sey and southern Ohio have unusual interest in respect to the climatic boundary under consideration. The snow-covered northward slopes are effectively microthermal as regards snow cover and the southward slopes are mesothermal. Thus, from the geomorphological standpoint, in the vicinity of the isotherm of January 32° F., we find an ideal expression of climatic borderline conditions, innumerable islands of one climate within the realm of another. Whereas climatic contrasts may take place within comparatively short distances in areas of considerable relief, it is unusual to find them so strikingly displayed in such comparatively flat regions as those under discussion and hence of all the greater significance.

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CHLORATES AS HERBICIDES

THE persistent spread of the more noxious perennial weeds has recently focused the attention of many experimental workers on the problem of a cheap, safe and effective chemical method for the eradication of these plants. Sodium chlorate has proved in many trials to be the most generally effective herbicide now in use. With proper methods, such weeds as Canada thistle (*Cirsium arvense*), European bindweed (*Convolvulus arvensis*), quack grass (*Agropyron repens*) and similar plants can be controlled with one or more applications of this chemical. The cost ranges from twenty-five to one hundred dollars an acre and the fire hazard may be very serious with the usual methods of application in which a chlorate spray is applied to a heavy growth of foliage.

A three-year study of the herbicidal action of sodium chlorate in the botany department of the Iowa State College indicates that this compound may be more effective when applied to the roots rather than to the aerial portions of the plant, and suggests that under humid conditions the elimination of perennial plants by spraying with chlorates is dependent upon a portion of the spray residue reaching the soil. By applying the chemical, either crystalline or in solution, directly to the moist soil it is possible to reduce the quantities applied, and if the top growth of the plants is removed before treating, the principal fire hazard is eliminated. The apparently unchanged chlorate salt persists in the soil for a period varying with the conditions from a few weeks to two or more years. The herbicidal action consists of both a direct killing of the underground portions of the plants and of translocation to and slow killing of any new sprouts which may be formed. The importance of the two effects probably varies with the plant and the conditions. Quack grass or Canada thistle rhizomes and roots may be killed in the dormant stage, so that the effects of ultra-violet light are not required for the toxic action of chlorates. We have been unable to obtain any appreciable translocation of the toxin except in the transpiration stream, and any generalized action seems to be dependent upon the ability of the salt to persist in the soil solution, where, as stated, it may either penetrate and kill the roots and rhizomes, or be absorbed and translocated to transpiring regions of the top. The continued killing of the tops adds starvation to the direct action on the underground organs and explains the effectiveness of the treatment.

The tendency of the chlorate to persist in the soil may become seriously objectionable under some conditions. In our field tests we find that heavy applications which result in a large quantity of the salt reaching the sub-soil are particularly persistent. Temperature and leaching seem to be the most important factors concerned in the disappearance of chlorates. At temperatures of 25 to 30° C. treated soil loses its toxic properties in a few weeks, while in the sub-soils mentioned (three to five feet) the chlorate concentration is still too high to permit crop growth nearly two years after the initial application. The surface foot of these same plots which received chlorate at the rate of 1,000 pounds per acre is normal. The use of lighter applications under more favorable conditions should reduce the deep penetration and persistence of chlorates.

The recognition of the fact that chlorates are effective when used as root absorption poisons will permit the use of the sodium salt instead of the more expensive calcium chlorate. It will make it possible to eliminate the fire danger, now a very serious factor, avoid the destruction of chlorates exposed on the leaves of sprayed plants and help to reduce the after-effects of chlorate applications by avoiding excessive applications in cool soils not subject to leaching.

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THE CAUSATIVE ORGANISM OF A PAPULAR TYPE OF APPLE MEASLES[1]

THE disease known as apple measles, reported first by Hewitt and Truax[2] in 1912 as an obscure apple disease, has recently attracted especial attention in certain sections. This disease has been reported under various names which include "measles," "pimple

[1] Approved by the director of the West Virginia Agricultural Experiment Station, as Scientific Paper No. 97.

[2] J. L. Hewitt and H. E. Truax, "An Unknown Apple Tree Disease," Arkansas Agric. Exp. Sta. Bull. 112: 481–491, 14 figs, 1912.