vessel made from a thin test tube with fused-on siphon and stopcock, and containing some of the original acetate solution with a little quinhydrone supported in the beaker. Electrodes cut from the same piece of platinum foil are immersed in the solutions, and connected through a very sensitive galvanometer. The solution in the beaker is vigorously stirred by motor, while fifth normal ammonia is run in at a rather rapid rate until the galvanometer shows no deflection. By the adoption of a standardized procedure, it has been found possible to obtain consistent results on duplicate percolations made at different times. It is necessary to renew the solution in the comparison electrode vessel for each determination and to work rapidly, as the quinhydrone is quickly oxidized and the electrodes become polarized. The titrated solution is evaporated, organic matter gotten rid of by a careful ignition in the beaker and the subsequent separations made by standard methods. The alkalies are determined in the same solution after the magnesium, which is precipitated as arsenate, and the filtrate evaporated and ignited; the excess arsenate is entirely volatile with ammonium chloride. Needless to say, in this procedure it is necessary to use minimum amounts of pure ammonium salts only as reagents. The ignition in glass has not been found to result in any considerable contamination; the blank for potassium has always been found to be low, and while that for sodium is important and for calcium appreciable, the principal source of these impurities has been traced to the ammonia solution used for the preparation of the acetate.

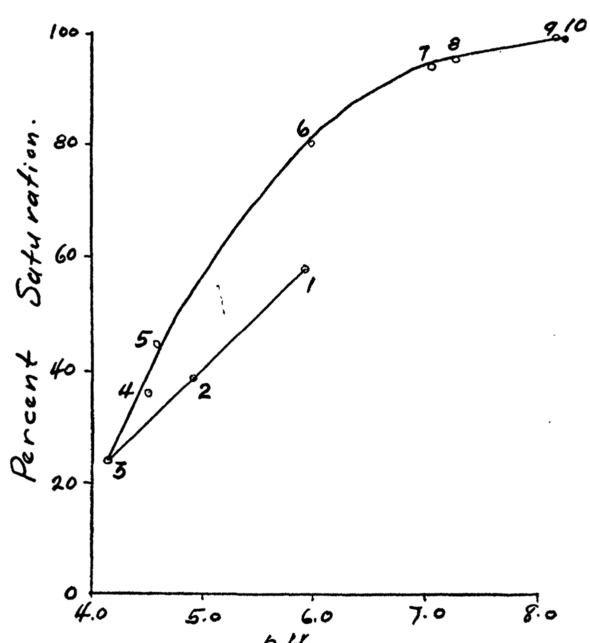

FIG. 1. The relation of degree of saturation to pH. The numbers refer to the various horizons.

The best criterion for general accuracy in these procedures is the excellent balance between the sum of milligram-equivalents of cations exchanged and ammonia absorbed by the leached soil. Surface soils sometimes show an excess of ammonia absorbed, possibly due to absorption of ammonium acetate as a whole by organic matter. Soils containing much carbonate show excess of base dissolved, which may be corrected for by determinations of carbonate in original soil and leached residue, best dried and finely ground for this purpose. Drying the leached soil prior to determination of absorbed ammonia is not permissible, as ammonia has been found to be lost.

In an examination of samples from a Clermont silt loam profile, a detailed description of which will appear elsewhere, an excellent correlation between percentage of total base absorbent capacity satisfied by neutral salt-forming bases and soil reaction has been discovered. This soil represents an extreme example of weathering *in situ* of a very old (Illinoian glaciation) calcareous till, the highly eluviated surface and subsurface horizons being acid and practically all carbonates leached out to the depth of eight or nine feet. The relation is shown graphically in the figure, degree of saturation being plotted against pH determined on 1:1 suspensions of dried soil and water, after 3 days standing for equilibrium to become established. The points are numbered according to order in sampling, 1 being surface soil and 10 the parent material, 108–120 inches, with over 25 per cent. carbonate. The figure shows that the first two horizons are less acid and more saturated than the third, and that beginning with the fourth horizon acidity decreases and degree of saturation increases as the parent material is approached. From the first to the third horizon the points are on a straight line, but points corresponding to lower horizons are all near a smooth curve with slope different from that of the line. The difference in slopes may indicate that there is a difference between base absorbents at the surface and below, perhaps due to the presence of organic matter.

C. J. SCHOLLENBERGER
OHIO AGRICULTURAL EXPERIMENT STATION,
WOOSTER, OHIO

TUMORS IN KALE

DURING the past two years experiments have been made in an effort to induce tumors by artificial stimulation in kale plants. Three methods have been utilized, involving (1) the subjection of the entire plant to vapors; (2) subjecting localized areas of leaf surface to vapor effects; and (3) stimulation by injections made with hard glass needles.

The first and second methods involving stimulation by means of vapors were productive only of warty intumescences similar to those formed in the greenhouse and outside in certain conditions of light and humidity without stimulation by means of chemical vapors. The vapors of ammonia, alcohol (ethyl) and acetic acid increased to a considerable degree the number of intumescences produced but did not definitely increase their size. This effect was produced without bringing about artificially reduced transpiration. This, as far as ammonia is concerned, is in accord with the work of von Schrenk[1] and with Smith's work[2] with each of the three.

In the third method, needles sealed at one end were filled with the solution to be used by heating and later cooling with the open tip in the solution, so that the liquid was drawn into the needle with the contraction of the enclosed air. The tip was then sealed and broken off later at the time of injection. The tip was inserted into the midrib of the leaf or some other portion of the plant and again warmed at one end with a match to drive the contained liquid into the tissue or they were merely left with the tip inserted and diffusion depended upon to carry the material out into the tissues. Little difference was noted in the results obtained by the two methods of injection.

As a result of these injections extensive proliferation occurred resulting in the formation of small "tumors" of varying size up to two and one half centimeters in length to one and one half centimeters in breadth, not infrequently breaking through the leaf on both the upper and lower sides. Both hyperplasia and hypertrophy occurred with a disappearance (or non-appearance) of the chlorophyl from the tumor tissue. There was not only a proliferation of parenchymatous tissue, but also in many cases the phloem became involved. The nuclear structure showed, as far as investigated, no particular deviations from the normal (no double or giant nuclei).

The following materials were injected into the leaf midrib with definitely positive results in the percentage of cases given.

N	Sodium chloride	18.2 per cent. of the trials
0.1N	" "	53.9
.05N	" "	8.7
.02N	" "	9.1
.01N	" "	28.6
20 per cent.	Ethyl alcohol	48.2
1 " "	" "	58.5
10 " "	" "	66.6
0.1N	Calcium chloride	23.5
1 per cent.	Acetone	73.0
1 " "	Glycerine	41.2
1 " "	Cane sugar	54.5
	Paraffine oil	16.6
	Distilled water	25.0
	Extract of kale	53.3

[1] Schrenk, H. V., Rept. Mo. Bot. Gard., 1905, V. 16, p. 125.

[2] Smith, E. F., *Jour. Agr. Res.*, 1917, VII, pp. 165–186.

When empty needles were inserted no tumors were formed, although a certain amount of callous tissue was produced which was not comparable to the tumors described above.

The ability of such a variety of materials to induce tumor formation leaves the causative factor in kale, as with plants used in other investigations,[3] very much in doubt. Apparently any wound accompanied by a liquid injection is sufficient stimulus; other conditions being favorable to bring about the proliferation of tissue.

External weather conditions appear to be of considerable importance in this type of tumor formation, as is true in the formation of intumescences.[4] Tumors of large size were produced here only during the spring rainy season when there was abundant rainfall, minimum daily sunlight and humid atmosphere. Only very small tumors or none at all were produced during the dry season, even in cases where an effort was made to reproduce rainy season conditions under glass of varying penetrability to sunlight and under burlap kept moist by a continuous water spray. That conditions of the plant, relative to turgidity of cells and transpiration rate, are of importance can not be doubted, though these alone do not apparently account for the seasonal difference in tumor formation.

The effect of light, believed by Dale[5] to be of importance in intumescence formation, is at least not apparent in these experiments. Further work is planned relative to conditions governing formation and to physiological conditions in the tumor cells, and a more complete report will be made elsewhere.

I wish here to express to Dr. L. B. Becking, of the School of Biology, Stanford University, my sincere thanks for suggestions, interest and material aid in carrying on these experiments.

P. N. ANNAND

SAN MATEO, CALIF.

[3] Sorauer, Paul, "Manual of Plant Diseases," pp. 435–451.

[4] Dale, E., J. Proc. Royal Soc. Lon., 1901, V. 194, p. 163.

[5] Dale, E., Royal Soc. Lond., Phil. Trans., 196, V. 198, p. 221.