[2] have reported them on oranges in New Zealand. Haas[3] has described symptoms on citrus grown in nutrient cultures. Extension and clarification of descriptions of deficiency symptoms on citrus, especially on lemon

[1] A. F. Camp and Walter Reuther, *Florida Agr. Expt. Sta. Ann. Rpt.*, 1937, pp. 32–135.

[2] G. G. Taylor and M. M. Burns, *New Zealand Jour. Sci. and Technol.*, 20(2): 115A–119A, 1938.

[3] A. R. C. Haas, *Hilgardia*, 7(4): 181–206, 1932.

trees, has resulted from recent studies by Chapman, Liebig and Parker.[4]

For many years investigators[5] in California have applied manganese to soil and to leaves of citrus trees in an effort to diagnose the cause of subnormal tree behavior. Results of concluded trials are not definite. Recently, however, responses to manganese treatments have been obtained on citrus trees in the Santa Clara River valley in southern California. Certain vigorous lemon trees in that area normally produce young leaves which are pale green in color with sharply defined green midrib and veins. Very pale green blotches, about 3mm in diameter, appear at random in interveinal spaces. Occasional terminal leaves are devoid of green color. Old leaves are frequently affected with a faint mottling. Spraying of the leaves of one limb of one of these trees with a concentrated solution of $MnSO_4$ in August, 1937, resulted in severe injury and repression of new growth. Some new growth appeared on this limb during 1939, however, and in August was considered normal. No improvement was noticed elsewhere. Liberal applications of $MnSO_4$ in 1937 to the soil about other trees in this area have not yet caused improvement.

In July, 1939, we inspected a lemon orchard in the same valley, in which the trees are subject to premature "decline." Recent foliage of trees in the beginning stages of decline showed typical symptoms of manganese deficiency, as recently determined.[4] Analysis of such leaves indicated a low manganese content. Treatment of several trees on August 2, 1939, by injection with C.P. $MnCl_2 \cdot 4\,H_2O$ solutions and crystals (3–8 gm per 3-inch limb), as well as by spraying with 1.25–1.5 per cent. solutions of this material, resulted in greening of leaves within 15 days. The sprays caused slight burning of tender leaves.

Subsequently, several hundred trees were treated by spraying and injection with corresponding effects. The results indicate a deficiency of manganese for citrus trees in this area. The relations of this condition to premature decline of fruit trees may be of importance.

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THE PRODUCTION AND UTILIZATION OF ALCOHOL BY PLANT TISSUES

SOME recent work in this laboratory on the metabolism of legume nodules and of legume and non-legume roots has led to results which apply to the general problem of the role of ethyl alcohol in plant respiration. Since these results have a broader application than merely to nodule metabolism, in connection with which they will be published in full, it seems worth while to give a brief résumé of them here.

The investigations were carried out partly by the Warburg manometric technique and partly by chemical analysis. The following results were secured concerning the production and disappearance of alcohol in the tissues: (1) Under anaerobic conditions alcohol and carbon dioxide were produced by both nodules and roots in proportions which indicate that alcohol was the chief unoxidized product. (2) Under aerobic conditions increasing amounts of alcohol in the medium reduced the respiratory quotient (R.Q.) of both tissues from about 1.00 (lower for roots) without alcohol almost to 0.67 (the theoretical R.Q. for complete oxidation of alcohol) with only a slight increase in oxygen consumption; and, as shown by chemical analyses, part of the alcohol disappeared. Added glucose increased oxygen consumption slightly. Under complete aerobiosis it did not affect the R.Q. if the latter was already approximately 1.00 but increased it under oxygen deficit or if it was already below 1.00. The effect of each substance occurred in the presence as well as in the absence of the other. (3) In nodules, either without added carbon source or with glucose, increasing the oxygen concentration led to increased carbohydrate breakdown, as shown by the CO_2 evolved and O_2 consumed; while in roots, without added carbon source or with alcohol, and in nodules with alcohol increasing the oxygen concentration led to decreased carbohydrate breakdown.

The following seems to be the most reasonable interpretation of these facts: In the absence of oxygen sugar is fermented to alcohol (chiefly) and carbon dioxide, and in the presence of oxygen both sugar and alcohol (if present) are oxidized competitively to carbon dioxide and water. Any oxidative resynthesis of the alcohol to fermentable compounds as the cause of its disappearance seems to be ruled out because of the apparent lack of any decrease in carbohydrate breakdown in tissues respiring carbohydrate chiefly, and because the R.Q. following the addition of increasing amounts of alcohol to the medium did not fall below that (6.67) characteristic of the complete oxidation of alcohol. (The R.Q. of an oxidative resynthesis is smaller than this.) In these tissues the presence of a sparing action of oxygen on carbohydrate consumed seems therefore to depend on the presence of enough alcohol (or similar fermentation product) to serve as a substitute for a considerable fraction of the carbohydrate.

[4] H. D. Chapman, Geo. F. Liebig and E. R. Parker, *California Citrograph*, 24: 454; 25: 11–15.

[5] L. D. Batchelor, E. R. Parker, G. Surr and R. W. Southwick, unpublished data.