RECENT SERVICES OF CHEMICAL SCIENCE TO AGRICULTURE

A radio talk by Dr. Henry G. Knight, Chief, Bureau of Chemistry and Soils, broadcast Wednesday, July 25, 1934, in the Department of Agriculture period, National Farm and Home Hour, by a network of 50 associate NBC radio stations.

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I'm glad again to have the opportunity to visit with this radio audience. It has been nearly two years since I gave you a series of talks reporting the current chemical discoveries that promised immediate or potential improvements in the efficiency of farming operations.

Since I last talked with you, the chemists of the Department have been producing new knowledge at the same rate as before. I shall not try to give you a list of all the new facts of promise to farming that they have gathered in the past two years. I shall simply report to you on some of the recent results of research which are of greatest interest to farmers. The list includes: Our work with insecticides, especially with nicotine compounds and organic sulfur compounds; our work on making use of the by-products of farming industries, particularly the citrus and sweet potato industries; and our work on the processing of farm products, especially of walnuts.

As all of you know, nicotine, or nicotine sulfate is commonly used in liquid sprays for killing sucking insects. Nicotine also is poisonous to chewing insects. But it hasn't been much used against those insects in the past because it evaporates into the air or washes away in rain water very quickly. You can see that it would be an advantage to get nicotine into a solid form that wouldn't evaporate or dissolve so easily. Our chemists have been working at the problem for some years. Recently they seem to have found at least a partial solution.

This solution is to make nicotine into a chemical compound with a powder of a clay-like material called bentonite. The resulting product, we have found, is a definite chemical compound. It can be used as a dust in fighting chewing insects.

This discovery is important for two reasons. One is that it makes nicotine more useful. The other is that when our chemists demonstrated that nicotine and bentonite make a true chemical compound, they opened the way to making other liquid organic compounds into solid forms and using them as poisons for chewing insects. Already they and the entomologists are testing the value of compounds based on anabasine, as well as on nicotine. And our men have applied for a public service patent on the nicotine-bentonite compound and the process of preparing it. That is, a patent which dedicates the discovery to the use of the public without personal profit to the discoverer.

Well, so much for the work on turning liquid insect poisons to solid, more usable forms. Now, my second report on the insecticide work concerns experiments with organic sulfur compounds. These experiments have brought to light at least one promising compound. At present it goes by either one of two names -- phenothiazine or thiodiphenylamine. But forget its jaw-cracking

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names, you orchardists and keep your eye on its future course. It may turn out to be the long-sought substitute for lead arsenate as a control for the codling moth.

We tried it at first against mosquito larvae. We found it far more deadly than rotenone to them. Rotenone, you know, is the remarkable insecticide obtained from certain kinds of tropical plants. I have often talked with you about rotenone and our experiments with it.

But to get back to phenothiazine: After trying it out on mosquito larvae with such splendid results, we used it against larvae of several varieties of insects, including codling moth. It was quite effective. So now we have joined with the Department entomologists in making tests of phenothiazine against codling moths under orchard conditions. We do not yet know whether it will damage foliage or fruit, whether it will kill moth under orchard conditions, nor what the physiological effects on human beings may be. These are yet to be worked out. Until they are determined phenothiazine will not be approved by the Department of Agriculture. However, all points considered it is a very promising insecticidal material.

Now, we'll leave the insecticide experiments and turn to some of the recent work on utilizing farm by-products. First, a report of the work with citrus.

Citrus fruits have been used for a long time in the South for the preparation of home-made wines. Realizing that the commercial production of citrus wines would create a market for surplus and culls and help to stabilize prices of graded citrus fruits, the Bureau recently began to study the processes and conditions necessary to produce uniform and acceptable wines and other alcoholic beverages from oranges, tangerines, and grapefruit. Results obtained thus far in the citrus by-products laboratories indicate that sweet wines of pleasing aroma and taste, and having commercial possibilities, can be prepared from oranges and tangerines by adding sugar to increase the sugar content of the juice to about 25 percent, inoculating with a pure culture of wine yeast, and allowing to ferment at a low temperature. Of course, the fermentation must be followed by clarification and aging. The proper length of time and best conditions for aging, and other problems, still remain to be worked out. Brandies and wine spirits were made from oranges, grapefruit, and tangerines by fermenting the sweetened juices and distilling with a rectifying column. A product closely resembling Sherry wine was made by fortifying natural citrus wine with citrus brandy. Orange, lime, lemon, tangerine and grapefruit cordials were prepared by adding sugar, water, and the oil from the peel of these fruits to citrus wine spirits. Pleasing beverages were also prepared by adding combinations of citrus oils, anise and different herbs to citrus wine spirits. The results of this work point to a possible large scale utilization of surplus and cull citrus fruits, as these products can be produced in large quantity in years of bountiful yield and carried over in years of low yield with actual improvement in quality.

In previous radio talks, I have discussed with you some of the results of our efforts to develop the manufacture of high grade starch for industrial uses from sweetpotato culls. Since that time a number of

cotton mill operators have tested sweetpotato starch for sizing warp yarns and finishing fabrics. They all report that sweetpotato starch gives equally as good results as the imported white potato starch now used, and it takes less of the sweet potato starch. A number of experts have also pronounced it to be the finest known starch for certain laundry purposes. The Bureau of Engraving and Printing has recently tested dextrin made from sweetpotato starch for its value as an adhesive on postage stamps. Both laboratory and machine tests showed it to be equal to the dextrin now used, which is made from imported cassave starch.

The Bureau of Engraving and Printing uses about a million pounds of dextrin per year. As much or more is used on the envelopes, labels and franks which the Government buys under contract. Sweetpotato starch dextrin is the first domestic product which has met the requirements of the Bureau of Engraving and Printing. Under the law requiring the Government to purchase products of domestic origin whenever feasible, a market would be afforded sweetpotato starch dextrin for use as postage stamps, envelops and other gummed paper products produced or used by the Government

Sweetpotato starch would not compete primarily with other domestic starches But, because of its special properties, it is expected to gradually displace imported white potato starch in the sizing and finishing of cotton goods and imported cassava starch as an adhesive for postage stamps, envelopes, etc. When that day comes, we expect an increase of 4 million dollars a year in returns to sweetpotato growers.

It seems that in the manufacture of this starch numerous small factories scattered over the producing area would be more practical than a few large factories. The immediate prospective market for sweetpotato starch would absorb the output of about 25 factories, each having a production capacity of about two million pounds annually. Steps have already been taken to establish a sweetpotato starch industry in the South. A commercial firm of Atlanta, Georgia, is now constructing a factory at Quitman, Georgia, and another factory is being erected at Laurel, Mississippi, which is expected to be in operation this year.

Now just time for one more report.

A recent discovery of the Bureau is that treatment with ethylene gas will loosen the hulls from "stick-tight" nuts. Unless Persian walnuts are harvested, hulled, and dried as soon as mature, the kernels are likely to acquire a dark color which materially lowers the market value of the nuts. By the time the hulls of all the nuts are free from the shell considerable color deterioration has already developed. Early harvesting is therefore desirable but the experience of growers has been that a considerable percentage of early harvested walnuts can not be hulled, either by hand or machine. They are called "stick-tight" nuts. The chemists of the Bureau's fruit and vegetable chemistry laboratory in Los Angeles experimented with ethylene gas treatments, and found that such treatments loosened up the hulls on both mature and immature nuts and facilitated their removal. Now it will be necessary to work out some simple but sure index of maturity that can be used while the walnuts are still on the tree. The cost of the treatment is estimated to be only from 6 to 8 cents per ton of nuts. The California Walnut Growers Association believes that general use of the ethylene gas treatment will eliminate most of the losses due to excessive percentage of amber kernels lowering the grade and price of walnuts. During the past seven years these losses have averaged about $375,000 annually.

I shall have to close this report today, but I hope soon to return with more facts revealed by recent chemical and soils research.