The reported minimum cost was \$500,000 for a pesticide chemical that apparently encountered no serious roadblocks on its way to certification of usefulness by USDA, and the establishment of official tolerances by FDA under Public Law 518 (Miller Amendment). Another compound, however, created for its owner a frustrating variety of obstacles to commercial registration, and its development cost rocketed to nearly \$3.75 million.

Ranges up to \$3.25 Million

Neither the lowest cost nor the highest is quite representative. The probable range confronting developers of new pesticide chemicals appears to be \$750,000 to \$3.25 million—but the trend is constantly upward.

The principal purpose of the study was not to pinpoint a range of costs; it was to establish a breakdown of cost into categories. The table on the facing page may serve as the pattern even though each pesticidal chemical creates its own family of cost factors.

One cooperator supplied ranges of costs for several proprietaries in five groups of categories. It has been practical to allocate into those categories the cost figures supplied by other cooperators. Further refinement into more categories would serve only to extend the principle of cost range.

Magnitude of Pesticide Development

The development of a modern pesticide is a project of such magnitude that it appears to be feasible only for an organization that includes specialists in many areas of scientific research, backed by large financial resources.



C. O. BARNARD, who "retired" in 1954, after more than 25 years with American Cyanamid, is now executive secretary of Western Agricultural Chemicals Association. He describes himself as

"just a country boy who started working at an early age and kept at it, doing my best without benefit of formal education." At Cyanamid, his jobs ranged from insecticide salesman to western sales manager of the insecticide department to chief of technical surveys. While with Cyanamid, he was especially interested in the fumigation of citrus (an interest that took him to Egypt for a year) and grains with calcium cyanide. He also worked on the fumigation of flour mills with hydrocyanic acid.



TECHNICAL SECTION

JULY 1958

Volume 6, Number 7

PESTICIDES

Potentiation in Pesticide Toxicity, In Vivo Effects of Paired Combinations of Five Organic Phosphate Insecticides	
M. W. Williams, H. N. Fuyat, J. P. Frawley, and O. G. Fitzhugh	514

- Insecticide Residues, Endrin Content of Body Tissues of Steers, Lambs, and Hogs Receiving Endrin in Their Daily Diet
 - L. C. Terriere, Ulo Kiigemagi, and D. C. England. 516
- Insecticide Residues, Endrin Content of Milk and Body Tissues of Dairy Cows Receiving Endrin Daily in Their Diet
- Insecticide Residues, Field Persistence Comparisons of Residues of the Insecticide, Diazinon, in Lemons and Valencia Oranges, and Effects on Juice Flavor
 - F. A. Gunther, W. H. Ewart, R. C. Blinn, H. S. Elmer, and G. B. Wacker 521

PLANT NUTRIENTS AND REGULATORS

Corrosion in Fertilizer Equipment, Corrosion of Metals by Liquid Mixed Fertilizers	
J. D. Hatfield, A. V. Slack, G. L. Crow, and H. B. Shaffer, Jr	524
Glass as a Boron Source, Effect of Composition and Reactivity of Boro- silicate Glass on Boron Status of Alfalfa	
E. R. Holden and W. L. Hill	531
Plant Estrogens, Isolation of a New Estrogen from Ladino Clover	
E. M. Bickoff, A. N. Booth, R. L. Lyman, A. L. Livingston, C. R. Thompson, and G. O. Kohler	536
Phosphorus Availability, Effect of Particle Size on Availability to Plants of Phosphorus in Phosphate Rock from Various Sources	
W. H. Armiger and Maurice Fried	539

FERMENTATION/FOOD PROCESSING

Feed Supplements Production, Microbiological Production of Beta-Carotene	
in Shaken Flasks	
R. F. Anderson, Margie Arnold, G. E. N. Nelson, and Alex Ciegler	543
Fruit Glycoside Hydrolysis, Enzymic Hydrolysis of Naringin in Grapefruit	

	•										•		•						-				•			
s. v	. Ting .	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	546

NUTRITION/FOOD PROCESSING

Vitamin .	A in	Eggs,	Seas	ional	Varic	ition	s in	the	Vitamin	AC	Content	of	Hens'	
Eggs														
				-										~

S. L. Bandemer, R. J. Evans, and J. A. Davidson 549