Historical Pesticide Purchases for a New Jersey Apple Orchard from 1931-1936 and 1943-1945, with Notes on Remnant "Legacy" Pesticide Concentrations in Soil

By David Moskowitz, Michael Levinson, and Evie McMenamin

DOI: http://dx.doi.org/10.14713/njs.v5i1.189

For more than a century (1905-1998) the Smith Farm in East Brunswick, New Jersey was well-known. At its peak it was the largest apple orchard in the state. The father and son proprietors, George and Lawrence Smith, were innovators, pioneering new and improved orchard management and apple growing techniques, and were dubbed "Apple Kings" and "Master Farmers" for their work. In 1998, the pesticide purchase records at the farm from 1931-1936 and 1943-1945 were serendipitously rescued from a dumpster. The receipts and other materials provide a historical glimpse of two time periods marked by rapid and significant changes in agricultural pesticides from largely naturally derived, to synthetic, a legacy of World War II chemical innovation. As cutting-edge orchardists, the Smith's employed and experimented with the most up to date pest control methods of their time and their pesticide purchases reflect that. However, many of the chemicals used at the farm remain in soils for long periods after application. Soil sampling in 1998 identified extensive contamination from these "legacy" pesticides, an issue plaguing orchards across the United States. In 1999, with the oversight of the New Jersey Department of Environmental Protection, the contaminated orchard soils were remediated as part of a process to develop the property for housing. The orchard is long gone now, and in its place there is a housing development known as Apple Ridge Estates (with streets named after apple varieties). The history of the pesticide purchases at the farm may provide an important lesson about how one generation's innovation may be seen as a subsequent generation's curse.

"*There's small choice in rotten apples*." -William Shakespeare

Introduction

The Smith Farm in East Brunswick, New Jersey was started in 1879 when George Smith purchased 60 acres for $1,500.00. In 1905 he planted the first apple trees and the farm would continue as an apple orchard from about that time through 1998.[1] In 2001, the site was converted into a housing development.

1940 (left) and 2018 (right) aerial photographs of the Smith Farm site showing the orchard on April 10, 1940 and the current Apple Ridge Estates housing development in 2018. 1940 photograph reprinted with permission of EcolSciences, Inc. 2018 photograph courtesy Google Earth.

At its height, the Smith Farm had 4,500 apple trees, producing 35,000 bushels of apples annually on approximately 60 acres, making it the largest apple orchard in New Jersey.[2] The size and success of the orchard earned praise for George Smith and his son Lawrence J. Smith, who was given the title of East Brunswick "Apple King" in the early 20th century.[3] The Smith's

[1] A. Alvarez, *The Smith Farm* (East Brunswick, New Jersey: East Brunswick Historical Society, undated).
[2] "East Brunswick's 'Apple King' Is Cited as Top Farmer and Citizen at Dinner in His Honor," *Daily Home News* (New Brunswick, New Jersey), November 9, 1951.
[3] K. Demasters, "On the Map; After 120 Years, the Last Apple Falls, and a Family Business With It," *New York Times,* November 8, 1998.

were well known in the New Jersey agricultural community as innovators and pioneers of new and improved apple-growing and orchard management techniques.[4] They were repeatedly recognized for these efforts. In 1930 Lawrence Smith was awarded a gold medal by the *Pennsylvania Farmer* magazine recognizing him as a master farmer in New Jersey[5] and in 1934, New Jersey Governor Morgan Larson named George and Lawrence Smith "Master Farmers."[2] Because of their pioneering innovations in apple production, the pesticides purchased for their farm are expected to have been state of the art providing a window into the historical development of insect pest control at New Jersey orchards.

When the orchard ceased operations in 1998, approximately 43 acres remained. On a somewhat ironic note, after the farm was developed for housing, the residential project was named Apple Ridge Estates and the streets were named after apple varieties including, Cortland Drive, Winesap Drive and Braeburn Place. In 1999, as the orchard office was being demolished, an opportunity arose to salvage and preserve some of the farm records that had been disposed of in a dumpster. These records included the extensive pesticide purchases for the farm from 1931-1936 and 1943-1945. It is believed that these records are complete and cover all purchases during the two periods. Although the purchases for the intervening years are unfortunately now lost to history, the two periods covering nine years, prior to, and at the end of World War II, provide an interesting and important glimpse into the battle by the Smiths to combat insect pests and the shift from naturally-derived organic and inorganic pesticides to synthetic organic pesticides. This shift was a result of a number of factors including war time chemical development and use, agricultural pest resistance, and issues related to food safety and worker

[4] Alvarez, *The Smith Farm*.
[5] "Lawrence J. Smith of South River, One of Leading Farmers in County, Has Made Science of Apple Growing. Pioneer Agriculturalist Led in Applying Modern Methods," *Sunday Times* (New Brunswick, New Jersey), April 7, 1940.

chemical exposure. Ultimately, the shift led toward the environmental impacts and awareness that would arise with Rachel Carson's seminal book *Silent Spring* in 1962, detailing the ecological crisis of synthetic pesticides.[6]

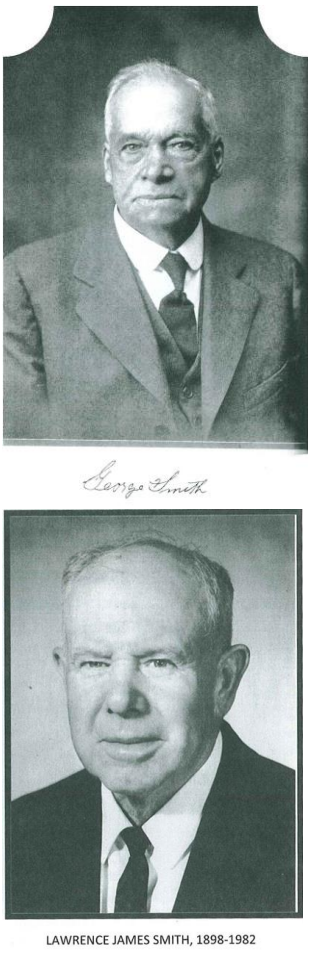
In 1998, prior to the development of the site for single-family homes, the orchard soils were sampled as part of a process to ensure the land met acceptable New Jersey Department of Environmental Protection (NJDEP) standards for residual pesticides.[7] Residual pesticides that remain in the soil from historic applications are an important issue throughout the United States, particularly as agricultural lands are developed for residential and other uses.[8] Many states, including New Jersey, have issued guidelines or created regulations to address remnant historic pesticides in soils.[9] Financial institutions and developers often conduct studies as part of environmental due diligence for real estate transactions involving current or historic farmlands and the Smith farm was no exception. This paper provides a review of the pesticide concentrations detected in the soils in 1998 and the efforts to remediate the contamination.

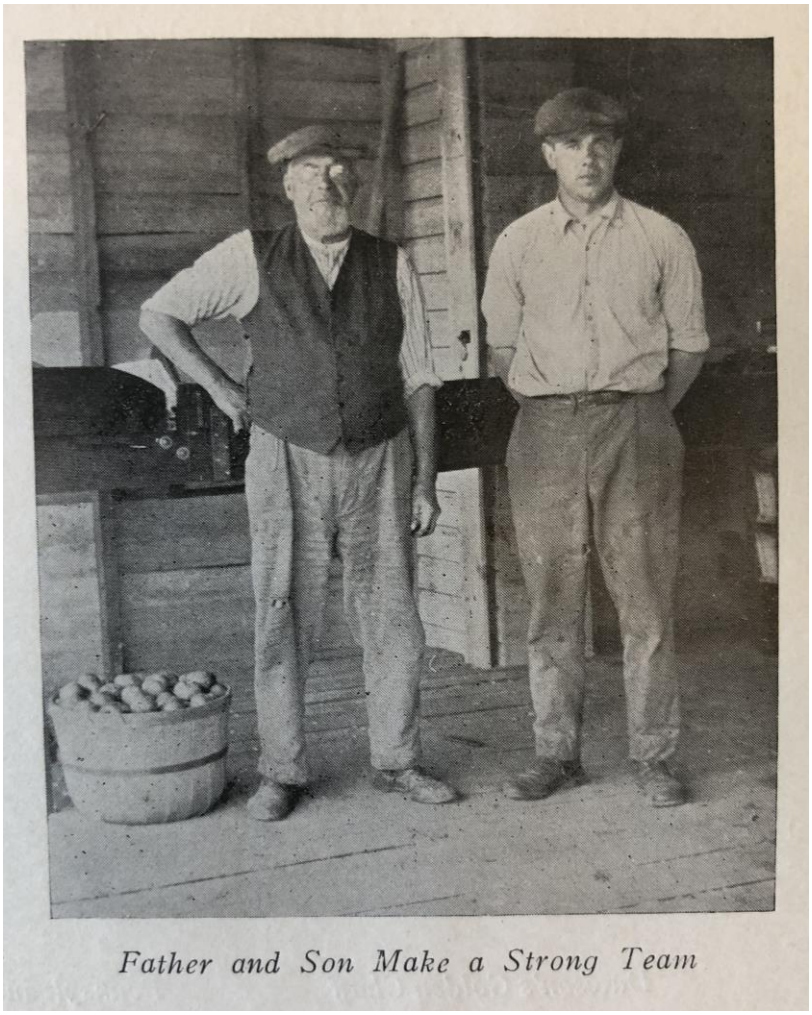
George and Lawrence J. Smith – The Orchardists

George Smith (1846-1940) and his son, Lawrence J. Smith (1898-1982) were well-known in the New Jersey agricultural community and were pioneers in apple growing and orchard management.

---

[6] J.C. Whorton, *Before Silent Spring. Pesticides and Public Health in Pre-DDT America* (Princeton, New Jersey: Princeton University Press, 1974).
[7] Melick-Tully and Associates, *P.C. Remedial Action Workplan submitted to NJDEP*, December 10, 1999.
[8] Y.M. Schooley, et al, "The History of Lead Arsenate Use in Apple Production: Comparison of its Impact in Virginia With Other States," *Journal of Pesticide Safety Education* 10 (2008).
[9] New Jersey Department of Environmental Protection, *Findings and Recommendations for the Remediation of Historic Pesticide Contamination*, March 1999.



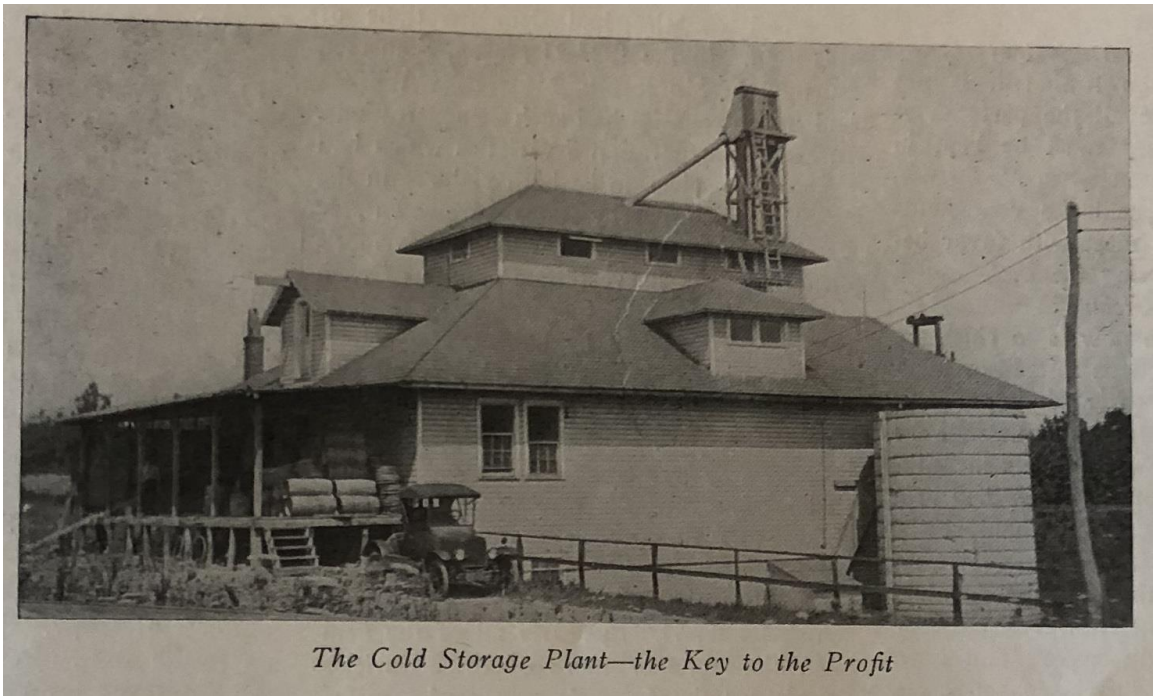


Left: photographs of George and Lawrence Smith. Reprinted courtesy of the East Brunswick Historical Society. Right: George (left) and Lawrence (right) Smith circa 1923, courtesy *NJ Agriculture*.[10]

In 1905, George Smith planted the first 45 acres of the Smith Farm with apples trees and with peach trees as fillers. The orchard would eventually grow to 60 acres by 1940. George Smith was apparently a master orchardist and as his orchard flourished, he produced more fruit that he could sell, losing a large portion of the crop to spoilage. In 1911, he decided to build a cold storage building that would use ice to keep the fruit cold until it could be sold. The building

[10]"Short Course Helped This Man to Farm, Lawrence J. Smith Makes Money With Apples," *New Jersey Agriculture* V, no. 9 (1923): 5.

was completed in 1912 and was the first fruit cold storage building in New Jersey and one of only a few in the United States. The cold storage greatly extended the life of the fruit, allowing for sales at higher prices in the winter when fresh fruit was scarce. Soon after it was constructed, the cold storage building was used as an educational tool by the nearby State Agricultural College. The college had a 100-acre experimental farm in New Brunswick that ultimately would become the present-day George H. Cook campus and students attending the school would visit the Smith Farm cold storage building.[11]



The Smith Farm Cold Storage Building circa 1923, courtesy *NJ Agriculture*.[12]

In 1919, Lawrence Smith was twenty-one and was encouraged by his father to enroll in the State Agricultural College fruit course.[13] He attended the course between 1919 and 1920.[14]

[11] Alvarez, *The Smith Farm*.
[12] "Short Course Helped This Man to Farm, Lawrence J. Smith Makes Money With Apples."
[13] Alvarez, *The Smith Farm*.

Among the farm records salvaged from the dumpster was his test notebook from the course dated January 19, 1920. The handwritten entries found on pages three and four of the notebook are the definitions of an insecticide, a list of ten insecticides, the way they work, and the target insects they killed. Lawrence Smith scored a 98 out of 100 on the test in what may been the genesis of his innovative use of pesticides at the orchard. Lawrence Smith noted the importance of the short course for insect and disease control and pesticide spraying in 1923:

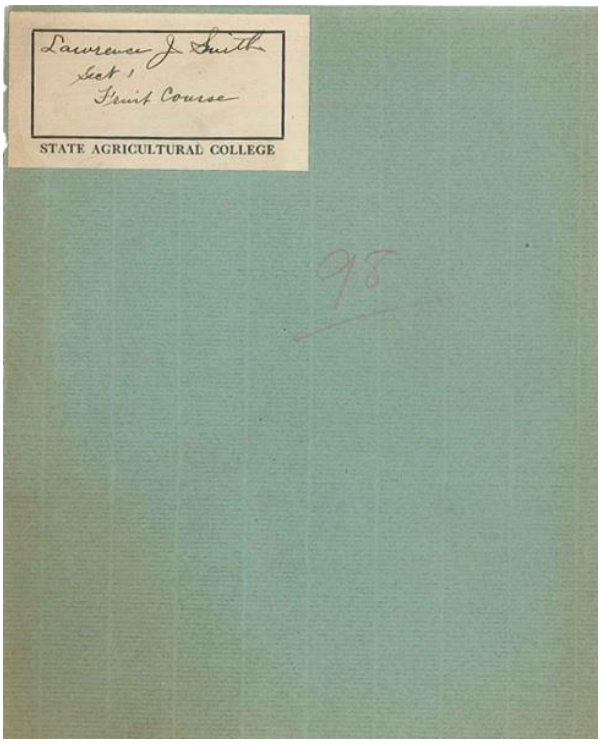
> The Short Courses have given me training of inestimable value in farm management, insect and disease control, and spraying and pruning. Furthermore, through the contacts I have maintained with my Instructors since leaving school I am keeping our methods right up-to-date.[15]

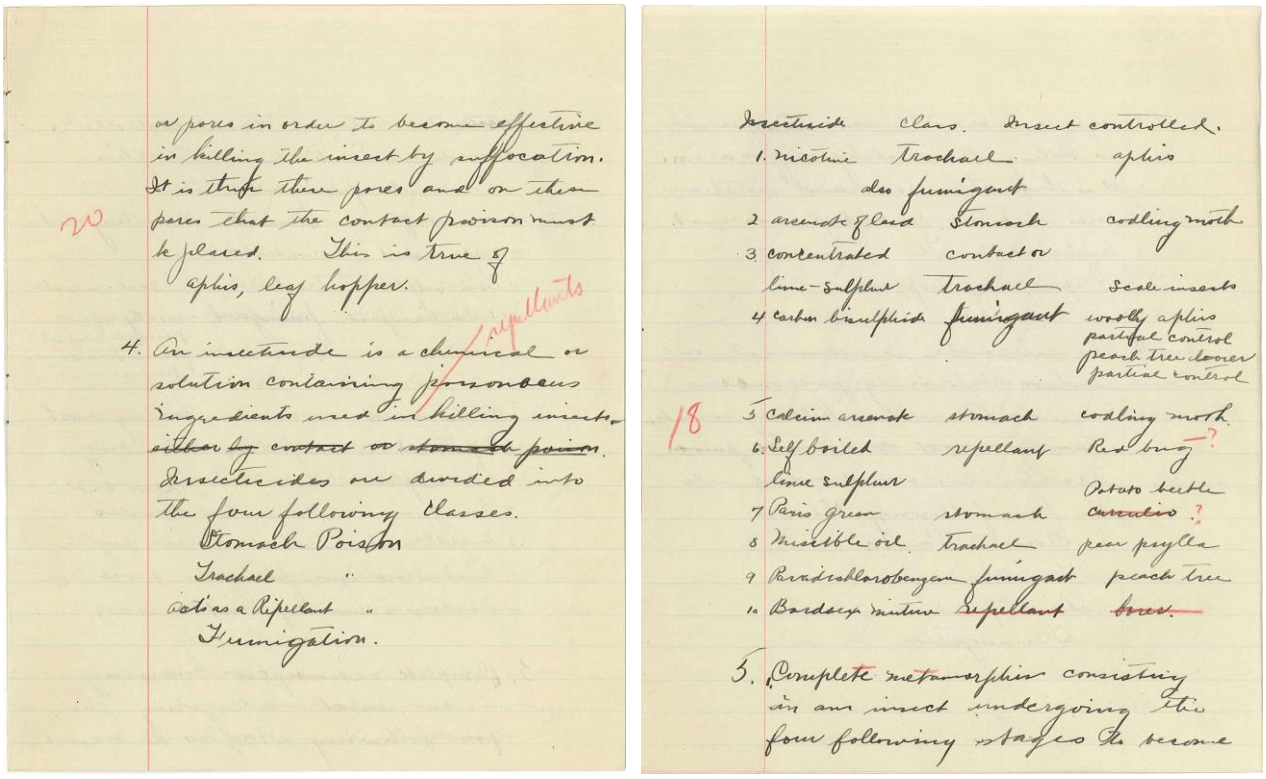
Lawrence Smith would become a pillar of the New Jersey agricultural community, honored by the A.B. Agricultural Society at Rutgers in 1940, the Rutgers Agricultural College in 1950, and the New Jersey State Board of Agriculture in 1970. His influence on agriculture in New Jersey cannot be overstated. He served as President of the following organizations and Boards: Middlesex County Board of Agriculture, State Horticultural Societies, Hightstown National Farm Association, Farmers' Cooperative Association of New Jersey, and the Rutgers College of Agriculture and Environmental Societies. Given this involvement in many aspects of the New Jersey agricultural community, and his recognition as an innovator in apple production and orchard management, it is not surprising that the Smith Farm was at the forefront of insect and other pest control practices utilizing the latest state of the art pesticides and methods available.

---

[14] "Lawrence J. Smith of South River, One of Leading Farmers in County, Has Made Science of Apple Growing. Pioneer Agriculturalist Led in Applying Modern Methods," *Sunday Times* (New Brunswick, New Jersey), April 7, 1940.

[15] Lawrence Smith, *The Daily Home News* (New Brunswick, New Jersey), September 29, 1923.





or pores in order to become effective in killing the insect by suffocation. It is through these pores and on these pores that the contact poison must be placed. This is true of aphis, leaf hopper.

20

4. An insecticide is a chemical or solution containing poisonous ingredients used in killing insects. ~~either by contact or stomach poison~~. Insecticides are divided into the four following classes.
Stomach Poison
Tracheal "
acts as a Repellant "
Fumigation.

Insecticide class. Insect controlled.
1. nicotine tracheal aphis
also fumigant
2 arsenate of lead stomach codling moth
3 concentrated contact or
lime-sulphur tracheal Scale insects
4 carbon bisulphide fumigant woolly aphis partial control peach tree borer partial control

18

5 Calcium arsenate stomach codling moth
6 Self boiled repellant Red bug —?
lime sulphur
Potato beetle
7 Paris green stomach ~~Curculio~~ ?
8 Miscible oil tracheal pear psylla
9 Paradichlorobenzene fumigant peach tree
10 Bordeaux mixture ~~Repellant~~ ~~bores~~.

3. Complete metamorphis consisting in an insect undergoing the four following stages to become

Lawrence Smith test notebook from the State Agricultural College short course, dated January 19, 1920. Private collection of D. Moskowitz.

Historic Pesticide Purchases

The history of pesticide use on apple orchards is well documented and reflects a continual battle against insects and diseases that damage the fruit or prevents the fruit from developing. The Smith Farm records illustrate this well. Purchases for the orchard reflect an initial use of large quantities of naturally derived pesticides and then a gradual shift to synthetic pesticides including DDT (see Table 1 below).

Pecticide	1931	1932	1933	1934	1935	1936	1943	1944	1945
Lead arsenate	9,024 lb.	8,064 lb	3,034 lb	8,016 lb	3,150 lb	2,016 lb		3,840 lb	2,016 lb
Flotation sulphur	2,000 lb		4,020 lb			1,020 lb			
C.P.O. solid	1,346lb.	1,504 lb						470 lb	448 lb
Scale Oil	654 gal.								
Black leaf 50		168 lb							
Ortho k Medium Oil		162 gal.							
Magnesium arsenate		80 lb		48 lb					
Liquid lime sulphur		1,500 gal.		750 gal	600 gal				
Sulfrox wettable sulphur			100 lb						
Koppers wettable sulfur								16,000 lb	
Calrox			480 lb						
Dormoil			324 gal						
Nicotine sulphate 40			120 lb	200 lb					
Anhydrous Ammonia				106 lb			105 lb		210 lb
Kleen-O-Cil				324 gal		972 gal			
Bowkers Flowable Oil Emulsion				108 gal					
High-Calcium Chemical Spraying Lime				9,000 lb					
Koppers Flotation Sulphur				3,000 lb					
Fluxit				100 lb					
Coposil				240 lb					
Kolofog				60 lb	60 lb			720 lb	960 lb
Miscible Oil				216 gal	270 gal				
Ortho K Summer Oil				270 gal	270 gal				
Borax					50 lb			100 lb	
White Satin Powdered soap					100 lb				
Kleen-O-Oil					1,188 gal				
Sulfrox Dusting Sulphur						2,000 lb			
Kleenup Ready Mix						108 gal			
Ground Lime Stone						80,000 lb			
Apple coposil							720 lb	1,344 lb	
Othol K Emulsion (229)							107 gal	972 gal	
Othol K Ready Mix (230)							108 gal	162 gal	
Black leaf 40							100 lb	210 lb	
Black leaf 155							480 lb	960 lb	
Muriatic acid							230 lb	512 lb	
Fruitone							48 lb		
Parmone concentrate							3 gal		
Niagara Stick							96 lb		
Ortho Dry Spreader							50 lb		
Parmone dust							4000 lb		4,000 lb
Elgetol								120 gal	
Colgate white flakes								220 lb	
Kleenup Soluble								648 gal	
Kleenup Emulsion								594 gal	
Orthol D Soluble								108 gal	
Ammonia Oil								30 gal	
Liquid Orthex								378 gal	
SW Lead								2,016 lb	
Cyanamid									2,000 lb
Flake zinc sulfate									200 lb
Flotation sulphur paste									1,000 lb
DDT									2 pt
Kolodust									1,000 lb
Krenite									30 gal
Fermate									150 lb

Table 1. Smith Farm Pesticide Purchases from Receipts 1931-1936 and 1943-1945.

Illustrating the early recognition of this issue is a 1915 quote in *Insect Pests of Farm, Garden and Orchard*:

> Ever since the locust plagues in the time of the Pharaohs history is replete with accounts of insect scourges and the enormous losses they have caused agriculturalists of all ages. However, instead of diminishing with the advancement of agricultural methods, injurious insects have undoubtably become both more numerous and more destructive in modern times.[16]

The extent of the problem and the vast costs of insect damage just after the turn of the 20th century was described by C. L. Marlatt, Assistant Chief of the Bureau of Entomology, US Department of Agriculture in the *1904 Yearbook US Department of Agriculture*.

> Very careful estimates, based on crop reports and actual insect damage over a series of years, show the loss due to insect pests of farm products, including fruits and livestock, now reaches an almost inconceivable total of $1,000,000,000, annually. [17]

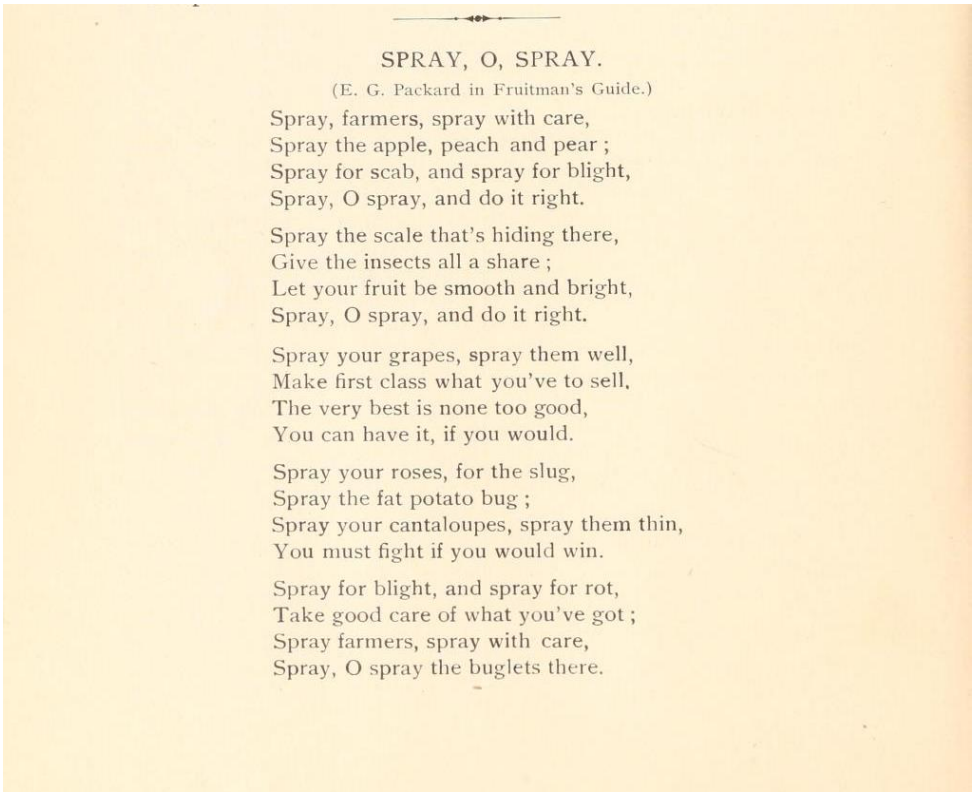
In *Insect Pests of Farm, Garden and Orchard*, published a decade later, E. D. Sanderson, commenting on Marlatt's assessment, continued:

> The above quotations by Mr. C. L. Marlatt, Assistant Chief of the Bureau of Entomology, US Department of Agriculture, may appear to the reader either ludicrous or startling, according to whether he be more or less informed concerning the important role which insects play in our agricultural community, which in turn forms the warp of American prosperity. [18]

In 1906, E. G. Packard's poem "Spray, O, Spray" was published in *Entomological News*, a leading entomological journal, and perhaps lightly demonstrates the importance of insecticide spraying and the way it was viewed by the entomological community of the time.

---

[16] E.D. Sanderson, *Insect Pests of Farm, Garden and Orchard* (London: John Wiley & Sons, 1915).
[17] US Department of Agriculture, *1904 Yearbook* (Washington, DC: US Department of Agriculture, 1904).
[18] Sanderson, *Insect Pests of Farm, Garden and Orchard.*



SPRAY, O, SPRAY.

(E. G. Packard in Fruitman's Guide.)

Spray, farmers, spray with care,
Spray the apple, peach and pear ;
Spray for scab, and spray for blight,
Spray, O spray, and do it right.

Spray the scale that's hiding there,
Give the insects all a share ;
Let your fruit be smooth and bright,
Spray, O spray, and do it right.

Spray your grapes, spray them well,
Make first class what you've to sell,
The very best is none too good,
You can have it, if you would.

Spray your roses, for the slug,
Spray the fat potato bug ;
Spray your cantaloupes, spray them thin,
You must fight if you would win.

Spray for blight, and spray for rot,
Take good care of what you've got ;
Spray farmers, spray with care,
Spray, O spray the buglets there.

"Spray, O, Spray" poem from the 1906 *Entomological News.* [19]

The insect problem, addressed with ever increasing spray rates, was compounded by resistance to pesticides complicating their use and resulting in the need to find ever more powerful and effective compounds and application methods. Insect resistance to the naturally derived compounds resulted in continuously higher application rates and a concomitant concern for pesticide residues on the fruit, human consumption safety, damage to the trees and fruit, and the need to find more effective pest controls.

From the late 1800s until the mid-1920s, the pesticide of choice, used for a wide variety of insect pests were largely arsenical based compounds mixed with lead.[20] As

[19] E.G. Packard, "Spray, O, Spray," *Entomological News* 17 no. 7 (1906).
[20] J.C. Whorton, *Before Silent Spring. Pesticides and Public Health in Pre-DDT America* (Princeton, New Jersey: Princeton University Press, 1974).

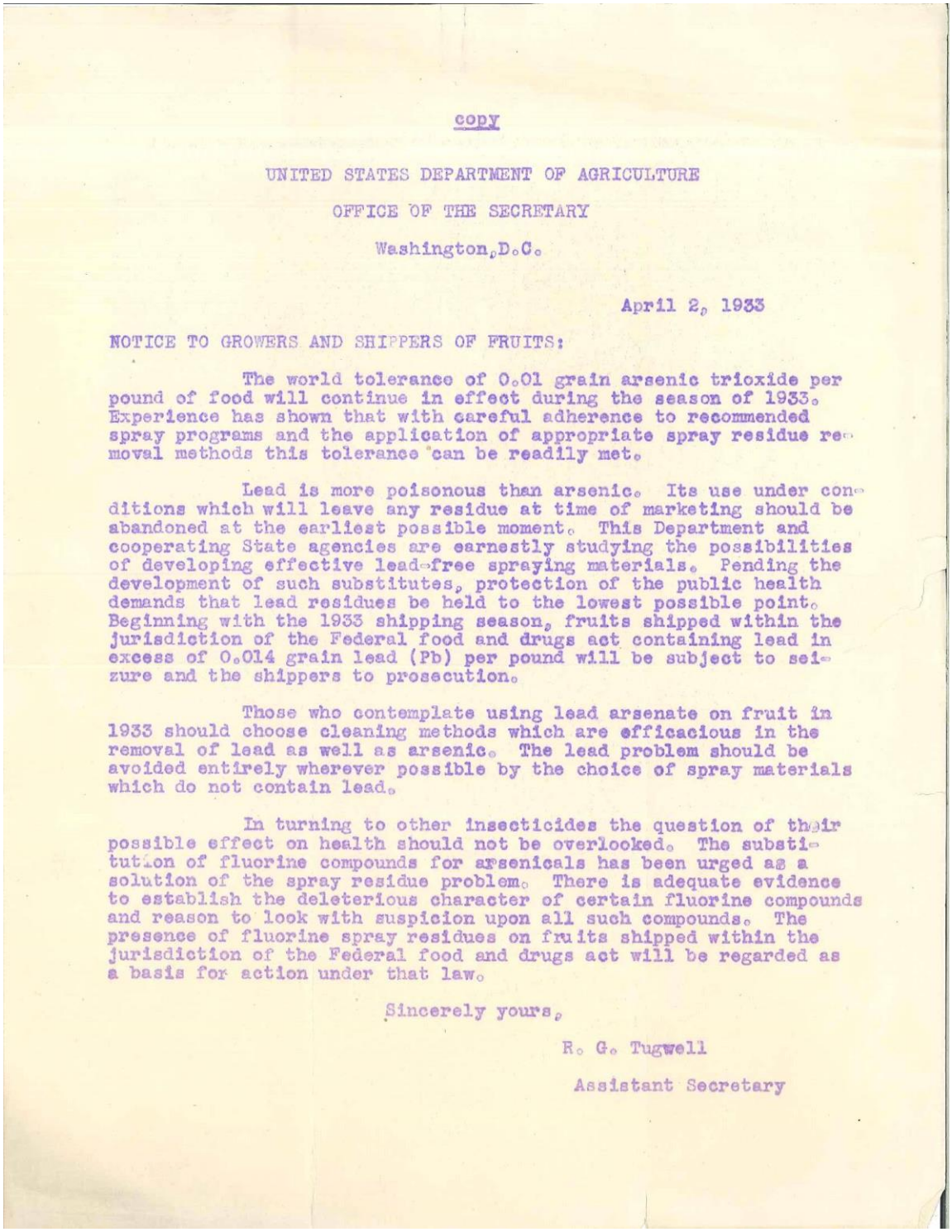
insects became resistant to these pesticides, more frequent and heavier spraying was employed. By 1925 lead residues on apples in New Jersey and elsewhere resulting from heavier lead arsenate applications were beginning to come into focus. The problem became critical to New Jersey orchardists in 1925 when:

> Several New Jersey fruit growers experienced their first serious difficulty with spray residue in the harvest of their 1925 crop of apples as a result of the enforcement of a temporary embargo by the US Department of Agriculture following the announcement by Government health officials of the failure of the fruit in storage to comply with pure food requirements. Distribution of the harvested crop was prohibited pending the reduction of spray residues.[21]

In 1933, due to growing concerns about human lead exposure from residues on apples, the Federal Food and Drug Administration set a desirable zero tolerance limit on pesticides containing lead and allowable lead residues on fruit. Among the records salvaged from the Smith Farm was a letter dated April 6, 1933 from Harry McLean, Chief Spray Residue Investigations, containing a memo stating:

> This Department and cooperating State agencies are earnestly studying the possibilities of developing effective lead-free spraying, materials. Pending the development of such substitutes, protection of the public health demands that lead residues be held to the lowest possible point. Beginning with the 1933 shipping season, fruits shipped within the jurisdiction of the Federal food and drugs act containing lead in excess of 0.014 grain lead (Pb) per pound will be subject to seizure and the shippers to prosecution.

[21] H. McLean and A. Weber, *Modern Methods of Removing Spray Residues from Apples and Pears*: *Agricultural Experiment Station Extension Bulletin 87* (New Jersey State College of Agriculture, 1931).



copy

UNITED STATES DEPARTMENT OF AGRICULTURE

OFFICE OF THE SECRETARY

Washington, D. C.

April 2, 1933

NOTICE TO GROWERS AND SHIPPERS OF FRUITS:

The world tolerance of 0.01 grain arsenic trioxide per pound of food will continue in effect during the season of 1933. Experience has shown that with careful adherence to recommended spray programs and the application of appropriate spray residue removal methods this tolerance can be readily met.

Lead is more poisonous than arsenic. Its use under conditions which will leave any residue at time of marketing should be abandoned at the earliest possible moment. This Department and cooperating State agencies are earnestly studying the possibilities of developing effective lead-free spraying materials. Pending the development of such substitutes, protection of the public health demands that lead residues be held to the lowest possible point. Beginning with the 1933 shipping season, fruits shipped within the jurisdiction of the Federal food and drugs act containing lead in excess of 0.014 grain lead (Pb) per pound will be subject to seizure and the shippers to prosecution.

Those who contemplate using lead arsenate on fruit in 1933 should choose cleaning methods which are efficacious in the removal of lead as well as arsenic. The lead problem should be avoided entirely wherever possible by the choice of spray materials which do not contain lead.

In turning to other insecticides the question of their possible effect on health should not be overlooked. The substitution of fluorine compounds for arsenicals has been urged as a solution of the spray residue problem. There is adequate evidence to establish the deleterious character of certain fluorine compounds and reason to look with suspicion upon all such compounds. The presence of fluorine spray residues on fruits shipped within the jurisdiction of the Federal food and drugs act will be regarded as a basis for action under that law.

Sincerely yours,

R. G. Tugwell

Assistant Secretary

Letter dated April 6, 1933 from Harry McLean, Chief Spray Residue Investigations regarding lead standards on fruit. Private collection of D. Moskowitz.

In 1937, in order to give farmers guidance on preventing residues on fruit, the New Jersey Agricultural Experiment Station "*Spraying Recommendations for Apples*" began including a table for the "Latest Dates on Which A Lead Arsenate Spray May Be Used Without Danger of Leaving an Excessive Lead or Arsenic Residue on the Fruit at Harvest."[22] Pesticide residues on the apples and regulatory efforts to control them resulted in the need to find alternative pesticides and methods to clean the fruit. This in turn, drove agricultural chemical innovation and research. The pesticide purchases at the Smith Farm reflect this during the two periods when receipts are available.

LATEST DATES ON WHICH A LEAD ARSENATE SPRAY MAY BE USED ON APPLES WITHOUT DANGER OF LEAVING AN EXCESSIVE LEAD OR ARSENIC RESIDUE ON THE FRUIT AT HARVEST

Harvest Period	Quantity of spray per 25′ by 25′ tree	
	8 gallons	15 gallons
July 5 to 17	May 27	May 27
July 17 to August 17	June 5	June 5
August 17 to September 7	June 20	June 10
September 7 to 21	June 25	June 15
September 21 and later	July 7	June 25

The first late date spraying table from 1937 for lead arsenate in New Jersey orchards.[23]

Pesticide and Agricultural Chemical Purchases: 1931-1936

The pesticides utilized at the Smith Farm during this period were naturally derived and primarily a continuation of those used at orchards since the late nineteenth

[22] *Spraying Recommendations for Apples*: *Bulletin Number 188* (New Jersey Agricultural Extension Service, 1937).
[23] Ibid.

century.[24] These pesticides were mineral or plant based and mined or harvested. Despite being natural, many issues were emerging from the use of these pesticides including insect resistance, fruit and tree damage, worker health and food safety. Pesticide purchases during this period included large quantities of arsenical-based compounds including Lead, Magnesium and Calcium arsenic, Sulphur and lime-based compounds, copper compounds, insecticidal soaps made from plant and animal oils (C.P.O.), petroleum oils and nicotine-based formulations.

C.P.O. What it is How it does it cuts spray cost 2/3

What It Is

C. P. O. is a soap spreader for use with contact insecticides for control of many forms of Aphids (plant lice) and other soft-bodied sucking insects. This soap is sold as the result of the successful research supported by the manufacturers of Black Leaf 40, at the New Jersey Agricultural Experiment Station. These experiments were conducted to determine which soaps, if any, would permit a reduced charge of nicotine.

C. P. O., at first, was only sold as an activator of nicotine. It is now being widely recommended and used as a necessary spreader for Pyrethrum sprays and many other poisons. C. P. O. is not a preventive, but is indeed a very inexpensive relief from damage by these insect pests. REMEMBER, C. P. O. is approved not only by leading entomologists and experiment stations, but is also endorsed by many of the largest fruit growers and nurserymen in the country. These testimonials are in our files and copies of these letters are yours for the asking.

Whether you grow FRUIT, VEGETABLES, FLOWERING PLANTS or NURSERY STOCK, you have use for C. P. O. No plant life is immune from Aphis or plant lice, Leaf Hopper, Red Spider and other such insects. And, when they attack, the damage resulting is costly.

PRICE LIST

C. P. O. (Solid) (60% Soap) 40% Water

is packed as follows:

Barrels, 450 lbs. $45.00
½ Barrels, 250 lbs. .. 27.50
Kegs, 100 lbs. 12.00

C. P. O. (Liquid) (40% Soap) 60% Water

is packed as follows:

Drums, 55 Gallon .. $44.00
Drums, 30 Gallon ... 27.00
Drums, 10 Gallon ... 10.00
(Containers Included)

All Prices F.O.B. Philadelphia, Pa.

New Way
½ Pt. Nicotine (50%)
6 Lbs. C. P. O.
100 Gal. Water
Cost 1.1c Gal.

Old Way
1½ Pts. Nicotine (50%)
6 Lbs. Ordinary Soap
100 Gal. Water
Cost Over 6c Gal.

What It Does

In many instances, the effectiveness of nicotine has been increased 350% with the use of C. P. O.

6 pounds C. P. O. (Solid)
¾ pint Nicotine 50%
100 gallons water

will give satisfactory control of Rosy and Green Aphis of the apple, whereas the ordinary recommendations in New Jersey formerly required one and one half (1½) pints nicotine 50%, 6 pounds Whale Oil Soap and 100 gallons of water. Thus, the cost of spraying for the commercial grower has been reduced from three (3) cents a gallon to approximately one (1) cent a gallon.

C. P. O. has been so successful from an economic, practical and commercial standpoint that substitutes are now being offered, under other trade names. This, to us, is the best endorsement for C. P. O. that any grower may expect.

When you buy C. P. O., you are assured of receiving the original soap, made only by us.

Whether you use Nicotine, Pyrethrum or Derris Compound, you cannot afford to be without C. P. O.—first, to *obtain a better spread and penetration* of these poisons and—secondly, to *permit you to use less of them*, thus *reducing your spraying costs.*

You cannot expect satisfaction when you use ordinary whale oil or laundry soaps, for the reason they are used without regard for their soap value or water content, and also because many soaps were *never intended* for use in spraying. C. P. O. is carefully compounded so that the finished spray contains a *definite* amount of actual soap. Because of this, satisfactory results have been obtained under the most unusual conditions.

Many readers have had the unpleasant task of chipping and boiling common laundry soap only to find that the solution would jell or thicken on cooling, consequently, resulting in clogging their spraying apparatus. This condition occurs, particularly, when too much soap is used. C. P. O. overcomes all these objections, because it does its best work under normal spraying temperatures.

How It Works

As C. P. O. is a true cold water soap, its functions can easily be understood. It reduces the surface tension of the waxy surface of the leaves, thus preventing the spray solution from rolling off in little drops or balls. It also reduces the tension between the spray solution and the insect's body.

The effectiveness of contact insecticides in killing Aphis, Red Spider, Leaf Hopper, Crawling Young Scale and many other sucking insects is primarily dependent on direct contact (wetting). A secondary advantage is the "gassing" effects of the penetrating nicotine fumes set free in the spray solution. C. P. O. increases this two-fold action and helps definitely towards securing the highest degree of efficiency.

Description of C.P.O.

It is supplied in two forms — SOLID — containing 60% soap and — LIQUID — containing 40% soap. The SOLID is of putty-like consistency, contains *no objectionable odor*, in fact, may be called *odorless*. It *dissolves readily* in cold water on standing a few hours. For this reason, the large commercial grower does not pay freight on excess water, nor is there any muss or fuss in dissolving the soap. *No heat is necessary.* C. P. O. SOLID is packed in 450-pound barrels, 225-pound half barrels and 100-pound kegs.

C. P. O. LIQUID is a very convenient soap for the smaller user. It is *easily poured* and *does not thicken* or gum above freezing temperature. C. P. O. LIQUID is packed in 55-gallon drums, 30-gallon drums and 10-gallon drums.

Uses

C. P. O. may be used with most contact insecticides compatible with soap, but NOT with arsenical compounds.

C. P. O., when combined with nicotine, may be used against many forms of soft-bodied sucking insects on Apple, Pear, Melon, Grape and many other fruits. ALSO, on VEGETABLES, FLOWERING PLANTS, EVERGREENS, BOXWOOD and many other shrubs and vines.

Some of the insects controlled are: APHIS, LEAF HOPPER, THRIP, BEETLE (young), CRAWLING YOUNG SCALE, CHINCH BUG, LEAF MINER (certain forms), PINE NEEDLE SCALE, SPRUCE GALL APHIS and many other insects.

You know, by experience, when and where soaps should be applied. If, in the past, you have had only partial success, we urge you to order a supply of C. P. O. today. Write to obtain valuable information regarding the health of your crops. We have a broad and varied knowledge of technical soaps and our advice and assistance in adopting C. P. O. to your needs is free.

Your State Experiment Station knows about C. P. O.

Reasons Why You Should Use C.P.O. In Your Contact Insecticides

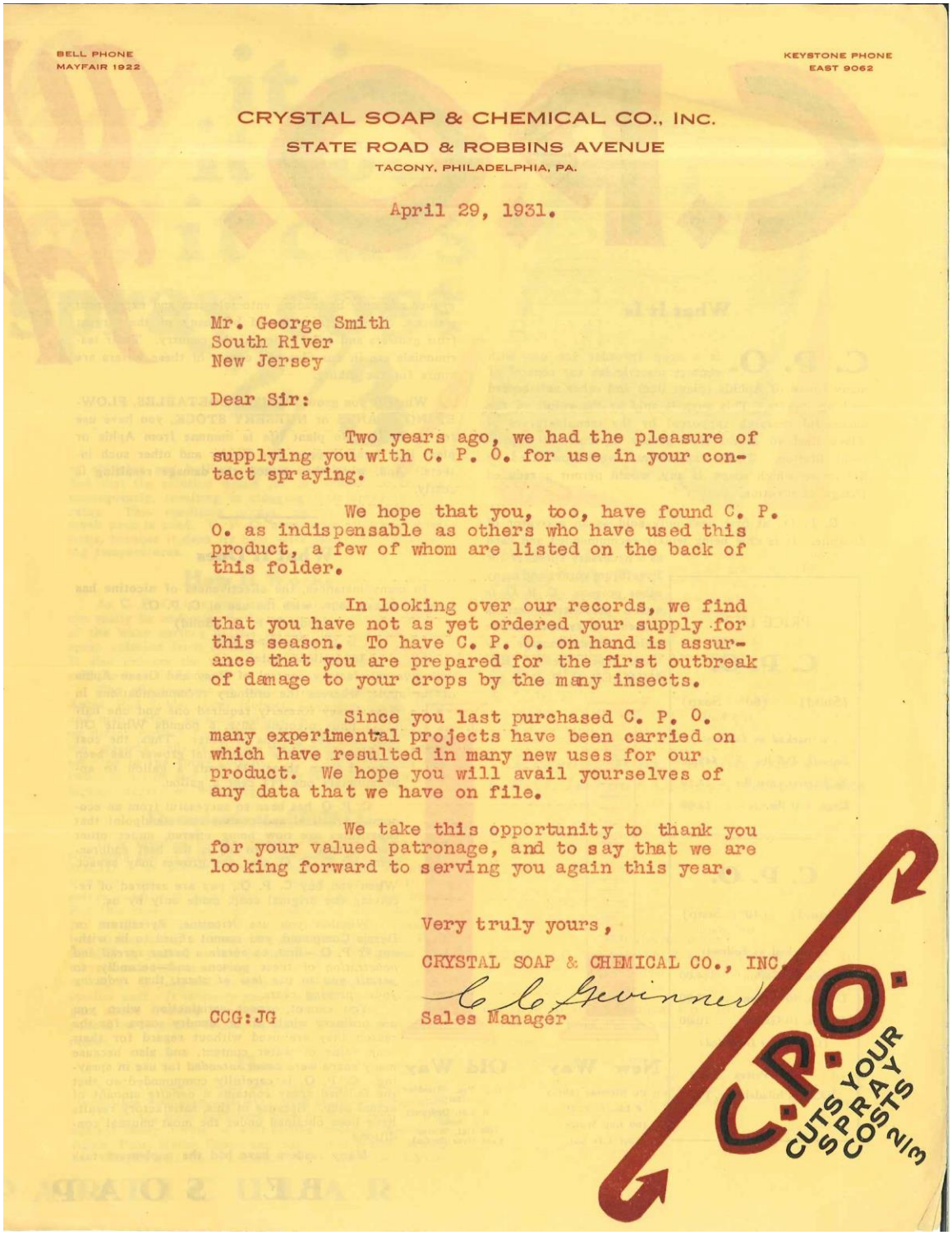
It is convenient to use, dissolving in cold water, without the aid of heat.
It has, in many instances, increased the efficiency of nicotine 350%
It does not contain any rosin.
It does not clog pumps or spray nozzles.
It gives better control of many forms of plant lice and soft-bodied sucking insects.
It costs very little.

Manufactured only by
CRYSTAL SOAP AND CHEMICAL CO., Inc.
6300 STATE ROAD, PHILADELPHIA, PENNSYLVANIA

Crystal Soap and Chemical Co., Inc.
6300 State Road, Philadelphia, Pa.
Dear Sirs:
Enclosed is my check for $.....
C. P. O. Liquid { 55 gal. Drum ☐ 30 gal. Drum ☐ 10 gal. Drum ☐ } Solid { Barrel ☐ ½ Barrel ☐ Keg ☐ }
Name.....
Mail Address.....

BE SOAP PARTICULAR

[24] A. Wilson, *Insects and Their Control* (New Brunswick, New Jersey: Thatcher-Anderson Co., 1929).



BELL PHONE
MAYFAIR 1922

KEYSTONE PHONE
EAST 9062

CRYSTAL SOAP & CHEMICAL CO., INC.
STATE ROAD & ROBBINS AVENUE
TACONY, PHILADELPHIA, PA.

April 29, 1931.

Mr. George Smith
South River
New Jersey

Dear Sir:

Two years ago, we had the pleasure of supplying you with C. P. O. for use in your contact spraying.

We hope that you, too, have found C. P. O. as indispensable as others who have used this product, a few of whom are listed on the back of this folder.

In looking over our records, we find that you have not as yet ordered your supply for this season. To have C. P. O. on hand is assurance that you are prepared for the first outbreak of damage to your crops by the many insects.

Since you last purchased C. P. O. many experimental projects have been carried on which have resulted in many new uses for our product. We hope you will avail yourselves of any data that we have on file.

We take this opportunity to thank you for your valued patronage, and to say that we are looking forward to serving you again this year.

Very truly yours,

CRYSTAL SOAP & CHEMICAL CO., INC.

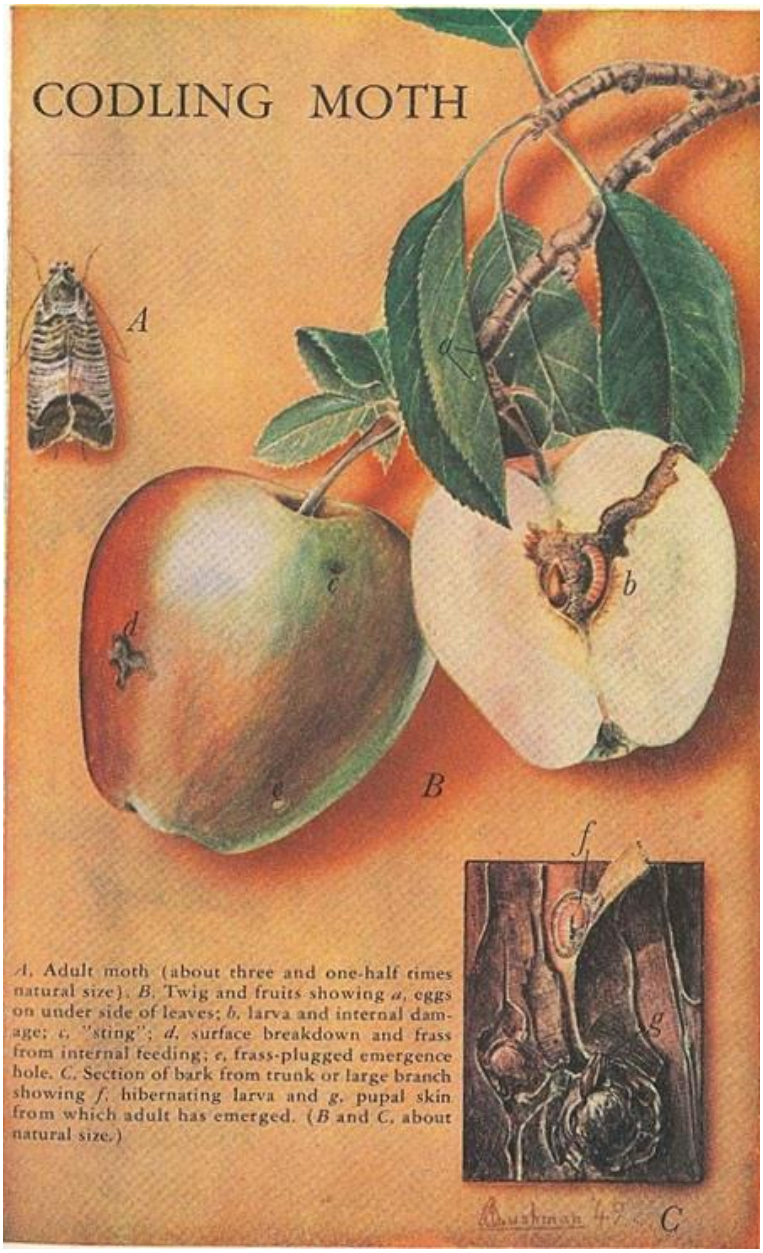
C C Gevinner

CCG:JG

Sales Manager

C.P.O.
CUTS YOUR SPRAY COSTS 2/3

1931 C.P.O. insecticidal soap spreader advertising materials found in the Smith Farm records. Private collection of D. Moskowitz.



The life history of the codling moth.[1]

Insect resistance to these formulations led to the need to continually increase the amount and rate of applications and the mixing of various chemicals to increase efficiency[25]. Lead arsenate provides perhaps the clearest example of this. Lead arsenate was first introduced in 1892 to control the non-agricultural gypsy moth and then in 1898 it was tested on apple orchards to control the codling moth, a serious pest of apples.

The codling moth was so damaging to apples and so widespread that without treatment between 20 and 95 percent of the crop in every orchard was estimated to be impacted. Lead arsenate was initially highly effective against the codling moth and as early as 1904, the United States Department of Agriculture was reporting that nearly

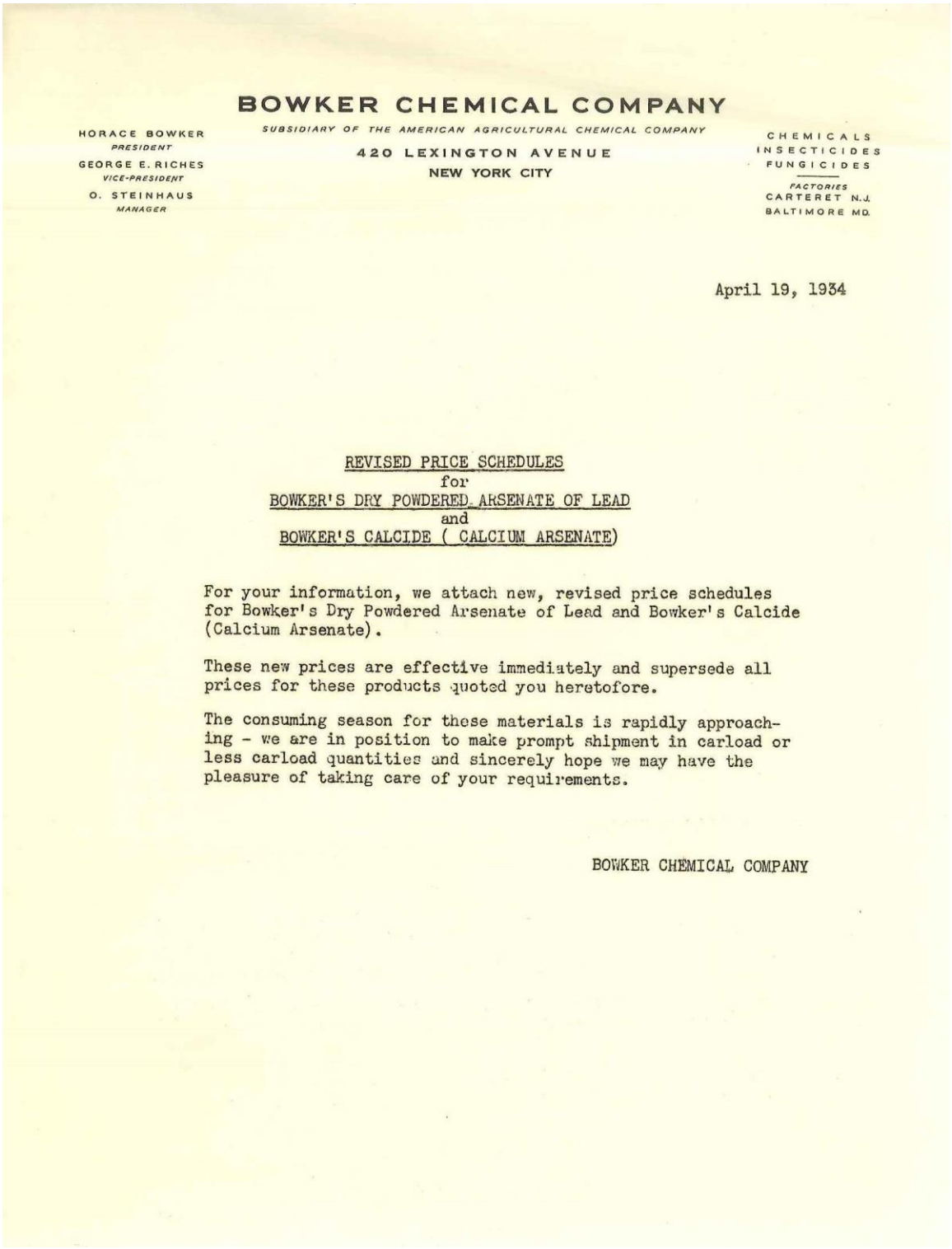
[25] M.B. Waite, et al, *Diseases and Pests of Fruits and Vegetables* (United States Department of Agriculture, 1925).

every commercial apple orchard was being treated with it. However, codling moth resistance developed quickly, and recommended spraying increased from one application in the first decade of the twentieth century, to two by the middle of the second decade and to four by the third decade.[26] Despite continued increases in the strength and frequency of lead arsenate applications, apple losses due to the codling moth also increased, and by 1944, apple growers across the United States were concerned it would lead to the collapse of the industry.

In New Jersey, lead arsenate was recommended continuously by the New Jersey Agricultural Experiment Station (NJAES) for the routine spraying of apples throughout the growing season from 1917 through 1964 and in every year covered by the Smith Farm receipts.[27] Application recommendations ranged from 2 to 4 pounds of lead arsenate mixed in 100 gallons of water and sprayed three or more times in the growing season. For a large orchard like the Smith's this required large quantities of lead arsenate, which is reflected in their purchases. During this six-year period, the farm receipts show 27,352 pounds of lead arsenate was purchased. Other arsenical compounds were also purchased during this period, including 128 pounds of magnesium arsenate and 480 pounds of calcium arsenate. The use of non-lead arsenicals including magnesium and calcium directly resulted from concerns with lead residues on harvested fruit and human health.[28] Based on estimates by Murphy and Aucott,[29] recommended spray rates for New

[26] L. Gianessi and M. Phillips, *Pesticide Use in US Apple Orchards: A Short History* (National Center for Food and Agricultural Policy Discussion Paper PS-94-2, 1994).
[27] E.A. Murphy and M. Aucott, "An Assessment of the Amounts of Arsenical Pesticides Used Historically in a Geographic Area," *The Science of the Total Environment* 218 (1998): 89-101.
[28] *Codling Moth Biology and Control Investigations* (Wooster, Ohio: Ohio Agricultural Experiment Station Bulletin 583, 1937).
[29] Murphy, "An Assessment of the Amounts of Arsenical Pesticides Used Historically in a Geographic Area."

Jersey apple orchards translate to approximately 24 to 100 pounds of lead arsenate applied to each acre during the growing season.



BOWKER CHEMICAL COMPANY

SUBSIDIARY OF THE AMERICAN AGRICULTURAL CHEMICAL COMPANY

420 LEXINGTON AVENUE
NEW YORK CITY

HORACE BOWKER, PRESIDENT
GEORGE E. RICHES, VICE-PRESIDENT
O. STEINHAUS, MANAGER

CHEMICALS
INSECTICIDES
FUNGICIDES

FACTORIES
CARTERET N.J.
BALTIMORE MD.

April 19, 1934

REVISED PRICE SCHEDULES
for
BOWKER'S DRY POWDERED ARSENATE OF LEAD
and
BOWKER'S CALCIDE (CALCIUM ARSENATE)

For your information, we attach new, revised price schedules for Bowker's Dry Powdered Arsenate of Lead and Bowker's Calcide (Calcium Arsenate).

These new prices are effective immediately and supersede all prices for these products quoted you heretofore.

The consuming season for these materials is rapidly approaching - we are in position to make prompt shipment in carload or less carload quantities and sincerely hope we may have the pleasure of taking care of your requirements.

BOWKER CHEMICAL COMPANY

BOWKER CHEMICAL COMPANY

CALCIDE (CALCIUM ARSENATE) PRICE SCHEDULE

EFFECTIVE APRIL 17, 1934

APPLICABLE THROUGHOUT THE UNITED STATES

	CARLOAD	OVER 500 POUNDS	LESS THAN 500 POUNDS
100 lb. drum	5½¢ lb.	6¢ lb.	7¢ lb.
25 lb. bags (in single cartons).....	5½¢ "	6¢ "	7¢ "
4 lb. bags (12 to case).....	5½¢ "	6¢ "	7¢ "
1 lb. bags (50 to case).....	7½¢ "	9¼¢ "	10¼¢ "
1 lb. cartons (50 to case).....	9½¢ "	11¾¢ "	12¾¢ "

NOTE:- Mixed carloads of dry and paste insecticides and fungicides will take the carload price.

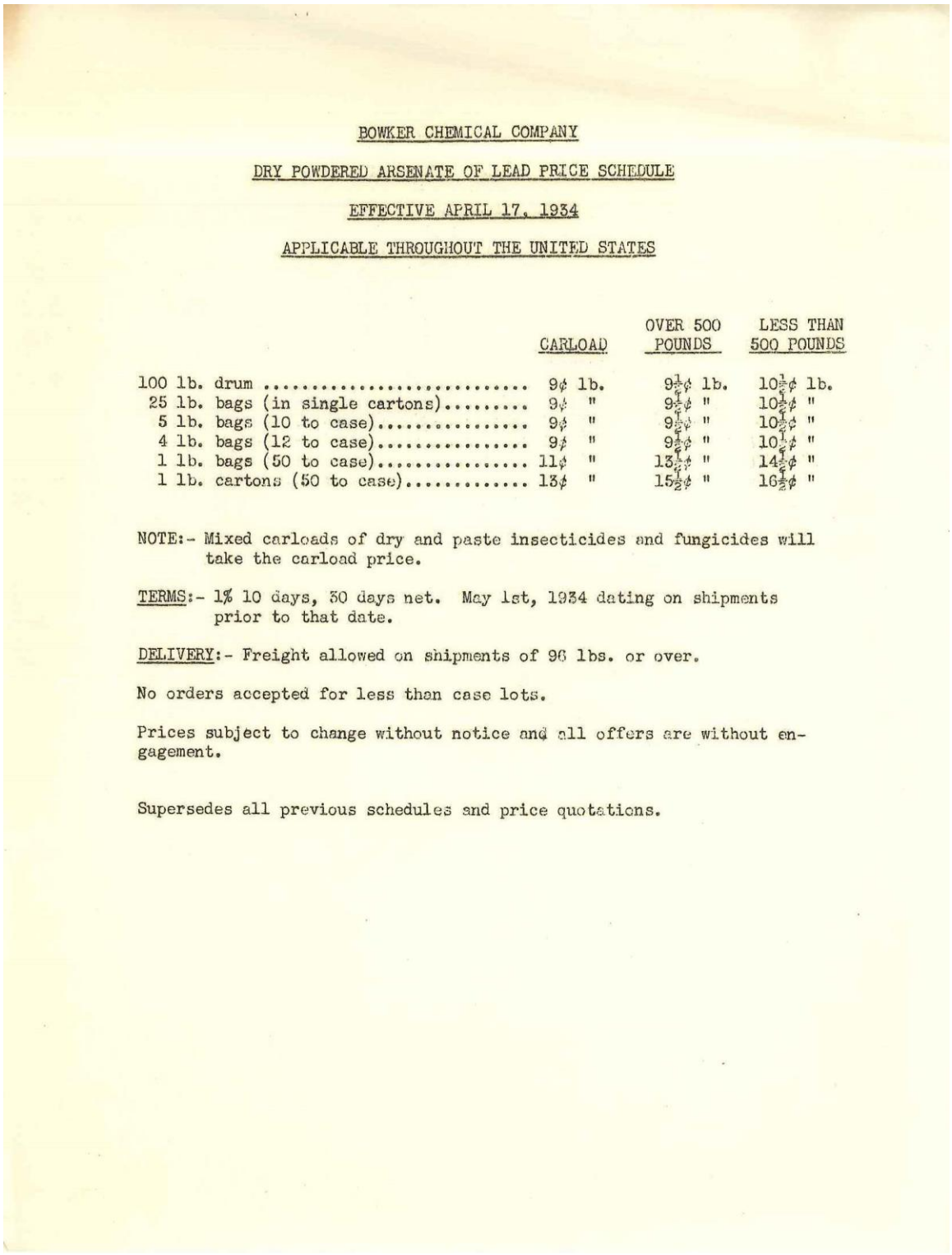
TERMS:- 1% 10 days, 30 days net. May 1st, 1934 dating on shipments prior to that date.

DELIVERY:- Freight allowed on shipments of 96 lbs. or over.

No orders accepted for less than case lots.

Prices subject to change without notice and all offers are without engagement.

Supersedes all previous schedules and price quotations.



BOWKER CHEMICAL COMPANY

DRY POWDERED ARSENATE OF LEAD PRICE SCHEDULE

EFFECTIVE APRIL 17, 1934

APPLICABLE THROUGHOUT THE UNITED STATES

	CARLOAD	OVER 500 POUNDS	LESS THAN 500 POUNDS
100 lb. drum	9¢ lb.	9½¢ lb.	10½¢ lb.
25 lb. bags (in single cartons)	9¢ "	9½¢ "	10½¢ "
5 lb. bags (10 to case)	9¢ "	9½¢ "	10½¢ "
4 lb. bags (12 to case)	9¢ "	9½¢ "	10½¢ "
1 lb. bags (50 to case)	11¢ "	13½¢ "	14½¢ "
1 lb. cartons (50 to case)	13¢ "	15½¢ "	16½¢ "

NOTE:- Mixed carloads of dry and paste insecticides and fungicides will take the carload price.

TERMS:- 1% 10 days, 30 days net. May 1st, 1934 dating on shipments prior to that date.

DELIVERY:- Freight allowed on shipments of 96 lbs. or over.

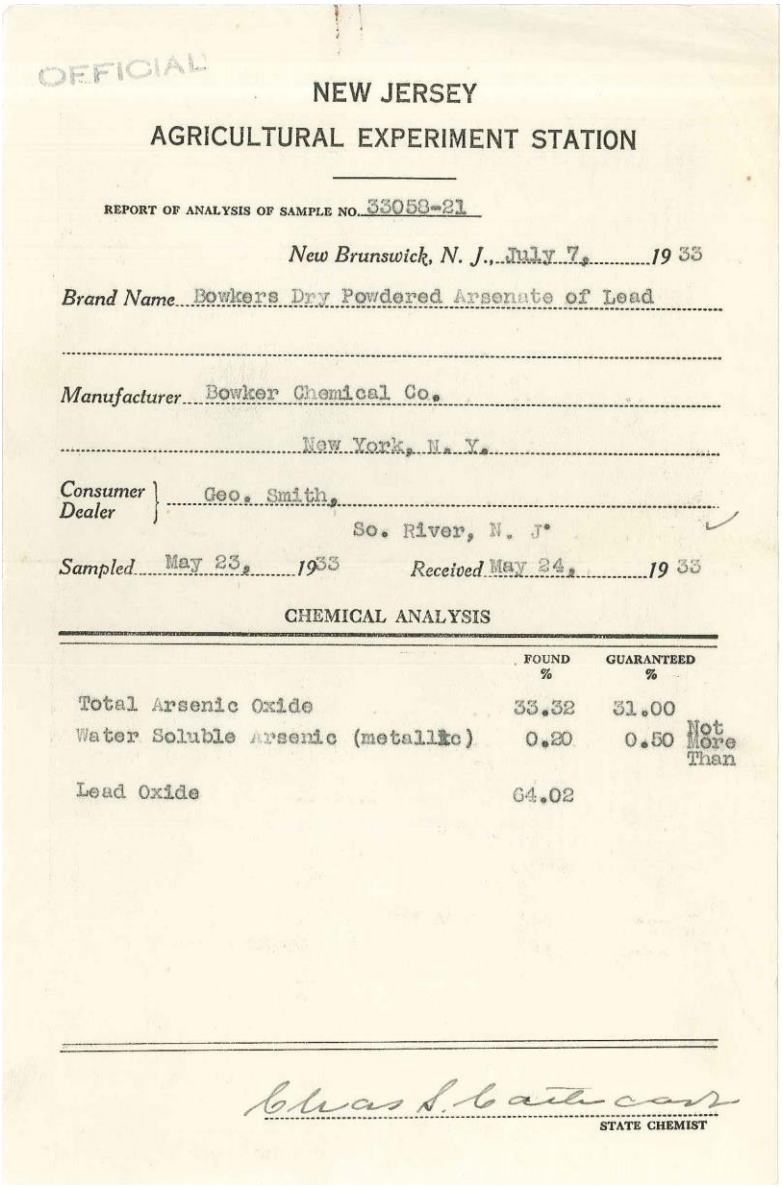
No orders accepted for less than case lots.

Prices subject to change without notice and all offers are without engagement.

Supersedes all previous schedules and price quotations.

1934 price schedules for lead and calcium arsenate. Private collection of D. Moskowitz.

Also found within the salvaged Smith Farm records were chemical analyses performed by the New Jersey Agricultural Experiment Station of three different lead arsenate (1933-1934) and one lime sulphur (1932) purchases providing data on the arsenic, lead, and sulphur concentrations in the samples. The lead arsenate samples revealed arsenic oxide concentrations between 32.09 and 33.32 percent, water soluble arsenic between 0.20 and 0.32 percent and lead oxide between 64.02 and 64.48 percent. The lime sulphur sample showed sulphur comprised 25.01 percent.



OFFICIAL

NEW JERSEY
AGRICULTURAL EXPERIMENT STATION

REPORT OF ANALYSIS OF SAMPLE NO. 33058-21

New Brunswick, N. J., July 7, *19* 33

Brand Name Bowkers Dry Powdered Arsenate of Lead

Manufacturer Bowker Chemical Co.
New York, N. Y.

Consumer / Dealer Geo. Smith,
So. River, N. J.

Sampled May 23, *19*33 *Received* May 24, *19* 33

CHEMICAL ANALYSIS

	FOUND %	GUARANTEED %	
Total Arsenic Oxide	33.32	31.00	
Water Soluble Arsenic (metallic)	0.20	0.50	Not More Than
Lead Oxide	64.02		

Chas. S. Cathcart
STATE CHEMIST

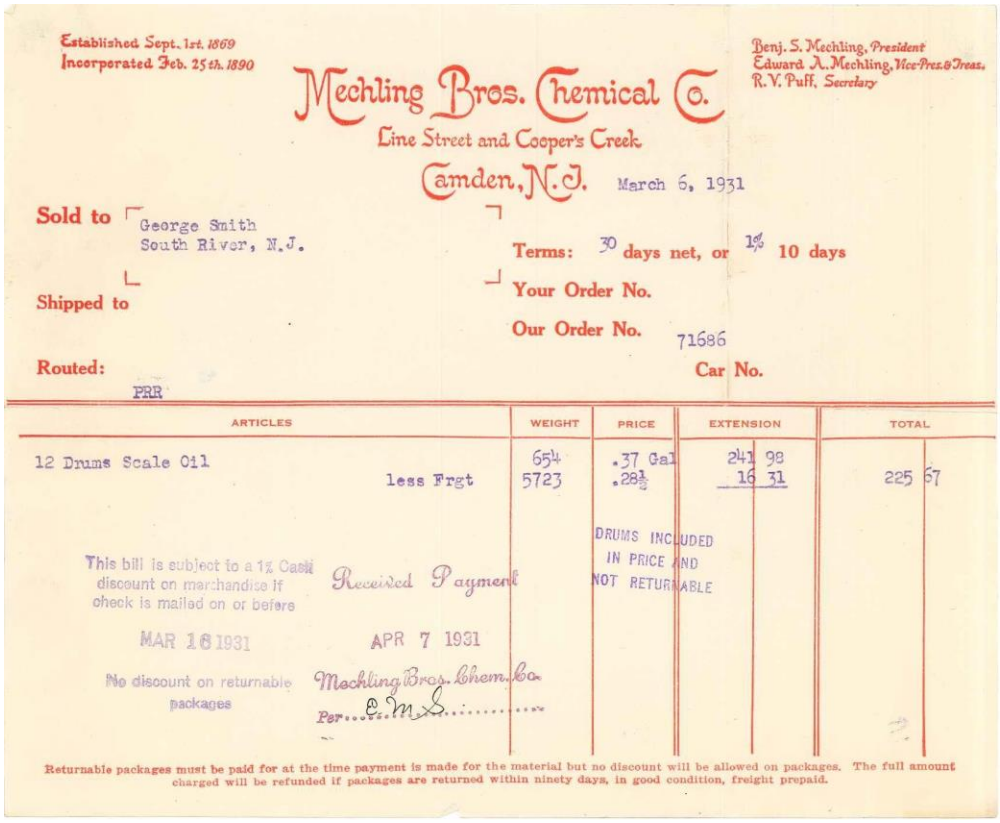
July 7, 1933 Report from the New Jersey Agricultural Experiment Station of Bowkers Dry Powdered Arsenate of Lead submitted by George Smith for analysis. Private collection of D. Moskowitz.

While the codling moth was perhaps the most destructive pest in New Jersey apple orchards during the 1930s, scale insects, mites, and diseases also took a heavy toll and various naturally derived pesticides were used to combat them as well.

San Jose Scale and Mite life histories.[30]

Sulphur and lime and petroleum-based-oil sprays were the most widely used. Various mixtures of these, like the arsenical compounds, were purchased in great quantities for the Smith Farm. Between 1931 and 1936, 101,260 pounds and 2,850 gallons of sulphur and lime were purchased.

[30] US Department of Agriculture, *1952 Yearbook* (Washington, DC: US Government Printing Office, 1952).



Established Sept. 1st. 1869
Incorporated Feb. 25th. 1890

Mechling Bros. Chemical Co.
Line Street and Cooper's Creek
Camden, N.J. March 6, 1931

Benj. S. Mechling, President
Edward A. Mechling, Vice-Pres. & Treas.
R. V. Puff, Secretary

Sold to George Smith
South River, N.J.

Terms: 30 days net, or 1% 10 days

Shipped to

Your Order No.

Our Order No. 71686

Routed: PRR

Car No.

ARTICLES	WEIGHT	PRICE	EXTENSION	TOTAL
12 Drums Scale Oil	654	.37 Gal	241 98	
less Frgt	5723	.2831/2	16 31	225 67

DRUMS INCLUDED IN PRICE AND NOT RETURNABLE

This bill is subject to a 1% Cash discount on merchandise if check is mailed on or before

MAR 16 1931

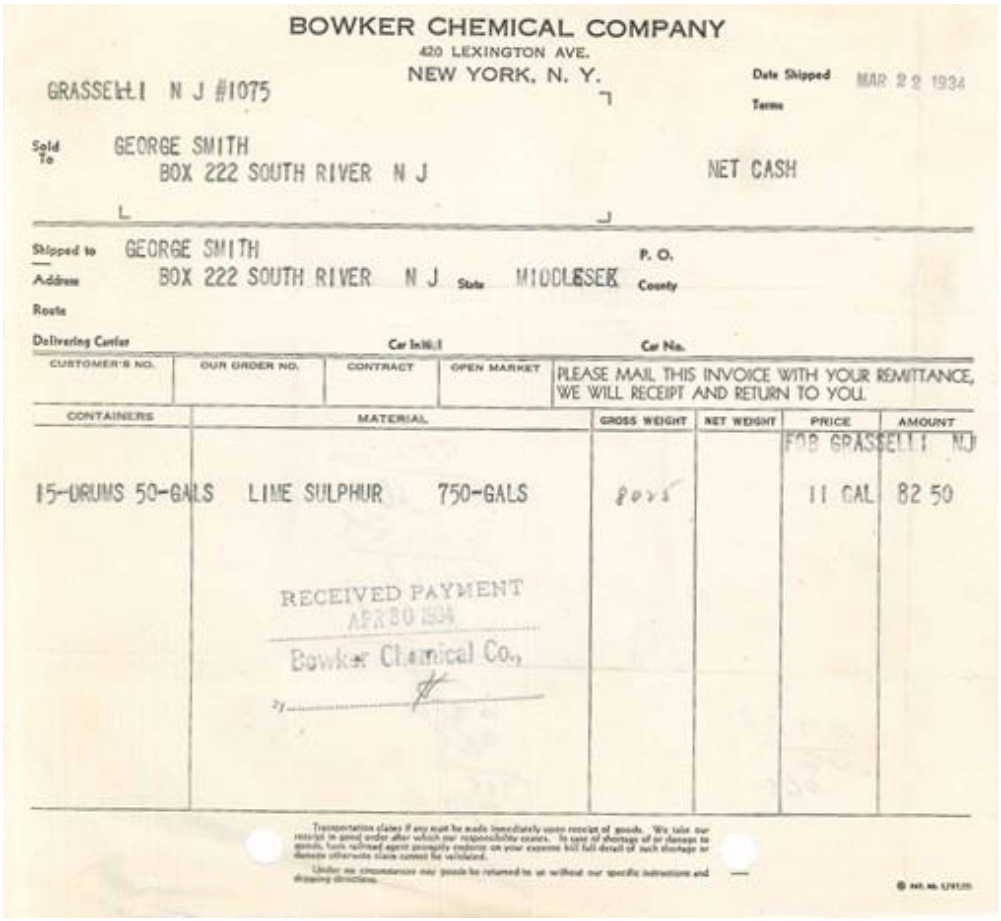
Received Payment

APR 7 1931

No discount on returnable packages

Mechling Bros. Chem. Co.
Per E. M. S.

Returnable packages must be paid for at the time payment is made for the material but no discount will be allowed on packages. The full amount charged will be refunded if packages are returned within ninety days, in good condition, freight prepaid.



BOWKER CHEMICAL COMPANY
420 LEXINGTON AVE.
NEW YORK, N. Y.

GRASSELLI N J #1075

Date Shipped MAR 22 1934

Terms

Sold To GEORGE SMITH
BOX 222 SOUTH RIVER N J

NET CASH

Shipped to GEORGE SMITH

Address BOX 222 SOUTH RIVER N J State MIDDLESEX County

P. O.

Route

Delivering Carrier Car Initial Car No.

CUSTOMER'S NO.	OUR ORDER NO.	CONTRACT	OPEN MARKET	PLEASE MAIL THIS INVOICE WITH YOUR REMITTANCE, WE WILL RECEIPT AND RETURN TO YOU.

CONTAINERS	MATERIAL	GROSS WEIGHT	NET WEIGHT	PRICE	AMOUNT
				F.O.B. GRASSELLI N.J.	
15-DRUMS 50-GALS	LIME SULPHUR 750-GALS	8075		11 GAL	82 50

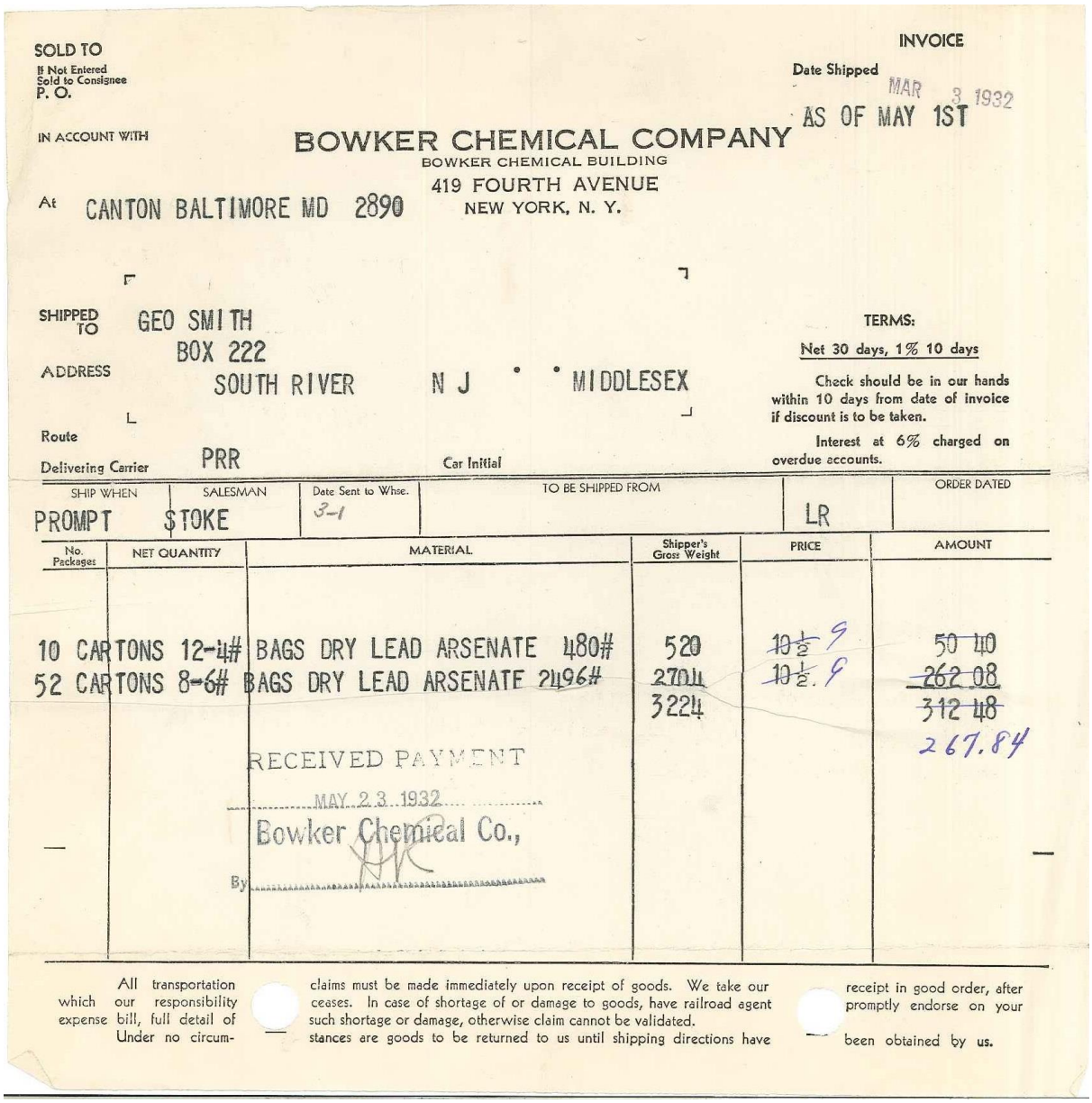
RECEIVED PAYMENT
APR 30 1934
Bowker Chemical Co.,
By

Transportation claims if any must be made immediately upon receipt of goods. We take our receipt in good order after which our responsibility ceases. In case of shortage of or damage to goods, have railroad agent promptly endorse on your express bill full detail of such shortage or damage otherwise claim cannot be validated.

Under no circumstances may goods be returned to us without our specific instructions and shipping directions.

Shipping invoices for Scale Oil and Lime Sulphur. Private collection of D. Moskowitz.

Other naturally derived pesticides were also purchased for the orchard during this time period: nicotine-based compounds and soaps including 268 pounds of nicotine sulphate, 2,950 pounds of solid Crystal Potassium Oleate (C.P.O.) soap and other powdered soap, copper compounds, and even milk-based preparations. These pesticides were used to combat a wide range of pests with varying degrees of effectiveness.



SOLD TO
If Not Entered Sold to Consignee P. O.

INVOICE

Date Shipped MAR 3 1932

AS OF MAY 1ST

IN ACCOUNT WITH

BOWKER CHEMICAL COMPANY
BOWKER CHEMICAL BUILDING
419 FOURTH AVENUE
NEW YORK, N. Y.

At CANTON BALTIMORE MD 2890

SHIPPED TO GEO SMITH
ADDRESS BOX 222
SOUTH RIVER N J • • MIDDLESEX

Route

Delivering Carrier PRR Car Initial

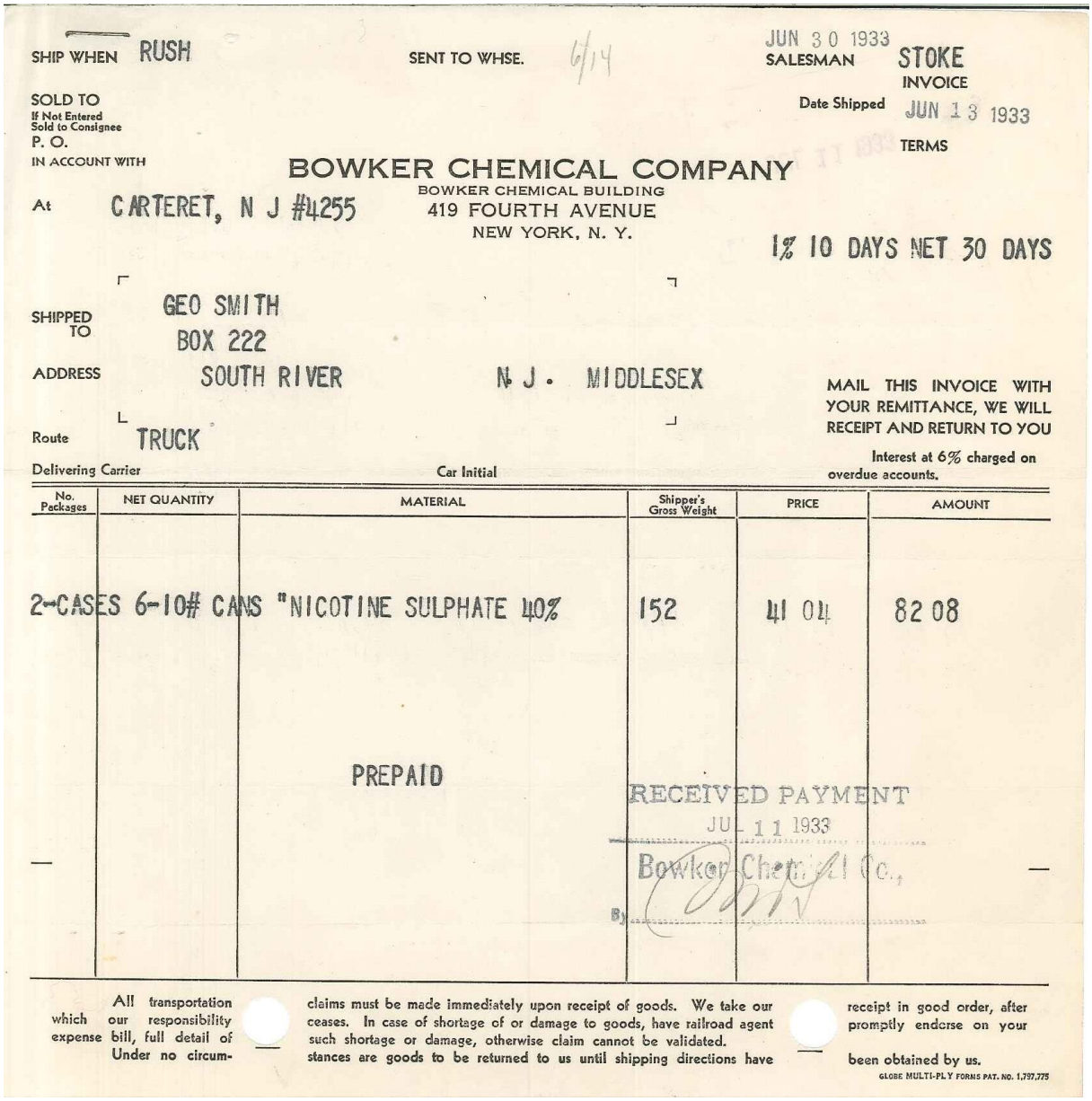
TERMS:
Net 30 days, 1% 10 days
Check should be in our hands within 10 days from date of invoice if discount is to be taken.
Interest at 6% charged on overdue accounts.

SHIP WHEN	SALESMAN	Date Sent to Whse.	TO BE SHIPPED FROM		ORDER DATED
PROMPT	STOKE	3-1		LR	

No. Packages	NET QUANTITY	MATERIAL	Shipper's Gross Weight	PRICE	AMOUNT
10	CARTONS 12-4#	BAGS DRY LEAD ARSENATE 480#	520	~~10½~~ 9	50 40
52	CARTONS 8-6#	BAGS DRY LEAD ARSENATE 2496#	2704	~~10½~~ 9	~~262 08~~
			3224		~~312 48~~ 267.84

RECEIVED PAYMENT
MAY 23 1932
Bowker Chemical Co.,
By

All transportation claims must be made immediately upon receipt of goods. We take our receipt in good order, after which our responsibility ceases. In case of shortage of or damage to goods, have railroad agent promptly endorse on your expense bill, full detail of such shortage or damage, otherwise claim cannot be validated. Under no circumstances are goods to be returned to us until shipping directions have been obtained by us.



SHIP WHEN RUSH — SENT TO WHSE. 6/14 — JUN 30 1933 — SALESMAN STOKE

INVOICE

SOLD TO
If Not Entered Sold to Consignee
P. O.
IN ACCOUNT WITH

Date Shipped JUN 13 1933

TERMS

BOWKER CHEMICAL COMPANY
BOWKER CHEMICAL BUILDING
419 FOURTH AVENUE
NEW YORK, N. Y.

At CARTERET, N J #4255

1% 10 DAYS NET 30 DAYS

SHIPPED TO GEO SMITH
ADDRESS BOX 222 SOUTH RIVER N J. MIDDLESEX

MAIL THIS INVOICE WITH YOUR REMITTANCE, WE WILL RECEIPT AND RETURN TO YOU

Route TRUCK
Delivering Carrier — Car Initial

Interest at 6% charged on overdue accounts.

No. Packages	NET QUANTITY	MATERIAL	Shipper's Gross Weight	PRICE	AMOUNT
2-CASES	6-10# CANS	"NICOTINE SULPHATE 40%	152	41 04	82 08

PREPAID

RECEIVED PAYMENT
JUL 11 1933
Bowker Chemical Co.,
By

All transportation claims must be made immediately upon receipt of goods. We take our receipt in good order, after which our responsibility ceases. In case of shortage of or damage to goods, have railroad agent promptly endorse on your expense bill, full detail of such shortage or damage, otherwise claim cannot be validated. Under no circumstances are goods to be returned to us until shipping directions have been obtained by us.

GLOBE MULTI-PLY FORMS PAT. NO. 1,797,775

Shipping invoices for large quantities of Lead Arsenate and Nicotine Sulphate. Private collection of D. Moskowitz.

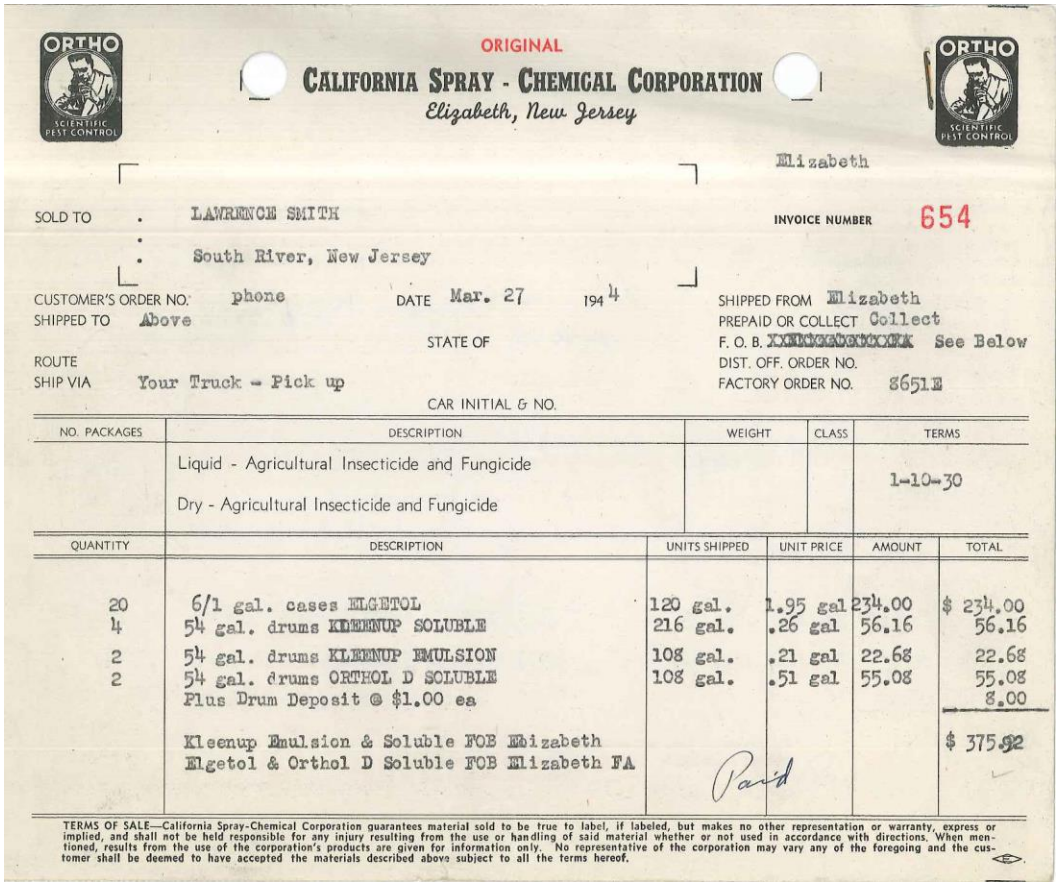
Pesticide and Agricultural Chemical Purchases: 1943-1945

World War II was a turning point in agricultural pesticides as compounds developed during the war, or at least that had their value identified during the war, found wide application for agricultural purposes. Troop health was linked to effective warfare and extensive pesticide research was conducted to prevent insect and arachnid-borne

epidemics from lice, mites, ticks, chiggers, mosquitoes, fleas, flies and bedbugs.[31] As A.W.A. Brown would write in 1951,

> The search for insecticidal compounds, greatly accelerated during World War II, continues to advance into the fertile fields pioneered by the organic chemist. As a result, insecticides of ever greater power are being discovered, and the arsenal of weapons for insect control is steadily increasing.[32]

The pesticide purchases for the Smith Farm illustrate this well with the first purchases of Parmone and Elegtol in 1943 and then Krenite, Fermate and perhaps most significantly, two pints of DDT in 1945.



ORIGINAL

CALIFORNIA SPRAY - CHEMICAL CORPORATION

Elizabeth, New Jersey

Elizabeth

SOLD TO . LAWRENCE SMITH

INVOICE NUMBER 654

South River, New Jersey

CUSTOMER'S ORDER NO. phone DATE Mar. 27 194 4

SHIPPED TO Above

STATE OF

SHIPPED FROM Elizabeth

PREPAID OR COLLECT Collect

F. O. B. XXXXXXXXXXXX See Below

ROUTE

SHIP VIA Your Truck - Pick up

DIST. OFF. ORDER NO.

FACTORY ORDER NO. 8651E

CAR INITIAL & NO.

NO. PACKAGES	DESCRIPTION	WEIGHT	CLASS	TERMS
	Liquid - Agricultural Insecticide and Fungicide Dry - Agricultural Insecticide and Fungicide			1-10-30

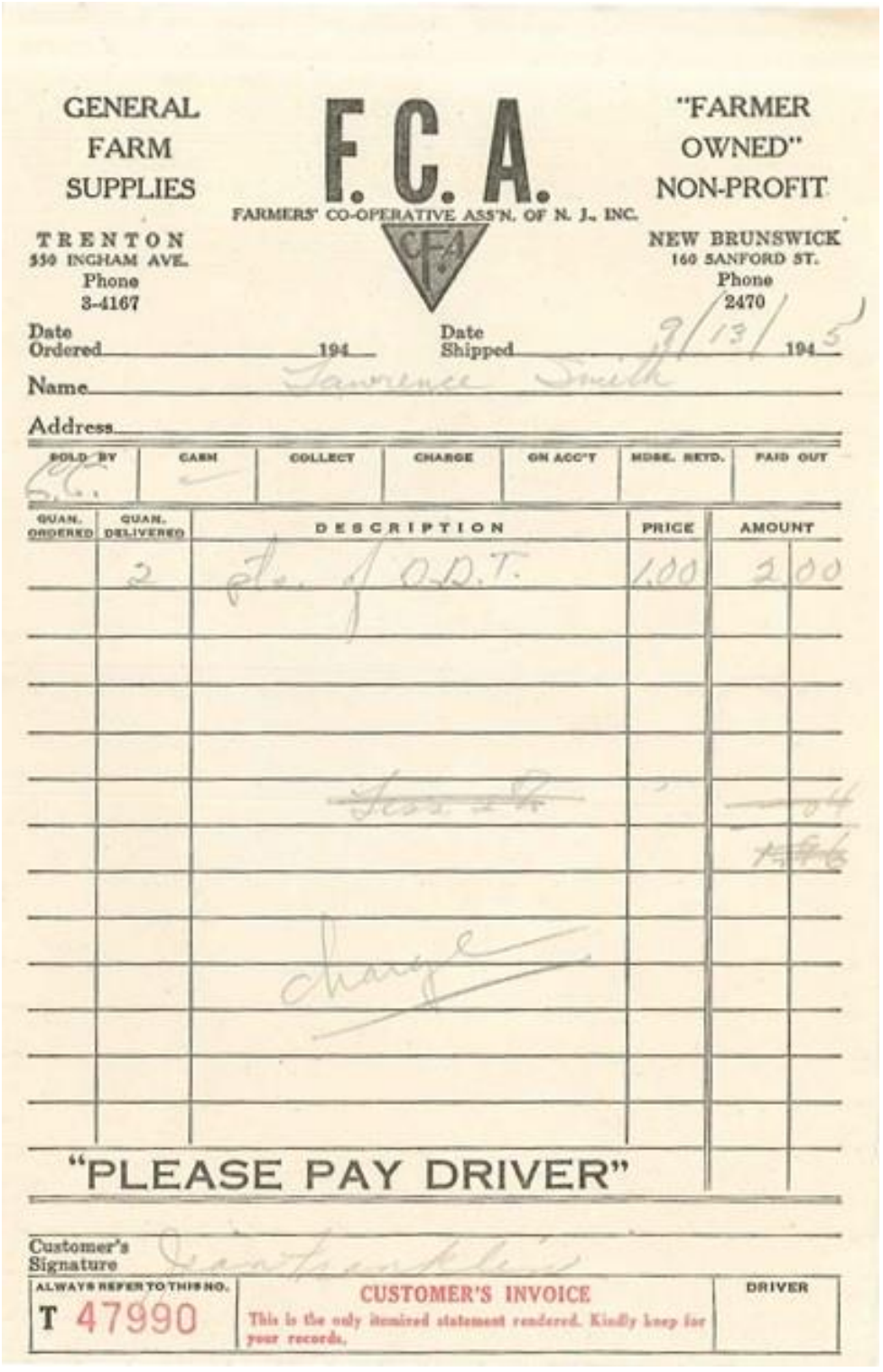
QUANTITY	DESCRIPTION	UNITS SHIPPED	UNIT PRICE	AMOUNT	TOTAL
20	6/1 gal. cases ELGETOL	120 gal.	1.95 gal	234.00	$ 234.00
4	54 gal. drums KLEENUP SOLUBLE	216 gal.	.26 gal	56.16	56.16
2	54 gal. drums KLEENUP EMULSION	108 gal.	.21 gal	22.68	22.68
2	54 gal. drums ORTHOL D SOLUBLE	108 gal.	.51 gal	55.08	55.08
	Plus Drum Deposit @ $1.00 ea				8.00
	Kleenup Emulsion & Soluble FOB Elizabeth Elgetol & Orthol D Soluble FOB Elizabeth FA				$ 375.92

Paid

TERMS OF SALE—California Spray-Chemical Corporation guarantees material sold to be true to label, if labeled, but makes no other representation or warranty, express or implied, and shall not be held responsible for any injury resulting from the use or handling of said material whether or not used in accordance with directions. When mentioned, results from the use of the corporation's products are given for information only. No representative of the corporation may vary any of the foregoing and the customer shall be deemed to have accepted the materials described above subject to all the terms hereof.

Smith Farm receipt for Ortho pesticide products. Private collection of D. Moskowitz.

[31] F.C. Bishopp, "Insect Problems in World War II with special references to the insecticide DDT," *American Journal of Public Health and the Nation's Health* 35, no. 4 (1945): 373–378.
[32] A.W.A. Brown, *Insect Control by Chemicals* (New York: John Wiley and Sons, Inc. 1951).



GENERAL FARM SUPPLIES

F. C. A.

FARMERS' CO-OPERATIVE ASS'N. OF N. J., INC.

"FARMER OWNED" NON-PROFIT

TRENTON
550 INGHAM AVE.
Phone
3-4167

NEW BRUNSWICK
160 SANFORD ST.
Phone
2470

Date Ordered _____ 194_

Date Shipped 9/13/ 194 5

Name Lawrence Smith

Address

SOLD BY	CASH	COLLECT	CHARGE	ON ACC'T	MDSE. RET'D.	PAID OUT
[illegible]						

QUAN. ORDERED	QUAN. DELIVERED	DESCRIPTION	PRICE	AMOUNT	
	2	Lbs. D.D.T.	1.00	2	00
		~~Less 2%~~		~~-04~~	
				~~1.96~~	
		charge			

"PLEASE PAY DRIVER"

Customer's Signature [illegible]

ALWAYS REFER TO THIS NO. T 47990

CUSTOMER'S INVOICE

This is the only itemized statement rendered. Kindly keep for your records.

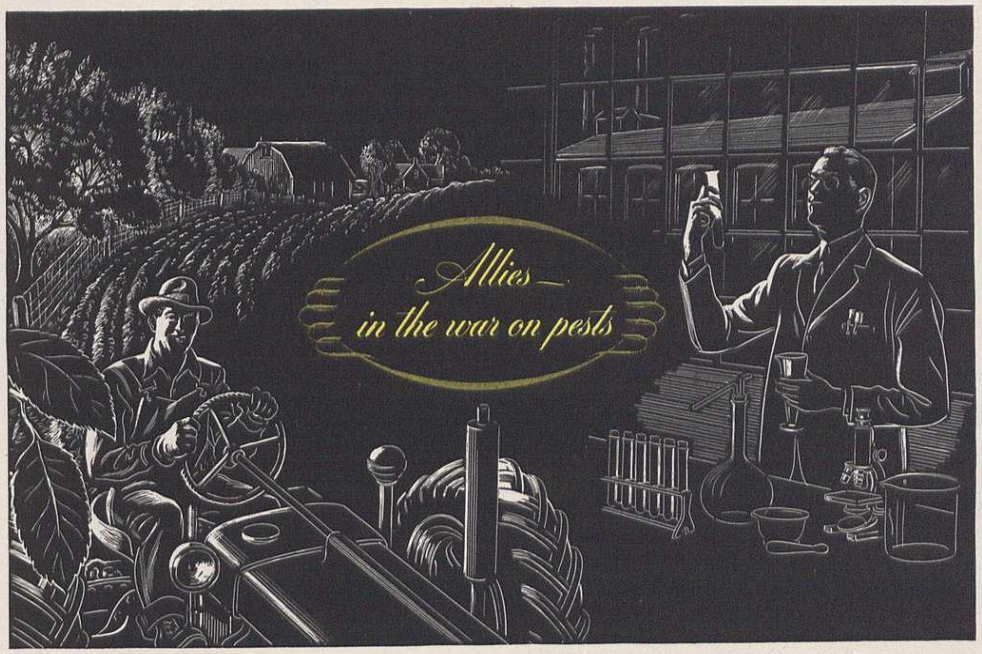
DRIVER

September 13, 1945 shipping receipt for the first purchase of DDT by Lawrence Smith. Private collection of D. Moskowitz.

DDT was first synthesized in 1874 but its effectiveness as an insecticide was only discovered in 1939.[33] During World War II, the United States began producing large quantities of DDT to control vector-borne diseases such as typhus and malaria among the troops.[34] DDT rapidly changed the use of pesticides in apple orchards, reducing and then eliminating lead arsenate and other naturally-derived compounds. It would, in time, become one of the most vilified pesticides in the United States and elsewhere, starting with the publication of Rachel Carson's seminal book *Silent Spring* in 1962.[35] The book illustrated the environmental impact of DDT and was the impetus for its ban a decade later in 1972 by the United States Environmental Protection Agency.[36] The other synthesized compounds purchased in 1943 and 1945 were at the forefront of the large shift from naturally-derived to synthetic organic pesticides. Du Pont Pest Control Products was an early leader in the production of agricultural pesticides and in *1945 The Du Pont Magazine* featured a full-page overview with the following:

> At Du Pont, research scientists are continually seeking new and better insecticidal compounds to aid the farmer in his age-old battle against insect enemies. More than 30 such compounds, listed at right, testify to the continual effort of Du Pont scientists in helping the farmer with his task of destroying the destroyers.[37]

[33] A.S. Perry, et al, "The Organochlorine Insecticides," *Insecticides in Agriculture and Environment: Retrospects and Prospects* (Berlin: Springer, 1998).
[34] National Pesticide Information Center. *DDT* (General Fact Sheet). Accessed October 22, 2019 http://npic.orst.edu/factsheets/ddtgen.pdf
[35] Whorton, *Before Silent Spring. Pesticides and Public Health in Pre-DDT America*.
[36] US Environmental Protection Agency. *DDT - A Brief History and Status*. Accessed October 20, 2019. https://www.epa.gov/ingredients-used-pesticide-products/ddt-brief-history-and-status
[37] "Destroying the Destroyers," *The Du Pont Magazine*, 1945. Accessed October 20, 2019 https://digital.hagley.org/1945_39_03#page/2/mode/2up.



DESTROYING THE DESTROYERS

THERE are thousands of different kinds of destructive insects—billions upon billions of them—on the farms of this country. Uncontrolled, this predatory population would destroy valuable food crops of first importance to the farmer and to you.

But the scientists and the farmers have banded together to fight these insect pests, and the result of their joint work is to make the American farmer the most productive farmer, and the American family the best fed, in the world.

At Du Pont, research scientists are continually seeking for new and better insecticidal compounds to aid the farmer in his age-old battle against insect enemies. More than 30 such compounds, listed at right, testify to the continual effort of Du Pont scientists in helping the farmer with his task of destroying the destroyers.

E. I. du Pont de Nemours & Company (Inc.), Grasselli Chemicals Department, Wilmington 98, Delaware.

DU PONT PEST CONTROL PRODUCTS

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

DU PONT PEST CONTROL PRODUCTS

"Grasselli" lead arsenate
"NuRexform" lead arsenate
"Deenate" DDT insecticides
Calcium arsenate
"Alorco" cryolite
Paris green
Lime sulfur solution
Dry lime sulfur
"Sulforon" wettable sulfur
Flotation sulfur paste
Copper-A Compound
Bordeaux mixture
Du Pont Garden Dust
Du Pont Potato Dust
Copper sulfate (blue vitriol)
Black Leaf "40" (nicotine sulfate 40%)
Black Leaf "155" (fixed nicotine)
Copper sulfate—monohydrated
"Parapont" paradichlorobenzene
Du Pont Spreader-Sticker
"Loro" contact insecticide
Dust mixtures
Zinc sulfate—flake and crystal
Spray oil—dormant
Spray oil—summer
"Fermate" fungicide
"Krenite" dinitro dormant spray
"Parmone" pre-harvest fruit-drop inhibitor Spray—Dust (also in Oil for Airplane and Ground spraying in the Pacific Northwest)

1945 Du Pont advestisement for pest control products.[27]

[27] Ibid.

The Du Pont slogan of the time, "*Better Things for Better Living…Through Chemistry*" fit well with the rapid growth of synthetic pesticides available to the farmer in the mid to latter part of the 1940s. The Smith Farm receipts illustrate this well with four of the new Du Pont chemicals purchased in 1943 and 1945.

A comparison of the Smith Farm receipts with the NJAES yearly *Spraying Recommendations for Apples* indicates, not unexpectedly, that the Smith's were on the cutting edge of the most current pesticide advances. For example, the fungicide Elgetol, used to control Apple Scab, was first noted in the 1946 NJAES Spray Recommendations but was purchased by the Smith's three years earlier in 1943. Similarly, DDT was first recommended in the 1947 NJAES Spray Recommendations but was purchased in late 1945 for the orchard. Fermate was also purchased in 1945, the same year it was recommended in the NJAES Spray Recommendations. Krenite was also purchased by the Smith's in 1945, and although not noted by name, it is the same class of fungicide as Fermate recommended for use by NJAES in 1945.[38] In 1943, the receipts also show the first purchases of Parmone, a Dupont synthetic hormone used to reduce fruit drop. The Smith's were pioneers in modern orchard practices, clearly utilizing the most advanced methods for fruit production and insect and disease control. But those efforts would have a long and unanticipated legacy.

Pesticide Residues in Smith Farm Orchard Soils and Their Remediation - 1998

In 1998, as part of the development of the Smith Farm for housing, the orchard soils were sampled for pesticides that can remain long after their application. High concentrations of many of these "legacy" chemicals were found. Soil screening,

[38] D.H. Palmiter, "Sooty Blotch Disease of Pears and Its Control: Bulletin No. 734" (Geneva, New York: New York State Agricultural Experiment Station, 1948).

particularly in orchards which were known to have had high pesticide application rates, is routinely conducted by the New Jersey development community. In 1999, in order to provide sampling guidance and consistency to evaluations, the NJDEP Historic Pesticide Contamination Task Force that was tasked with creating a guidance document to address this issue published "*Findings and Recommendations for the Remediation of Historic Pesticide Contamination."* As noted in the report introduction:

> Farmers, orchardists, homeowners, turf growers, local governments and others have used a wide variety of pesticides over the last 100 years in an effort to control pests and increase crop yield. Many pesticides were used in limited circumstances, others became widely used, and some became the "pesticide of choice" for entire crops or industries. Some of these pesticides are persistent in the environment, and thus may be present in the soil long after they have been applied. As a result, residues of a number of pesticides (including arsenical pesticides, DDT and dieldrin) can be found in soils at levels that may pose a human health risk. The New Jersey Department of Environmental Protection ("the Department") estimates that up to 5 percent of the state's acreage may be impacted by the historical use of arsenical pesticides alone. The primary concern with historical pesticide residues is human health risk from inadvertent ingestion of contaminated soil, particularly by children.
>
> As more and more agricultural land is developed, developers, municipal officials, homebuyers and others are becoming increasingly aware of the possible presence of pesticide residues in soils. Some municipalities now require environmental assessments of land as part of their site approval process. Banking institutions take environmental risk factors into consideration in their lending decisions. Developers and builders sample soil more frequently to determine whether or not to purchase land or how to develop land they already own. Homebuyers are also considering pesticide residues along with a myriad of other environmental factors such as indoor air radon levels, the presence of lead paint in the home, and the quality of potable water. The presence of pesticide residues is also a consideration in non-residential property uses including day care centers, schools, parks and general commercial and municipal usage.[39]

[39] *Findings and Recommendations for the Remediation of Historic Pesticide Contamination*. New Jersey Department of Environmental Protection Historic Pesticide Contamination Task Force Final Report - March 1999.

It comes as no surprise given the large quantities of pesticides purchased for the Smith Farm that "legacy" pesticides were found in the orchard soils in 1998. These included arsenic, lead, DDT and DDE (among other chemicals not available in the time periods covered by the Smith Farm receipts). DDE is a metabolite of DDT reflecting the breakdown of the chemical bonds over time.[40] Although a direct comparison cannot be made between the large pesticide purchases made in the 1930s and 1940s and the residual concentrations found in 1998, they must certainly be a part of the legacy of those.

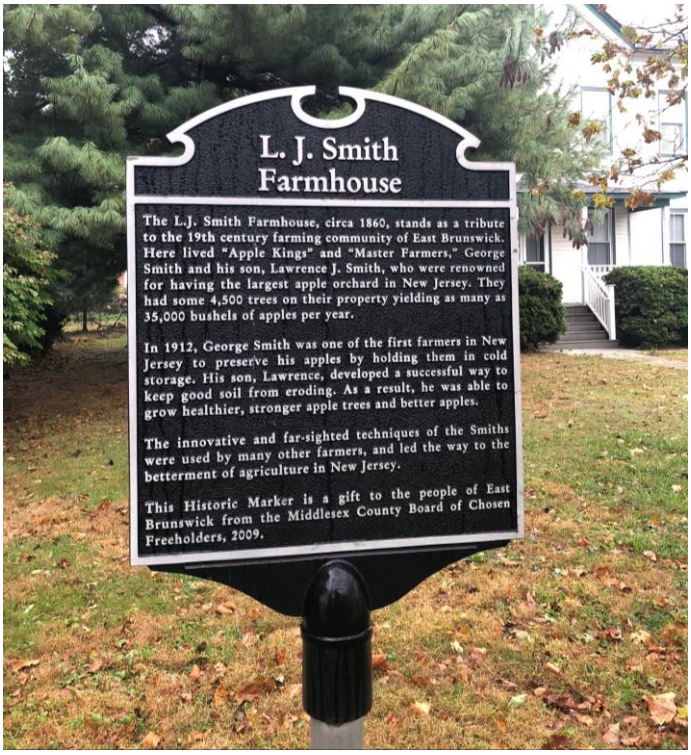
The presence of "legacy" pesticide contamination was noted in a comprehensive Remedial Action Workplan (RAW) approved by the New Jersey Department of Environmental Protection. The purpose of the RAW was to develop a plan to remediate the site contamination to levels within acceptable NJDEP cleanup criteria, allowing development for housing. Extensive soil sampling conducted as part of this study confirmed the presence of dieldrin, lead, 4,4' DDE and 4,4'-DDT at depths ranging from six to thirty inches below the ground surface. It was concluded that the presence of these compounds was a result of routine historic pesticide applications.

Based on the recommendations provided in the RAW, the soils that contained pesticides, arsenic and lead at levels that exceeded the NJDEP cleanup criteria were delineated by further soil sampling to understand their spatial extent and depth. They were then excavated and relocated to a designated portion of the site where it would not be at risk of human contact. Following these remedial activities, the impacted areas were "capped" with a twelve-inch layer of clean fill soil plus an additional six inches of imported certified clean topsoil. These areas were then fenced to limit access, deed

[40] W.D. Guenzi and W. E. Beard. *The Effects of Temperature and Soil Water on Conversion of DDT to DDE in Soil* (New York: Van Nostrand Reinhold Company, 1986).

restricted from future development, and are now maintained as large lawns within the housing development. Once all of the remedial activities were completed, and the New Jersey Department of Environmental Protection determined they were acceptable to protect human health, a No Further Action Letter was issued by the agency confirming the site was able to be developed into the single-family homes that currently occupy the property.

The old Smith farmhouse remains adjacent to the property and now serves as the headquarters of the East Brunswick Historical Society. The apple trees are all gone now. But a historical marker on the front lawn of the Society serves as a silent reminder of the vast apple orchard that once occupied the property and the pioneering and innovative farming methods of George and Lawrence Smith, the "Apple Kings" of times now past.



The L. J. Smith Farmhouse Historical Marker on Milltown Road, East Brunswick, New Jersey.[41] Photograph by D. Moskowitz on October 20, 2019.

[41] "L. J. Smith Farmhouse," *The Historical Marker Database*. Accessed October 21, 2019 https://www.hmdb.org/marker.asp?marker=93891.

David Moskowitz holds a B.A. in Environmental Studies from The George Washington University, an M.S. in Environmental Policy Studies from the New Jersey Institute of Technology and a Ph.D. in Entomology from Rutgers University. He is Senior Vice President with EcolSciences, Inc. in Rockaway, New Jersey and has been with the company for thirty-three years.

Michael Levinson received his B.S. in Environmental Science from Rutgers University and an M.S. in Biology from Montclair State University. He is Senior Project Manager with EcolSciences, Inc. in Rockaway, New Jersey and has over 11 years of environmental experience.

Evie McMenamin received her Bachelor of Technology in Wildlife Management from the State University of New York in Cobleskill. She is Environmental Scientist with EcolSciences, Inc. in Rockaway, New Jersey, and has been with the company for six years.

Authors note: The Smith Farm documents have been donated to the East Brunswick Historical Society (https://ebhistoricalsociety.webs.com/) so they can be available for future research.

The authors would like to thank the East Brunswick Historical Society for permission to use photographs of the Smiths, and Richard Walling for assistance with early newspaper archives. We are also indebted to two anonymous reviewers for their suggestions that improved the manuscript. Thank you is also due EcolSciences, Inc. for the time and resources to prepare this historical account. Finally, a special thank you is due Melissa Ziobro for her encouragement to write this history.