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Pennsylvania State Horticultural Association News

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84

PROCEEDINGS OF THE

Eighty-Fourth Annual Meeting

Chestnut Street Hall Auditorium, Harrisburg, Penna.

JANUARY 13 and 14, 1943

PENNSYLVANIA GROWN FRUIT TREES

I offer planters choice Pennsylvania grown fruit trees in all the leading varieties, including new double red strains of apple and the new peach varieties. Stock examined and certified to be true to name by expert authorities. Prices are reasonable as sales are direct to the planter.

Write for Latest Catalogue and Prices

Adams County Nursery & Fruit Farms

ASPERS, PA.

H. G. BAUGHER, Prop. EST. 1905

In Memoriam

Harry Wharton Skinner

Died, January 29th, 1943

President of this Association 1941-1942

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INTENTIONAL SECOND EXPOSURE

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State Horticultural Association of Pennsylvania

OFFICERS FOR 1943

President—H M. Anderson, New Park

Vice President—J. Eric Linde, Orefield

Treasurer—Paul Thayer, Carlisle

Secretary—J. U. Ruef, State College

STANDING COMMITTEES

Executive Committee: The above named officers and R. J. Gillan. St. Thomas; H. F. Hershey, Hamburg; J. A. Runk, Huntingdon.

Legislation and Representatives on Agricultural Council: J. Eric Linde, Orefield, Ch.; G. F Gillan, St. Thomas; M. E. Knouse, Peach Glen; J. T. Raine, Fairview; R. T. Criswell, Chambersburg; W. E. Grove, York Springs; W. O. Bingham, St. Thomas.

State Farm Show and Exhibition: Guy L. Hayman, Northbrook, Ch.; R. C. McDonald, Shippensburg; R. J. Gillan, St. Thomas.

Insect Pests: J. O. Pepper, State College, Ch.; H. N. Worthley, State College; T. L. Guyton, Harrisburg.

Plant Diseases: H. W. Thurston, State College, Ch.; R. S. Kirby, State College; H. F. Hershey, Hamburg; R. H. Bell, Harrisburg.

Game Laws: J. A. Runk, Huntingdon, Ch.; Geo. Rohrer, Dryville; R. D. Anthony, State College.

State College Relations: J. A. Runk, Huntingdon, Ch.; E. B. Mitchell, Harrisburg; Guy Smith, North East; H. F. Hershey, Hamburg; Francis Reiter, Mars; C. L. Packard, Ore Hill; Ralph Crowell, Buckingham; Fred Griest, Floradale.

PRESIDENT'S ADDRESS

H. M. ANDERSON — New Park, Pa.

Members of the Penna. State Horticultural Association,

Ladies and Gentlemen:

Another year has rolled by, a year more crowded with peril for us as a nation, and with problems and perplexities for us as individuals, than any of us could have foreseen a year ago. And yet, when we look back over it, we can see that it might have been infinitely worse.

We have at least had time to put our house in order and to prepare to carry the war to the enemy. We have been living in comfort and safety and a reasonable state of prosperity. When we compare our lot with that of any other nation on earth we should devoutly thank God that we are Americans and that his mercies are still granted to us as to no others in modern times. We have the brains, the genius and the initiation, the equipment, and materials to arm the world. We have a cause that is just, a conscience that is clear, a faith that is firm, and an arm that is strong, so that ultimate victory is certain.

This is a horticultural meeting and normally only horticultural topics are in order, but conditions are so abnormal that I think any organization would be remiss that did not stress at least two important facts of great interest to everyone.

One is that whole-hearted effort and co-operation on the part of every citizen would so shorten the war and so lessen the cost in life and in treasure that it is our patriotic duty to subordinate our own personal view-point, and make every effort to support the government and to prosecute the war.

I have no sympathy for the individuals who are living in ease and luxury and complaining about the conveniences which are restricted, when better men are losing their lives for the cause.

The other all-important fact we are facing is that uncontrolled inflation will hurt most of us financially worse even than war; and the only practical way to meet it is in seeing that everyone's surplus earnings are invested with safest security in the world today. If $20,000,000,000 of earnings is allowed to compete in our markets for $40,000,000,000 of commodities, prices will sky-rocket in a vicious circle and end in catastrophe.

If earnings above actual needs are invested in bonds, we will have attained three worthy objectives: we will support

the government; have a safe investment; and help to avert a catastrophe.

I hope and believe that all Pennsylvania fruit growers have had a prosperous year. I believe we can reasonably expect at least a few more good years if we can possibly secure the necessary labor. Of course we will have all of the old problems and new and unpredictable ones from day to day. The new ones will have to be faced as they develop, but we hope that our programs of today and tomorrow will shed new light on the old ones.

There is one old problem, however, that seems to have been missed, that I want to stress as strongly as I can. I refer to our relations to the Government, the Processors, the Grocers, and the Consumers.

About six years ago we organized Appalachian Apples to advertise apples. I have believed in it and supported it since its inception, and during recent years have been fairly close to its management, and I know it has been of very great value to the industry. This value has been cummulative, until today we can truthfully say of the last two years that every dime invested in Appalachian Apples has returned the investor a dollar. Certainly more than ten cents a bushel of the price agreed upon by the government for relief apples, and by the processors for canners during the past two years was a result of the efforts of Appalachain Apples to secure the growers a fair price.

These purchases were sufficiently large to establish effectively a floor under the apple market and influence all prices. Appalachian Apples influence in modifying government rulings have helped us all in several instances. When 500 growers visit 10,000 grocers and discuss marketing problems together and arrive at a mutual desire to co-operate and help each other, as Appalachian Apples has been doing with the chain stores, then the apple basket comes from

Good's Keystone Brand Sprays

KESO 83—An improved stabilized oil emulsion containing 83% by volume petroleum oil. May be combined with Lime Sulfur, Wettable Sulfur, Bordeaux, or Nicotine for dormant or delayed dormant spray.

KESO 66—66⅔% by volume petroleum oil emulsified with GOOD'S Potash Fish Oil Soap.

FISH OIL SOAP—For making your own emulsions with petroleum oil, ethylene dichloride, paradichlorobenzene, carbon bisulfide, etc. Efficient wetting and spreading agents and stickers, giving added insecticidal value to your spray mixtures.

JAMES GOOD, CO.

Manufacturing Chemists — since 1868

2106 E. Susquehanna Ave. Philadelphia, Pa.

under the counter, and apples assume the place of prominence that they deserve in the food store, and clerks are instructed in presenting them intelligently to the public.

Producers of sugar, flour, cereals, and other foods have given us thousands of dollars worth of free advertising and, incidentally, added color and attractiveness to their own work. In these ways we have distributed hundreds of thousands of pieces of display material and recipe books where they were most acceptable.

The price of all this -- a penny a bushel. The result -- tremendous.

Surely in this day of competition for the consumer's dollar, we cannot afford to be without able and efficient representatives whose business it is to care for our interests. Other food commodities spend millions of dollars in direct advertising. Citrus, for instance, has spent untold millions. Sun Maid raisins had admittedly spent $25,000,000 and others almost in proportion. Our resources are not sufficient to get anywhere in that line of work, but in our present lines we are getting wonderful results.

Our efforts in boosting peach sales have only covered the past two years. The support given by the growers in the various states was disappointing, but something did wonderfully help the demand for peaches in the last two years, and I think we are justified in believing that it was effort and money well-spent.

In view of the excessive peach planting of the past few years, peach growers should anticipate a lot of grief when these new trees get into full production unless a lot of intelligent effort is put into the marketing of the crops.

Rationing and other regulations and rulings have materially reduced our attendance so that most of the growers will not benefit by the "contacts" of the meeting, but we will see that all of the members get their printed reports as soon as we can, so that they may benefit by them as much as possible.

I want at this time to thank the members for the honor conferred upon me in making me your president and pledge you my earnest efforts for the good of the Association.

Harry M. Anderson

PENNSYLVANIA STATE HORTICULTURAL ASSOCIATION

Secretary's Account

1942 Receipts.

Jan.	24	Bank Balance	$ 259.05
		Advertising "Dec. News"	168.15
		Dues at Harrisburg Meeting	141.00
Jan.	26	Ketchum, MacLeod and Grove, Adv.	12.50
		R. S. Dillon, dues	2.00
		Elmore Turrell	2.00
Jan.	27	Jersey Package Co., Adv.	12.50
Feb.	7	Lebanon County Sec'y, dues	7.00
Feb.	14	Berks County Sec'y, dues	18.00
		A. B. Farquhar Co., Ltd., Adv.	10.63
		Lehigh County Sec'y, dues	30.00
Feb.	21	S. L. Simmons, Allegheny Co., dues	15.00
Mar.	2	G. M. Gardenhour, dues	2.00
		Luzerne County Sec'y, dues	27.00
		Victor Panovec, dues	2.00
		Micronizer Processing Co., Adv.	20.00
Mar.	9	J. L. Mecartney, dues	2.00
		G. R. Gressinger, Franklin Co., dues	27.00
Mar.	14	F. N. Fagan, dues	2.00
		Jas. G. Lamb, Adv	49.00
Mar.	16	Geo. Schriver, Adams Co., dues	35.00
Mar.	17	B. G. Pratt, Adv.	12.50
Mar.	20	A. W. Hetrick, Snyder Co., dues	17.00
Mar.	31	Geo. B. Merring, Wayne Co., dues	16.00
		A. L. Ebling, Berks Co., dues	5.00
Apr.	4	John H. Bice, Blair Co., dues	9.00
		C. B. Baldwin, Lawrence Co., dues	29.00
Apr.	8	Wick & Bros., Adv.	10.00
		Chipman Chemical Co., Adv.	20.00
		H. C. Worthington, Ches. & Del. Co., dues	25.00
Apr.	8	Albert Sidney Noble, Adv	10.62
		G. R. Gressinger, Franklin Co., dues	6.00
		Pa. Farm Bureau Co-op. Assoc., Adv.	12.50
Apr.	9	F. A. Read, Inc., Adv.	12.25
Apr.	10	H. G. Baugher, Adv.	12.50
Apr.	11	H. W. Stonebraker, Indiana Co., dues	33.00
Apr.	13	J. Hayden Twiss, Adv.	22.90
		Paris and Peart, Adv.	10.63
Apr.	14	Eschner Adv. Agency, Adv.	10.63
		Dennis Brokerage Co., dues	2.00
Apr.	16	Pacific Coast Borax Co., Adv.	7.50
Apr.	17	Anthony Hile, dues	2.00
		MacManus, John and Adams, Adv.	12.75
		G. R. Gressinger, Franklin Co., dues	3.00
		Fox and MacKenzie, Inc., Adv.	10.41
Apr.	20	Geo. L. Schriver, Adams Co., dues	6.00
Apr.	23	Jas. B. Wunder, dues	2.00
		A. L. Hacker, Lehigh Co., dues	5.00
		Chas. A. Rawson and Associates, Adv.	25.00
Apr.	24	G. R. Gressinger, Franklin Co., dues	2.00
May	2	Sterling Beeson, Inc., Adv.	8.50
		Central Chemical Corp., Adv.	15.00
		H. Lloyd Ott, Bucks Co., dues	13.00
		F. F. Meyers and Bros. Co., Adv.	20.00

May	9	Miller Chemical and Fertilizer Co., Adv.	7.50
		J. Walter Thompson Co., Adv.	10.41
		Jas. G. Lamb Co., Adv.	10.41
		H. W. Stonebraker, Indiana Co., dues	2.00
May	13	White Rock Quarries, Adv.	10.00
May	23	B. G. Pratt, Adv.	12.50
		A. L. Ebling, Berks Co., dues	2.00
		A. L. Hacker, Lehigh Co., dues	2.00
June	1	G. L. Schriver, Adams Co., dues	1.00
		Ketchum, MacLeod and Grove, Adv.	12.50
		Mercer County, dues	8.00
June	12	Russell S. Dayton, dues	2.00
June	27	Geo. F. Schriver, Adams Co., dues	3.00
June	29	Marlin T. Koch, Schuykill Co., dues	16.00
		Elias Berger, dues	1.00
July	3	Jas. D. Crist, dues	2.00
		National Gypsum Co., Adv.	20.00
		Pa. Farm Bureau Co-op. Assoc., Adv.	12.50
		F. A. Read, Inc., Adv.	12.50
		Jersey Package Co., Adv.	12.50
		Chipman Chemical Co., Adv.	20.00
July	6	Pacific Coast Borax Co., Adv.	7.50
		Fox MacKenzie Co., Adv.	10.41
		J. Hayden Twiss, Adv.	12.50
		Jas. Good, Inc., Adv.	7.50
		Samuel April, dues	2.00
July	10	F. Hayes White, dues	2.00
		J. G. Kuester and Assoc., Adv.	10.62
July	11	California Spray Chemical Corp., Adv.	12.50
July	13	Paris and Peart, Adv.	10.62
July	18	J. Walter Thompson Co., Adv.	10.41
		Geo. F. Schriver, Adams Co., dues	4.00
		Berks County Horticultural Assoc., dues	2.00
July	25	C. H. Musselman Co., dues	2.00
		Albert Sidney Noble, Adv	10.62
July	27	Bucks County Horticultural Assoc., dues	4.00
		B. G. Pratt Co., Adv.	12.50
Aug.	17	Lackawana Co. Horticultural Assoc., dues	5.00
		National Wooden Box Assoc., dues	2.00
Aug.	21	Miller Chemical Corp., Adv.	7.50
Sept.	12	Geo. Schriver, Adams Co., dues	1.00
Sept.	23	A. L. Hacker, Lehigh Co., dues	1.00
Sept.	26	Wick and Bros., Adv.	10.00
Oct.	2	F. A. Read, Inc., Adv.	12.25
		Pa. Farm Bureau Co-op. Assoc., Adv.	12.50
		Jersey Package Co., Adv.	12.50
		Jas. Good, Inc., Adv.	7.50
Oct.	10	Eschner Adv. Agency, Adv.	12.50
		MacManus, John and Adams, Adv.	12.75
		Pacific Coast Borax Co., Adv.	7.50
		J. Walter Thompson Co., Adv.	10.41
		Chas. A. Rawson & Assoc., Adv.	10.62
Oct.	12	Sterling Beeson, Adv.	8.50
Oct.	22	J. H. Knode, dues	1.00
		Geo. L. Schriver, Adams Co., dues	1.00
Oct.	29	G. R. Gressinger, Franklin Co., dues	1.00
Nov.	4	B. G. Pratt Co., Adv.	12.50
Nov.	6	H. G. Baugher, Adv.	20.00
Nov.	12	H. G. Baugher, Adv.	5.00
Nov.	23	J. G. Kuester & Assoc., Adv.	12.50

Dec.	11	American Potash Institute, dues	2.00
Dec.	14	Morris A. Barr, dues	1.00
Dec.	24	Atherton and Currier, Adv.	17.00
		Marvil Package Co., Adv.	20.00
		Jersey Package Co., Adv.	12.50
		Pacific Coast Borax Co., Adv.	7.50
		Florence E. Wunder, dues	2.00
		Miller Chemical and Fertilizer Co., Adv.	20.00
Dec.	31	F. A. Read, Inc., Adv.	50.00
		American Potash Inst., Adv.	20.00
Jan.	2	MacManus, John and Adams, Adv.	6.37
		California Spray Chem. Corp., Adv.	20.00
		J. Hayden Twiss, Adv.	10.41
		Jas. Good, Inc., Adv.	7.50
		Pa. Farm Bureau Co-op. Assoc., Adv.	12.50
		E. I. DuPont de Nemours & Co., Adv.	20 00
		F. E. Myers & Bros., Co., Adv.	20 00
			$1,972.20

1942 EXPENDITURES

Jan.	24	Postage, Freeport Sulphur	$ .35
Jan.	26	Philipsburg Ledger Co., December News	163.75
		Pennsylvania Council of Farm Organizations	5.00
Feb.	9	Cash, Telephone	1.20
		Mary E. Ruef, Stenographic service	25.00
Feb.	14	H. R. Rollins, Expenses Harrisburg Meeting	48.25
		V. R. Gardner, Expenses Harrisburg Meeting	51.61
		R. B. Corbett, Expenses Harrisburg Meeting	18.40
Feb.	16	Postage, Philipsburg Ledger	.86
Feb.	20	J. U. Ruef, Transportation, Philipsburg	5.20
Mar.	2	Truman Nold, Expenses Harrisburg Meeting	9.67
		F. P. Cullinan, Expenses Harrisburg Meeting	27.41
Mar.	7	Mary E. Ruef, Stenographic services	27.50
Mar.	16	Transportation, J. U. Ruef, Philipsburg	5.20
Apr.	1	Telephone and telegrams	3.94
Apr.	6	Philipsburg Ledger Co., Annual Report	300.00
Apr.	14	Postage	6.00
Apr.	18	W. B. Keeler, Labels	14.35
		Philipsburg Ledger Co., balance on report	204.54
June	1	Transportation, Philipsburg and Telephone	6.30
June	27	Mary E. Ruef, Stenographic services	24.50
		Transportation, Philipsburg	5.20
		Philipsburg Ledger Co., June News and Env.	151.29
		Philipsburg Ledger Co., Membership renewal blanks	2.25
July	7	Telephone and telegrams	1.75
July	10	Sylvia Meeker, Stenographic services	34.00
Aug.	8	Telegrams	1.05
Sept.	12	Transportation, Philipsburg	5.20
Sept.	16	Cash, postal deposit	10.00
Sept.	21	Mary E. Ruef, Stenographic services	20.00
Oct.	2	Philipsburg Ledger Co., Sept. News and Env.	154.40
		Telephone	1.66
Nov.	11	C. E. Dutton, Assessment National Planning Com.	30.00
Dec.	1	Transportation, Philipsburg	5.20
Dec.	2	Telephone and telegrams	2.11
Dec.	12	Transportation and postage	5.60
Dec.	15	Mary E. Ruef, Stenographic services	24.75
Dec.	31	Telephone and telegrams	5.44
			$1.408.93

FINANCIAL STATEMENT, JAN. 7, 1943

Jan.	7, 1942	Bank Balance		$ 259.05
		Receipts, Advertising and dues		1713.15
				$1,972.20
		Expenditures	$1,408.93	
		Bank Balance, January 7, 1943	563.27	
			$1,972.20	

TREASURER'S REPORT

Paul Thayer, Treasurer—January 13, 1943

1942			
Jan.	21	Balance	$ 1,726.03
Jan.	24	Received from Dr E. B. Bricker, dues	1.00
June	1	Interest Credited	16.34
"	"	Received from York Co. Assn., dues	56.00
Dec.	1	Interest credited	17.07
1943			
Jan.	4	Received from Dr. E. B. Bricker, dues	1.00
Jan.	12	Received from Lancaster Co., Assn., dues	45.00
			$1,862.44
April	17	Paid to L. E. Newcomer for services rendered	92.18
		Balance on hand Jan. 13, 1943	$ 1,770.26

Secretary Ruef's Account:

Jan. 21, 1942	Balance	$ 259.05	
	Dues and advertising	1,713.15	
		$1,972.20	
	Total expenditures	1,408.93	
	Balance		563.27
Total resources			$ 2,333.53

Approved Auditing Committee.

Francis Reiter
J. B. Kauffman

RESOLUTIONS

Whereas:

We learn with sorrow of the death since our last meeting of six of our valued members,

Ralph T. Crowell, of Buckingham
M. W. Welshans, of Jersey Shore
Paul C. Boyd, of Delta
George Stein, of Wrightsville
Daniel C. Jacobs, of Arendtsville, and
William W. Boyer, of Arendstville

And whereas:

We shall greatly miss their attendance at our meetings and their interest and loyalty in our association, Therefore, be it resolved:

That we hereby express our own sense of loss and deep sympathy to their families in their bereavement.

And further be it resolved: That this resolution be spread upon the minutes and that the Secretary be directed to send copies thereof to the respective families.

Whereas: The Pennsylvania State Horticultural Association has been informed that consideration has been given to an order or ruling to prohibit the use of wooden containers for packing certain fruit crops: The fruit growers of Pennsylvania recognize the urgent necessity for carefully apportioning the use of every material and facility needed for direct purposes, including lumber and man-power;

We also recognize and wish to accept our responsibilities as producers of food, which we must not only produce, but also package, store and ship;

Knowing our responsibilities and what they imply, we must insist upon the utmost conservation -- conservation of container materials, of transportation, of storage facilities, and of the fruits themselves, with all the materials and manpower they represent:

And whereas no substitute packages have been developed which are practicable in all stages of the normal travel of fruit from the tree to the consumer;

Therefore, be it resolved; That we strongly urge the War Production Board that a mimimum of restriction be placed on the manufacture and use of wooden containers until thorough tests of substitute materials have shown that packages made therefrom will carry fruits to the ultimate user in satisfactory condition.

Frederick E. Griest
J. Gordon Fetterman
George A. Goodling
Resolutions approved.

PEACH INSECT INVESTIGATION AND CONTROL*

H. M. Steiner, The Pennsylvania State College

* Authorized for publication on January 27, 1943, as paper No. 1161 in the Journal Series of the Pennsylvania Agricultural Experiment Station.

At your recent meetings, Doctor Worthley and I have given you results of our last few seasons' work with peach insects. He is now serving in the U. S. Army. I am sure that he would like to be remembered to all of you.

John Pepper and John Ruef invited me to cover the whole field of peach insect investigations but I must confine the discussion to a few pests of statewide importance and draw upon the work of others to give you a wider view than would be possible from our experiments in Pennsylvania.

The peach is a tender tree. Thus, we are limited in our use of insecticides and we feel the need for safer chemicals that will control peach pests. Until more of such materials are found, we must urge the full use of other control measures and adjust our control program to include the safest and minimum use of injurious materials. Most orchards not heretofore damaged by cold weather have suffered winter injury from the intense cold of last January and again last December, 1942. These injured trees are now more succeptible to injury by oils, arsenicals and possibly to materials used for peach borer. In some cases cold-injured trees will be less resistant to bark beetles and to certain other insects.

The Peach Tree Borer

Peach borer moths are on the wing in Pennsylvania from early July to late September. A single female may lay over 1000 eggs and may infest many trees in her lifetime. Eggs hatch in greatest numbers during late August and early September. Hatching is usually not complete until late September. Borer treatments for most of the peach growing areas of the state are usually most effective during the last week in September. Early September applications permit some of the late hatching larvae to enter the trees after treatment while very late applications give the borers a long time to feed and may increase the chances of injury from the treatments.

Paradichlorobenzene: PDB has been the standard material for treatment of peach borer for about 20 years. It is available in crystal form and in emulsible oils as **Boretox** and **Para-Scalecide.** It has been generally recommended for use in the crystal form and in a cottonseed oil emulsion. For early to mid-September applications, PDB crystals are most satisfactory for use against peach borer for they retain some degree of effectiveness against late hatching larvae. Crystals of PDB are applied in a narrow band one inch away from

Food Production is War Production

Let Tennessee Corporation help fortify your strip of America and combat fungus diseases with:

ES-MIN-EL

All essential mineral elements: Manganese, Zinc, Copper, and Iron; also Magnesium, Boron, and Cobalt. Greatly increases nutrient value of fruits. Appreciably increases yields.

ZINC SULPHATE

Stimulates growth of peach trees. Approved protective factor against arsenical spray injury in **Peach** and **Apple** sprays.

TRI-BASIC COPPER SULPHATE—53% Copper

For effective control of persistent diseases such as black rot on grapes.

34% COPPER FUNGICIDE

Used as a spray for control of severe infections of bitter rot on apples.

26% COPPER FUNGICIDE

For efficient control of bitter rot, scab, blotch, fruit spot, and other diseases on apples, cherries, pears, and other fruits.

TENNESSEE TRIPLE PEACH DUST

Complete dust for peaches.

TENNESSEE TRIPLE PEACH SPRAY

Complete spray for peaches.

The Mark of Quality

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Tennessee Corporation

ATLANTA, GEORGIA **LOCKLAND, OHIO**

the tree. They are mounded with soil to various depths. In our heavy Pennsylvania soils, gas is evolved slowly from the crystals, especially under deep mounds. We have found PDB crystals under six inch mounds more than six weeks after treatment when none were found under three inch mounds two weeks after treatment. The soil temperature at the level where crystals are applied has been measured and found to differ, being at times more than 5°F. higher under 3 inch mounds than under 6 inch mounds. When the temperature drops suddenly the gas from PDB sometimes condenses and forms crystals on the cool bark of the tree trunk. When this occurs a form of injury may appear as brown flecks or spots beneath the bark. The removal of deep mounds 4 to 6 weeks after treatment does not always leave sufficient time for the uncovered bark to harden before cold weather sets in and winter injury is thus aggravated. Since gas is evolved more quickly under 3 inch mounds than under deeper mounds, kill of borers occurs more quickly, and there appears to be less injury to the trees and the shallow mounds need not be removed until spring.

Emulsions containing PDB. Emulsions prepared by water dilution of either **Boretox** or **Para-Scalecide** have been much more satisfactory in our experiments than the cottonseed oil emulsion that we have used. The commercial recommendations for application of these materials call for treatment to the trunk and to the soil at the base of the tree. These materials are usually diluted at the rate of 1 part to 7 of water and are used in sufficient quantity to contain the recommended quantity of PDB for the tree. These materials kill more quickly than crystals for the gas is dispersed more rapidly. We have had good results with these materials where they were used from September 20 to October 20 and they have been safe on young trees. However, upon long standing and exposure to cold, these preparations tend to separate more or less. Thus great care should be taken to mix the concentrate thoroughly before using to insure a uniform dilution of the PDB. If this precaution is not taken, the first portion taken from a storage container may be too weak to give good control while the last portion containing more PDB may give serious injury. If these materials do not give a creamy white emulsion upon dilution after long standing they may also produce injury.

Ethylene dichloride emulsions: Commercial and home made mixtures of ethylene dichloride have been developed after the work of Dr. O. I. Snapp of the U. S. Bureau of Entomology. These have been widely used in several peach growing areas. In most orchards, ethylene dichloride has been used without serious injury. At currently recommend-

ed dosages it is more effective than PDB, especially at soil temperatures below 55°F. and it kills borers within a few hours after treatment.

Doctor Worthley reported to you last year on our previous experiments with ethylene dichloride injury. Reports of ethylene dichloride injury have often been traced to winter injury. The injuries actually traced to ethylene dichloride have been variously attributed to improper preparation, improper dilution and improper application of the emulsion. Trees are believed to be more susceptible to injury when applications are made in hot weather and when applications are made to wet soil especially in cool weather. Late maturing bark such as that on young trees and vigorously growing older trees in late seasons is thought to be more susceptible to injury. Unstable emulsions are thought to produce more injury than stable emulsions. Emulsions prepared with potash fish oil soap have been rendered unstable when filtered through some of our heavy Pennsylvania soils containing a high amount of moisture. Under these conditions and where the material has been placed against the tree trunk, raw ethylene dichloride can come into direct contact with the trunk and with shallow roots.

Our experiments with ethylene dichloride in Pennsylvania were designed to study relative differences in injury under different weather and soil conditions so most of our treatments have been applied directly at the base of the tree where materials were confined by shallow trenching. Applications made in this way gave no injury in 1938 and 1939 and a little injury in some treatments during 1941. However, applications made in the fall of 1940 produced severe injury that was most serious with treatments made on cool wet soil. Most of the injury from treatments made in the fall of 1941 occurred where applications were made to wet soil with materials confined to the base of the tree. More injury was encountered with trees in Penn gravelly loam than in Ashe-Porters loam or in sand. No injury attributable to ethylene dichloride occurred where the materials were confined to shallow trenches 1½ to 2½ inches from the base of the tree. Where the material was poured on unprepared soil (not loosened or trenched) it spread over a large area and gave poor control.

The recorded instances of injury from ethylene dichloride should not detract greatly from the value of the material as a peach borer treatment but should serve to emphasize the several precautions that might be observed for its safe use. Better emulsions can be made with materials other than potash fish oil soap. Other carriers than

water are also receiving attention. Just now the supply of ethylene dichloride is short for immediate use but in time this material or others will provide us with a much improved treatment for peach borer. Present recommendations call for application of ethylene dichloride made in such manner that none of the material comes in contact with the tree trunk.

Recommendations:

1. Level the soil around bases of trees before moth flight begins in early July.

2. Loosen the soil around the trees and remove masses of gum immediately before applying the treatment.

3. Avoid making applications at high temperatures, while the soil is frozen or so wet that it will ball up if squeezed in the hand.

4. Use the standard dosage or dilution of materials developed for the age of tree to be treated. Such dosages are stated on containers of commercial preparations and are given to you annually by your extension specialists and County Agents.

5. (a) Late September applications are most satisfactory in much of Pennsylvania. From September 20 to October 10 use either PDB crystals in a narrow band one inch away from the base of the tree or emulsions made from either well-stirred **Para-Scalecide** or **Boretox;** mound with 3 inches of soil and leave undisturbed until spring.

   (b) If the rush of work necessitates treatment in early September, use PDB crystals in a narrow band one inch from the base of the tree; mound with 6 inches of soil and remove mounds 2 to 3 weeks after treatment. Deep mounds can be used more safely at this time for the temperatures are usually higher than later. A few late-hatching larvae usually enter early treated trees but PDB crystals provide longer protection against these than other available materials. Late removal of mounds increases the danger of either PBD or winter injury.

   (c) Ethylene dichloride emulsions can be used from late September until the ground freezes. Avoid quick-breaking emulsions. Keep the materials well mixed by constant agitation; apply the standard dosage to loose soil close to the tree but at such distance that the material does not wet through to the trunk. Cover with 2 shovels of soil.

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(d) The liquid treatments for borers may also be applied in the spring but this practice is evidence of poor management as it permits too much time for the borers to feed.

The European Red Mite and the Scale Insects

The effects of late dormant oil sprays on these pests was discussed at your meetings last year. The regular dormant oils at a concentration of 3% are satisfactory for San Jose scale. Oil at this concentration has some value for terrapin and other Lecanium scales and for European red mite. The use of oil at more than 4% concentration is seldom justified for these pests. Late dormant sprays are most satisfactory if applied in clear, calm, warm weather just before the buds crack. Where control measures have not been applied for leaf curl, 2 gallons of liquid lime sulfur per 100 gallons of 3 to 4 per cent oil spray can safely be applied with oils emulsified with lignin pitch or stabilized for use with lime sulfur.

It is doubtful whether any winter injured trees should receive more than 3% oil and then only under ideal weather conditions.

We expect that the current research on oils, now being conducted by Dr. Chapman and his associates of the New York Station will soon give us specifications for better oils that will apply to our needs on peach.

Single summer treatments of summer oil alone and of summer oil with nicotine sulfate or rotenone have been partly effective against European red mite and young terrapin scale. However, we do not yet have an oil that fits into the summer schedule of sulfur for disease control. Generally summer oils cause injury if used less than 4 weeks after sulfur on peach.

Some of the di-nitro salts are effective against the active stages of the European red mite. We have used DN-111, a dicyclohexylamine salt of dinitro-ortho-cyclo hexylphenol, effectively against active mites but it had little effect against eggs and applications must therefore be repeated. It may be used with wettable sulfur but its effectiveness is reduced where lime is included in the spray. We have had good results where 1 lb. of the 40% powder was used per 100 gallons of spray. The petal-fall period is the most timely for foliage sprays against red mite.

Mannitan monolaurate alone and with added cube' or rotenone extractives has given good results against active mites as have various rotenone sprays but these lack effectiveness against eggs and must therefore be used in more than

one application for good results if applications are made after the petal-fall period. The supply of these materials is short at the present time.

Eggs of the European red mite are more abundant than usual in many orchards at this season and while the number of overwintering eggs does not provide a good index of the damage that may be expected during the following season, heavy damage is more likely to occur than where small numbers of eggs are present.

The Plum Curculio

Wherever full crops of peaches were produced in Southern Pennsylvania during 1942, the plum curculio is likely to be more injurious during 1943. The period of curculio attack was shortened by dashing rains in the early season of 1942 and generally less injury was experienced in most orchards. However, the moist soil and the lack of cultivation favored the development of larvae and pupae in the soil so that larger than normal numbers of adults matured and entered hibernation. I doubt that this condition exists in parts of the state where curculio attack had not progressed so far before the rains as it had in Southern Pennsylvania.

Arsenical injury: Injury, especially to budwood, again appeared in 1942. This was prevalent on soft bark in several orchards where arsenate of lead was used at 2 lbs. per 100 gallons of spray safened with zinc sulfate and hydrated lime. It did not appear where **basic lead arsenate** was used at 4 lbs. per 100 gallons of spray with 4 lbs. of hydrated lime. Zinc sulfate and lime gave good protection from arsenical injury to foliage but did not retain its effectiveness long enough to protect bark of bearing wood on which injury appeared late in the season. Additional sprays of zinc sulfate and lime may be needed following the curculio sprays for added safety in wet seasons.

Effectiveness of basic and acid lead arsenates: Field tests since 1939 have shown slight advantage in control where acid lead arsenate was used in comparison with a double amount of basic lead arsenate. Feeding tests in 1942 on foliage and fruits gave the following results: 25 males and 25 females placed on sprayed fruits and foliage 2 days after the shuckfall spray lived an average of 18 and 13 days after basic lead arsenate and acid lead arsenate sprays, and the females laid a total of 241 and 186 eggs in fruits replaced at 5 day intervals until all adults were dead. In this series of tests, adults on unsprayed fruits and foliage lived an average of 26 days and laid a total of 582 eggs. There was little difference in the total number of eggs laid in sprayed and unsprayed fruits during the first five days

of the test but the differences were larger at later intervals. Had spray applications been repeated, greater effectiveness of the sprays in relation to the check might have been observed. Our tests show that 2 lbs. of acid lead arsenate do not provide a high degree of control against plum curculio and that a spray of 4 lbs. basic lead arsenate plus 4 lbs. hydrated lime per 100 gallons of spray is almost as effective while producing less injury to the trees. We have gotten nowhere in our efforts to safen the more effective fluorine sprays for peach. However, we have hopes that some safener may be found or that other materials or combinations not yet tested may have more value against curculios than the safe dosages of arsenicals.

Dr. Snapp has used 2 applications of dichloroethyl ether in soil treatments to kill larvae and pupae in Georgia peach soils. The problem is more acute where the plum curculio produces a second brood. While we believe that existing control measures can be used to better advantage than they have and thus avoid the need for soil treatments, this additional measure provides equipment to handle an orchard problem that does not respond properly to conventional methods, when the material becomes readily available.

Timely early thinning and destruction of thinnings or drops by placing them in containers partly filled with water and a little crank case oil offers additional means for some orchardists to attack this pest.

The difficulty in making general recommendations for the plum curculio lies in the fact that losses range from less than 1% to more than 50% in Pennsylvania orchards. Measures that may be essential in one orchard are superfluous in others. In many orchards, the injured fruits drop and are removed in thinning operations while the orchardist underestimates his carry-over of curculios and can not understand a later seemingly sudden increase in curculio injury. The problem varies from orchard to orchard because of (1) variations in time of emergence of overwintered adults that appear early on southern slopes and late on northern slopes and along deep ravines: (2) differences in numbers of fruits available to curculios: (3) differences in amount and quality of curculio shelter: (4) differences in soils and soil moisture at critical periods while larvae are entering the soil or pupating therein: (5) variations in cultural practices and time of tillage: (6) variations in carry-over in wild hosts or in nearby cultivated fruits: (7) variations in time and number of control practices.

Supplementary control measures: These measures for all-over treatment of heavily infested orchards or for border

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rows of moderately infested orchards have been suggested by various workers. (1) timely destruction of overwintering shelter at about the pink stage of Elberta; (2) timely jarring of all or border rows to remove adults; (3) timely early thinning and destruction of thinnings or timely destruction of drop fruits: and (4) timely cultivation to destroy larvae and pupae in the soil. The latter measure is best accomplished during dry weather. Two or more thorough cultivations of the soil to a depth of 2½ inches are usually timed for the first and third weeks in July.

In general, 4 lbs. of basic lead arsenate plus 4 lbs. of hydrated lime per 100 gallons of spray applied in petal-fall, shuck-fall and 10-14 days later offers greater safety from arsenical injury in wet seasons than the slightly more effective acid lead arsenate- zinc sulfate- lime sprays that are commonly recommended. In severely infested orchards, supplementary control measures must be employed and it may sometimes be worthwhile to increase the use of arsenicals to include 3 lbs. of acid lead arsenate per 100 gallons of spray with a weak zinc sulfate-lime safener and continue the use of zinc sulfate-lime in one or two sprays after the curculio sprays have been applied. The shuck-split spray is generally the most effective of the three sprays but two others are usually needed although the weak concentrations of arsenicals now used are not sufficient to guard against outbreaks in years favorable to curculio unless supplementary measures are used.

We are usually aided in curculio control by weather conditions adverse to the development of certain stages of the insect. Larvae and pupae often suffer a high mortality when the surface of the ground is slaked and hard and when the temperature is very high. Larger numbers of larvae mature in drop fruits in shade than in sunlight. Adult beetles live longer in cool weather than in hot dry weather. The plum curculio has a few natural enemies that are of no economic importance in Pennsylvania.

The Japanese Beetle

The Japanese beetle is steadily entering the main peach belt of Pennsylvania. It is a general feeder but it should be considered in any discussion of peach pests for it is especially destructive to mid-season ripening peaches.

As you know, it breeds prolifically in permanent grasslands. Arsenical treatment have been very effective in killing grubs in heavily infested sods and I understand that most lawns and golf courses in Southeastern Pennsylvania have been so treated. This treatment of 10 lbs. lead arsenate per

1000 sq. feet is much too expensive for use in the pasture land and wasteland that is common in our large peach growing counties of the state.

Parasites of the Japanese beetle have received much attention by the U. S. Bureau of Entomology and the **Typhia** wasp and other parasites were widely liberated against the pest some time ago.

Many years ago, workers in the U. S. Bureau of Entomology began intensive studies on bacterial diseases of the Japanese beetle grubs. The milky diseases now offer much hope for alleviating and preventing severe losses from this pest. The milky disease organisms were spread in small experimental plots at West Chester, Pa., in the fall of 1935 and subsequent examinations by the Bureau workers showed that it had increased markedly by 1939. Although the devolopment of this work has been accompanied by many difficulties, it has reached a stage where widespread establishment of the diseases has been undertaken in the Eastern states. Your Entomologists of the Pennsylvania State Department of Agriculture are cooperating with the U. S. Bureau in distributing milky white diseases in the state. Dr. Tom Guyton has told me that all of Lancaster and part of York County have been treated with 2 one-half acre plots per square mile wherever breeding grounds were present and that he and his men have treated many other spots in the state. This work will continue in 1943.

It takes time for such diseases to build up to beneficial proportions so there will still be need for protecting peaches by repellent sprays. Some of the materials used in sprays for Jap beetle are temporarily unavailable but I understand that zinc sulfate-lime sprays may be used fairly satisfactorily as a repellent during periods while adult beetles are feeding.

Doctor Langford and other Maryland workers report that considerable reductions in numbers of beetles can be obtained by intensive trapping by using bait materials that had previously been used in scouting for beetles. He is now trying to find better substitute materials and more economical methods of using baits.

Certainly the Jap beetle does not present the great fear to fruit growers that was general a few years ago although continued effort is needed to bring the pest under control.

The Oriental Fruit Moth

Sprays and dusts: No really effective sprays or dusts have yet appeared that are suitable for general recommen-

dation against the Oriental fruit moth. There are a number of materials that will kill almost 100% of the eggs or larvae that are exposed on the tree at any one time. Protection is needed for such a long period that presently used materials are inadequate for good control for most of them provide protection for only 5 to 10 days. The development of satisfactory sprays should not be impossible. Materials used at the present time generally require 5 or 6 applications for protection against the last brood only. An oil-sulfur dust was developed in Illinois by W. P. Flint and his associates that gave good results over a period of years. It consisted of a 60-15-20-5 mixture of sulfur, lime, talc and petroleum oil. A similar dust gave fair results in tests by Doctor Dean in New York during 1941. Ralph Dean also tested Xanthone and fixed nicotine sprays and obtained only fair results. Most materials that have shown value against oriental fruit moth leave an objectionable residue at harvest or stain the fruit by interference with normal color development. The years when late brood sprays may be needed cannot be predicted with much success because of the variations in control by natural enemies.

Baits: Baits have been tested widely for the oriental fruit moth. Tests have shown that large numbers of moths can be captured. No general agreement has been reached on the most attractive substance to use in baits. Mr. Bobb of Virginia caught more moths in his experimental tests with a small amount of terpinyl acetate in a 5% lignin pitch base than with any other from 1936 to 1938. Terpinyl acetate was one of the best attractants tested by Doctor Frost in sweet baits during several seasons' work in Pennsylvania. In general, the investigators seem to hold the opinion that large scale or community baiting for fruit moth is a practical control measure but baiting of small orchards in the midst of large unbaited areas may actually increase the moth populations of the small baited areas and thus do the baiter more harm than good. In large scale tests conducted by the U. S. Bureau of Entomology in Georgia and in Indiana, high percentages of marked moths were captured and significant reductions in fruit moth infestation were obtained in large baited orchards.

Natural enemies: Oriental fruit moth parasites have been released thruout the Eastern states by the U. S. Bureau of Entomology and several state agencies. Macrocentrus **ancylivorous,** also a parasite of the strawberry leaf-roller and a native of New Jersey received greatest attention. In most areas where it was released, it soon increased greatly in numbers. In some areas it appears to freeze out in very cold winters. This was believed to have happened in Northern Ohio

and in Northern New Jersey as well as in other areas. **Macrocentrus** was widely released in Pennsylvania by cooperation between the U. S. Bureau and the State Department of Agriculture several years ago. It was the most abundant species in Adams County during 1938 but we found none in the few July collections that we reared in 1942. Native parasites, many of which also attack the ragweed borer, are common in Pennsylvania but few are of economic importance. In view of the good results that generally accompanied the liberation of **Macrocentrus,** it would seen that fruit growers would make some effort to keep it in their orchards. Some states make these available to their growers thru various arrangements but fruit growers can hardly expect this to be done for them indefinitely. At the present time, **Macrocentrus,** are available to growers thru at least one commercial collector in New Jersey. Some Pennsylvania growers have taken advantage of this opportunity to secure colonies at occasional intervals. Perhaps some effort should be made to maintain larger numbers of the alternate hosts of fruit moth parasites such as the strawberry leaf-roller and the ragweed borer in peach growing sections.

SOME NEWER METHODS OF SOIL MANAGEMENT IN PEACH ORCHARDS.

R. D. ANTHONY, Pennsylvania State College

When the Arendtsville Fruit Research Laboratory was being reorganized five years ago, the fruit growers' advisory committee was asked to name the most urgent problems for that area. The committee was unanimous in stating that better methods of peach orchard soil management should be the first problem to study. Shortly after that one of the leaders in the research work of the U. S. Soil Conservation Service told us that there was not a peach orchard from Maine to Georgia that did not have a soil erosion problem.

As soon as Prof. C. O. Dunbar came to the Laboratory from Connecticut, he began to study experimental areas in various nearby commercial peach orchards. At this time the College and the Soil Conservation Service entered into a joint agreement under which Dr. Nelson Shaulis was assigned to the Laboratory to aid in the soil studies. With these two men both spending much of their time in the peach orchards of that area the work has advanced steadily.

Generations of experience have lead our peach growers to believe that three months of intensive cultivation are desirable. This treatment has grown good trees and produced large crops but, unfortunately, it has been responsible

for the serious depletion of the soil in nearly every peach orchard in the state and has materially shortened the lives of these orchards.

You are all familiar with the steps in this process of soil destruction. The intensive cultivation of the young orchard creates conditions very favorable for breaking down the organic reserves of the soil. This releases a plentiful supply of plant nutrients and for a number of years the trees make a vigorous growth until the organic supply of the soil has disappeared to such an extent that the rains puddle the surface into an almost impervious putty. Then the rains wash down the slopes taking sheets of surface soil along. Gullies begin to appear, the trees suffer from lack of soil water and soil nutrients. Then you pull out the trees and spend the next five years trying to get the land back into production again.

Many of you will remember the demonstration Dr. Shaulis gave you at this meeting last year. He showed you a clod of earth taken from one of our peach plots which had received the usual treatment of two to three months of cultivation each year and another clod from a plot which had a minimum of cultivation and had grown a cover for nearly the entire year. When he submerged these two lumps, the one from the cultivated plot quickly disintegrated and formed a tight layer of mud at the bottom of the jar while the other lump held together for many minutes. The one soil washes badly in moderate rains; the other absorbs even heavy rains with little soil loss.

The job of the men at the Laboratory was to find ways of growing good peaches which would be economical and which would not wreck the soil but would actually improve it.

It is an easy job to stop erosion and build up a soil. This is being done in practically every apple orchard in the state. Short rotations of legume sods with lime, phosphate and potash to grow more cover and nitrogen to grow more trees have answered this problem. But when this system was tried in our peach orchards, tree growth and yield both suffered, especially in dry seasons. The problem, then, was to find some intermediate system of soil management which would not check the trees but which would also preserve the soil.

In the apple tree, the fruit spur which is the bearing area of the apple makes its elongation in a few days or a few weeks also the apple fruit bud is initiated very early in the season. The one-year growth at the ends of the branches does not become the fruiting area till two or three years later. In the peach, this season's terminal growth of the branches con-

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tains the fruit buds for the next crop. These buds may have been initiated all through the summer. If the terminal growth is short, next year's crop is decreased. To insure sufficient bearing area vigorous growth must be maintained in the peach tree long past the time when terminal growth in the apple may have ceased. Even a moderate amount of secondary branching on this season's terminal is desirable in the peach, especially in the younger trees.

This long-continued growing period cannot be maintained without a plentiful supply of plant nutrients in the ground, especially nitrogen, and this must be available much longer in the summer than is necessary with the apple. Also the leaves must be in healthy condition both to elaborate the materials necessary for this growth and to build up the carbohydrate reserves which seem essential to encourage the formation of fruit buds.

When sod rotations proved undesirable for the peach, the next step was to try cultivation on one side of the row with sod on the other, reversing these treatments each year. This proved considerably better than sod on both sides of the tree but in dry summers tree growth was checked and fruit size decreased. In wet years with trees in fairly deep and well drained soil such a treatment might be satisfactory but we can't foretell the weather.

Both Prof. Dunbar and Dr. Shaulis soon became convinced that some degree of annual cultivation was desirable in the peach orchard and that this cultivation could be used to stimulate a more vigorous summer growth of the tree. But many years of experience at the College had shown that any cultivation which left the ground bare for even a month could cause undesirable soil and water losses even on moderate slopes. This left a narrow range into which to fit cultivation without injury to the soil.

For four years one system of soil management has been under test at Arendtsville which involves a minor degree of annual cultivation yet which keeps the ground covered either with a growing cover or enough trash from the old cover to make the surface permeable and keep down water losses even in heavy rains. This system is proving so successful in growing trees and producing good crops and, at the same time, building up the land that a number of peach growers who have watched these tests are giving it a trial.

Under this system, one of the most important steps in securing a longer spread of the supply of plant nutrients in the soil has been to shift the first cultivation from early spring to mid-June. An application of a nitrogenous fertilizer is made in spring to give the trees a good start. Also at

this time phosphate and potash may be used to thicken up the cover which has lived through the winter. The mid-June cultivation is light - a "trashy" cultivation - so as to leave from a quarter to a half of the cover still growing.

A second, and last, cultivation is given in mid-July when the last of the cover crop is worked down but leaving as much of the dead cover on the ground as possible and still have a fair seed bed. The land is immediately reseeded and cultipacked. This firming of the soil is essential as the cover crop residues make such loose seed bed that dry weather following seeding would kill much of the sprouting seed if the cultipacker or roller were not used.

In this trial the cover has consisted of a mixture of 8 pounds of crimson clover and 8 pounds of winter vetch per acre with 2½ pounds of millet as a nurse-crop. The millet seems to shade the young clover plants from the hot summer sun and during the winter the stiff stalks hold the fallen leaves and snow. The first cultivation comes when the crimson clover seed head is maturing; the second when the earliest seed pods of the vetch are maturing.

We do not know the northern safe limits of crimson clover. It seems to grow successfully throughout southern and southeastern Pennsylvania and, used in the way we are trying it, it seems hardier than with later seedings. We are also trying other combinations of legumes which are more hardy but our experience with these is too limited to make any recommendations at present. Another and unusual system of soil management has interested us a good deal. We need more experience to know how widely it could be used in other parts of the state but its cheapness and its efficiency in preventing soil erosion and in growing desirable trees make it desirable to extend its trial. Korean lespedeza is seeded in early spring. If the land has not grown this crop before, the seed should be inoculated. If growth is rapid and the cover becomes thick by late June, it can be very lightly disced to cut out part of the plants or it can be mowed. If the weather is wet this reduction in the cover will be unnecessary.

Korean lespedeza is an annual. By November the ground should be well covered with a dry mat of plants containing quite a supply of mature seeds. This is roughly disced along the contour. This partly covers the old plants and removes a serious fire hazard. The disc ridges and the trash cover prevent any serious soil erosion. Lespedeza seed sprouts so early in the spring that any spring working of the land destroys a very large part of the new seeding. For this reason nothing is done to the soil until the following November unless there is necessity for a summer checking. A spring

application of nitrogen is necessary and possibly another one in early summer.

In one five-year old peach orchard, where lespedeza was seeded the year the trees were planted, natural reseeding has maintained a heavy stand each year. Usually only the November discing has been given but in two years the cover was checked in mid-summer by a light working and the mower has been used the other years. Nitrogen applications have been made each spring and also rather heavy applications of potash because of a serious potash deficiency. Some of the orchard is on a 20% slope yet there has been no serious soil loss. The trees are large for their age, yields are good and fruit size, color and quality are satisfactory. We know of no other successful peach orchard where the costs of soil management have been so low.

We do not yet know how widely Korean lespedeza can be used in the state; also there are other lespedezas which are reported as more hardy which need to be tested.

These experiments on soil management are only a beginning. We are certain we can stop soil erosion and build up the land. We think we can grow good peaches. We hope to be able to do both at the same time. Like all orchard operations it will not be possible for an outsider to tell you how to handle your land. These experiments are suggestive but they must be checked in your own orchard. If you have a well drained soil three to five feet deep you may find a certain system entirely satisfactory which fails in another orchard with a shallow, poorly drained soil. Those who survive in the business of fruit growing must use their eyes and their heads.

PEACH DISEASE CONTROL BASED ON RECENT EXPERIMENTAL WORK.

HAROLD J. MILLER, The Pennsylvania State College

Difficulties in Spraying Peach. Before discussing the experimental work on peach disease control I think it would be desirable to consider some of the factors which tend to limit the effectiveness of sprays on peaches. We tend to overlook these factors too easily and come to expect that a given spray material or schedule should, theoretically at least. be capable of giving completely satisfactory control. Unfortunately, such is not the case, as many of you growers will readily testify.

One requirement which must be fulfilled to get disease control with spraying is complete coverage of the plant part

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to be protected. This is not very easy to do with the peach. In fact, it is impossible with ordinary methods of spraying to get complete coverage of most of the peaches on a tree. One cause of this is the presence of foliage which partially covers almost every fruit during the later stages of development. In spite of thorough spraying or dusting, almost every fruit will have a part of its surface unprotected because of these leaves. Complete coverage of the fruit is also limited by the fact that the peach does not become "bald". The fuzz prevents the spreading of the liquid spray materials on the fruit, making it hard to wet with water.

Another factor limiting the control of brown rot by sprays is the tendency of certain varieties to crack at maturity exposing the flesh of the fruit which no spray application can protect. Insect and mechanical injuries expose unprotected areas to rot also. Early varieties planted adjacent to later maturing ones permit the brown rot inoculum to build up. This situation is especially bad if these early varieties crack easily such as South Haven.

The necessity of having fruit with a clean finish for marketing automatically limits the choice of materials to be applied in the two or three week period before harvest. Only those sprays leaving no objectionable residue can be used Unfortunately, this period represents the time of greatest susceptibility to brown rot.

Thus, the effectiveness of any new material or spray schedule will be sharply limited by all these factors plus many others which I haven't time to mention. Perhaps we even can say that completely satisfactory control of rot in a wet year cannot be hoped for with the present spray materials. Therefore, it is evident that we are faced with serious difficulties in developing a spray for brown rot control.

Experimental Work. With the introduction of self-boiled lime sulphur the first safe spray material for peach foliage came into use. Since then we have seen the introduction of the so-called dry-mix or homemade wettable sulphurs, commercial wettable and paste sulphurs, and dusting sulphur.

In reviewing the experimental data of five years' work on brown rot control one of the results that we should not overlook is the fact that the unsprayed check trees have always had more rot than any of the spray treatments. This proves, of course, that in spite of the diffiiculties involved in spraying the peach which we have just mentioned, a considerable amount of control is obtainable.

Having established the feasibility of spraying, we now are faced with two important questions to answer. These are (1) what is the best material to use and (2) what timing and number of applications will give best control?

Most of the experimental work has been conducted on types of materials. The old question as to the relative difference in effectiveness between self-boiled lime sulphur and commercial sulphurs would seem to be of academic interest only now, since growers do not feel justified in going to the extra bother of preparing it. The difficulty of eliminating the coarser particles is specially objectionable. Experimental work has shown no difference in control between self-boiled and wettable sulphurs when used at equivalent concentrations of sulphur. Some of the results seem to indicate that increasing the concentration of a wettable sulphur to the amount formerly recommended with self-boiled will give slightly better control. However, this has not been consistently true for all the treatments tested on this basis.

Little difference in control has appeared between the various types of wettable sulphurs used. It would seem that particle size of sulphurs is not of commercial importance in brown rot control. The choice of a material would appear to be decided by cost, lack of residue at harvest, etc.

The use of liquid sprays other than paste sulphurs or self-boiled lime sulphur has not resulted in objectionable residues at harvest. Thus the advantage of dusting would seem to be only in the speed of covering larger orchards in a short time.

The use of a petal fall application of sulphur in 1940 gave better control than treatments where it was omitted. Beneficial results from this spray could be expected, of course, only in seasons which were wet at the time of this application. However, since a lead arsenate spray is now being suggested at petal fall the inclusion of a sulphur at this time would seem to be rather cheap insurance. The pink application of a sulphur has been tried in a limited way and not enough data have been obtained for any conclusions as to the value of this spray for brown rot control.

A glance at the table showing the 1940 results illustrates some of the points I have been discussing. This was the year in which we had the most rot in any of the five years' experimental work.

Brown Rot Control Data in 1940

		% Fruit with rot	
		Elberta	Hale
0.	Unsprayed check	88.0	56.9
1.	Self-boiled lime sulphur	6.9	8.4
2.	Mike sulphur (at same conc. as self-boiled)	2.3	9.0
3.	Magnetic sulphur (at same conc. as self-boiled)	2.3	7.4
4.	Tank-Mix wettable 5-100	12.9	13.8
11.	Same as plot 3 but with petal fall spray	0.7	13.8

The self-boiled sulphur was applied at the rate of 8-8-100 at shuck and followed by two applications at 12-12-100. Dusting sulphur was applied at harvest. Mike and Magnetic were used at the same rates as the self-boiled. The tank mix sulphur was made with one pint of Orthex.

For two years we have tested an entirely new type of material for brown rot control. It contains no sulphur or copper but is called an organic material by the chemists and goes by the commercial name - Fermate. Results are inconclusive as yet but I think the experiences of you growers added to the experimental results which I have been discussing, most certainly emphasize the need for a new type of material. We have tried the available sulphurs so long without completely satisfactory results that the hope of the future would seem to be in the development of these new fungicides. It is encouraging that several are appearing now for experimental use and recent results on other fruits make them look very promising.

I have not said anything about scab control on peach as it does not need any attention provided the regular brown rot sprays are applied. Leaf curl experiments have been in progress for two years but no results have been obtained due to the lack of disease.

APPLE DISEASES AND PLANS FOR THEIR CONTROL IN 1943

R. S. KIRBY, The Pennsylvania State College

Producing more apples to win the war means adopting greater efficiency in production methods. Disease control methods, while an essential step in maintaining production, must be checked to determine how to get the greatest return from each man hour and unit of spray material and machinery.

The first step is to determine just what apple disease means to the Pennsylvania grower. Fortunately we have

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Ed. F. Kuhn manages his father's fruit farm in Swewll, N. J., and sprays every seven days with his 600 gallon Iron Age Skid Type Orchard Sprayer. Loaded with the full 600 gallon of spray material the outfit is easy to handle and only on two occasions when mud was deep did Mr. Kuhn have to start out with less than a full load.

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records for the past ten years on the amount of disease in unsprayed and sprayed orchards.

The records on some 3000 orchards show that during the past ten years an average of one and one-fourth different disease rots or blemishes have occured on each unsprayed apple in Pennsylvania. This means that any grower who left his orchards unsprayed had an average of more than one disease on each apple. The records show that 98.7 per cent of these diseases could have been prevented by proper spraying, supplemented with canker removal and the destruction of mummied apples. Those growers who followed these disease control practices had an average of 1.8 per cent of their fruit injured by disease.

The more important disease situations discussed below, should enable the grower to better plan his disease control program.

Apple Scab. This is the most important apple disease in Pennsylvania. In addition to infecting an average of 68.9 per cent of the unsprayed apples during the past ten years, scab reduces fruit set and tree vigor. The fungus causing scab lives over the winter in the old dead infected apple leaves. The following spring under favorable conditions over 175,000 spores can be shot from one leaf. Each of these spores can infect a new leaf, flower stem or bud in 4 to 6 hours if the new growth is wet and the temperature is from 68 to 75°F.

Scab Situation in 1942. The average state wide percentage of scab in unsprayed orchards was 50.7 per cent. This was 18.2 below the ten year average. In only the drought year of 1936 was there less scab than in 1942. Scab varied greatly in severity in different parts of the state.

There was a direct relationship between the amount of rain in April and May and the amount of scab occurring in the various sections of the state.

RELATION OF RAINFALL TO OCCURRENCE OF SCAB

Section of State	Precipitation in inches		Percentage Scab in unsprayed apples
	April	May	
Erie-Ebensburg	3.17	6.31	100.
Western	2.59	5.84	47.9
South Central	1.92	6.95	73.6
North Eastern	1.56	6.69	50.
South Eastern	1.54	4.78	32.5
Chester-Delaware	1.29	1.79	13.0

In the Erie-Ebensburg section where scab was severe in 1942, three pre-blossom sprays, a petal fall spray and three cover sprays were necessary to keep scab in check. In all

the other parts of the state it was possible to keep scab in check with two-blossom sprays plus petal fall and cover sprays. A contributing factor in being able to omit one of the pre-blossom sprays was a dry fall in 1941 which reduced the amount of scabby leaves on the ground in the spring of 1942. In the South East, scab conditions were the least favorable and a pink spray or one pre-blossom plus petal and cover sprays held scab in check. In the Chester-Delaware area where little or no rain fell until after the second cover spray, scab was controlled with a couple of cover sprays.

Sprays for 1943. Only as conditions develop in any section this spring can there be an answer given as to how many sprays will be needed. In general in the Erie area and other areas where scab was severe in 1942 three pre-blossom sprays will be needed in 1943. In those parts of the state, west, central, northeast, and southeast where less scab was present than usual in 1942 an effort will be made to omit one pre-blossom spray in 1943. However, many factors such as maturity of scab spores, amount of rain and favorable temperature must be considered for each locality before it is safe to omit sprays. Spray information letters will give the latest information and final decisions on the number of sprays needed.

In the Chester-Delaware area and in the Southwest corner area where little scab was able to develop last summer, it is hoped that one and maybe two pre-blossom sprays can be omitted.

Scab susceptibility of different varieties must also be considered. Very susceptible varieties like McIntosh should receive three pre-blossom sprays even where scab was below normal last year. The more scab resistant varieties, such as Baldwin, Grimes, Golden Delicious, and York with one less pre-blossom spray will usually have no more scab than Red Delicious, Rome, Stayman, Smokehouse and Winter Banana.

Spray Materials Needed for Scab Control. Lime sulphur is the most effective sulphur type of spray for disease control but it usually causes the most leaf burn. The addition of Manganese sulphate to lime sulphur (Catalytic lime sulphur) greatly reduces the danger of spray injury without apparently reducing the ability of the spray to control scab. Wettable sulphurs lack the ability to work back and kill out infections and must be applied before or during rains or before infection has taken place. The wettable sulphurs, with smaller particle size, are reported as more effective than those with large particle size. The paste forms of wettable sulphurs are reported as being more effective than the dry forms.

In June and July when temperatures are often above 85°F all forms of sulphur are likely to cause burning In the warmer or southern parts of the state, Bordeaux used in the last cover sprays has reduced leaf injury. Bordeaux if used to excess or under unfavorable conditions is likely to russet the fruit and cause leaves to turn yellow and fall. Bordeaux and othe copper sprays are likely to cause injury if applied to wet foliage and for safety should be applied to dry foliage only on warm days. Bordeaux and other copper sprays are most likely to injure apples from petal fall on for a period of about four weeks. At the end of this time of growth the young apples lose the fine hairy covering and become less susceptible to copper injury. Bordeaux 1-5-100 used in the 3rd and 4th cover sprays has proved to be very effective in preventing all diseases except bitter rot and severe cases of blotch.

The general plan for 1943 will be to use liquid lime sulphur in the pre- blossom sprays.

For the petal fall, 1st and 2nd cover sprays catalytic lime sulphur or wettable sulphurs will be generally used. Where scab is severe or on very susceptible varieties liquid lime sulphur may be needed.

For the 3rd and 4th cover sprays... The time of the last spray application depends on many factors, such as the amount of sooty blotch and storage scab that usually develop in any locality and on the amount of disease present when the spray is called and the likelihood of rain and heavy fogs.

In many sections like the Franklin, Adams county area and the central and western sections, the last spray usually may be applied the last of June. In the southeast, where sooty blotch is severe and storage scab is a factor, a spray is needed the last of July or first of August. Wherever storage scab is a factor on such varieties as Stayman, Paragon, Rome and Winter Banana these varieties should be sprayed around the first of August if any appreciable amount of foliage infection is present in late July. In the 3rd and 4th cover sprays most growers in the warmer sections of the state will use 1-5-100 Bordeaux as a fungicide. In the cooler or northern sections growers will use one of the sulphurs suggested for the petal fall and early cover sprays.

Sooty Blotch. Because of excess rain in July and August an average of 70.6 of unsprayed apples were infected in 1942. This is the most severe outbreak of this disease on record. Sooty blotch is usually very severe in the southeast, moderately severe in the central and northeast, and rather unimportant in the western part of the state. This is one of the easiest of the apple diseases to control. Spraying during the

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past ten years has been 99.3 per cent effective in preventing sooty blotch.

The disease is prevented by the cover sprays of which the 3rd and 4th are the most important.

Any form of sulphur is fairly effective in prevention but copper sprays are the most effective and either 1-5-100 or ½-3-100 Bordeaux will prevent sooty blotch.

Bitter Rot. Bitter rot is seldom serious except in southeastern Pennsylvania. When it becomes established on a susceptible variety like Polly, Smokehouse, or Winter Banana it becomes a serious problem. The fungus causing bitter rot is able to infect through sulphur and the copper fungicides used to prevent scab and most other diseases. Bitter rot can be reduced about 90 per cent by mummy removal and applying a strong Bordeaux 4-8-100 in the third and fourth covers and a special August spray. Bordeaux at this strength is very likely to cause injury and should only be used on apple trees that had bitter rot the year before or on trees on which bitter rot is developing.

PRODUCING FRUIT JUICES THAT MEET MARKET DEMANDS *

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* Presented at the 48th Annual Meeting of the Pennsylvania Htate Horticultural Society, January 14, 1943, at Harrisburg, Pennsylvania.

† The experimental work upon which this paper is based was conducted in cooperation with H. G. Beattie and D. K. Tressler of the Department of Chemistry, N. Y. S. Agric. Exper. Station.

During the present emergency, one should think not only of saving all the food produced, but one should think also of preparing it in such a way that we may have the greatest food value with the best flavor obtainable. There is a real shortage of fruit juices today due primarily to the large government purchases for the armed forces. But there is still a considerable quantity of fruit that might be used in preparation of high grade fruit juices.

It is hoped by this discussion that some of the problems involved in preparing of various fruit juices and fruit juice blends may be clarified. In the past, apple juice and grape juice have been the only fruit juices produced commercially in the Northeastern states. These two juices have been produced by entirely different methods, and it is these methods which are the basis of our discussion.

Hot Pressed Juice. Grape juice was the first fruit juice to be processed on a commercial scale. It is expressed from washed and stemmed grapes after heating to about 145°F. to extract the color. Experience has shown that this temperature gives good color without extraction of too much tannin. The juice is then heated to 180°F., filled into five gallon carboys, sealed and placed in a cool room to allow the excess tartrates to crystalize. This may require from 2 to5 months dependent upon temperature of storage. The clear juice on the top is then decanted off while the juice at the bottom is filtered. The two are mixed and sweetened when necessary and then pasteurized at about 175°. There have been a number of improvements in processing of grape juice within the past ten years or so, but these will be discussed later.

Cold Pressed Juice. Apples were heated to 145° before pressing one would obtain a product similar to apple sauce. Apples are pressed cold after grinding in a mill. This is the old process of making cider and need not be discussed here. However, in obtaining a satisfactory apple juice for pasteurizing, certain problems have arisen which have been under investigation for a number of years. When ordinary cider, as it is generally known, is heated either in the bottle or in a kettle or flash pasteurizer, and then bottled, the juice throws down a heavy flocculant sediment. Some samples entirely clarify themselves while others remain partly cloudy. Such juices are too unsightly and too lacking in uniformity to sell. Various attempts have been made to remedy this condition.

Clarification of Juice. Methods of clarification by use of either heat, gelatin-tannin, or "Pectinol" followed by filtration and pasteurization have been studied thoroughly. The Seitz filter has been used for filtration in experimental as well as commercial practice A very high clarity is obtained and this even removes the micro-organisms from the juice, thus eliminating the necessity for a second heating. All clarification methods haveproduced a sparkling clear juice with eye appeal though some loss of flavor. Further, such juices are not always stable. A high quality juice loses some of its character while a poor one may be improved.

Stabilizing Natural Juice. For the past several years, studies have been underway to produce a natural apple juice that will not deposit this heavy sediment but will remain stable over a long period of time. It was found that change in color, increase in sedimentation and change in flavor of apple juice occurred at the same time. One might assume

that the changes therefore had a single cause, but this is not true. Studies have shown that there are several factors to overcome.

Excessive contact with air causes oxidation and change in color and flavor. In order to reduce the effect of air as much as possible, we have replaced the flat bottomed wooden juice tank in our fruit juice press with a stainless steel tank sloped to the side so that the juice flows immediately into a deep tank with a smaller diameter. This is connected directly to a de-aerator so that we can remove the excess air. Following flash pasteurization at 170°F., bottles or cans are filled full to keep out air. By rapid handling of juice in this manner, the color and flavor are improved, less sediment is deposited and the juice is more stable.

Further study has shown that the excessive sedimentation was apparently due to some other factor, presumably enzyme action. Recent experiments have indicated that micro-organisms are the source of the enzymes that cause sedimentation in the juice. In other words, here we have a fundamental difference in effect upon juices expressed by hot pressing as in grape juice, and by cold pressing as in apple juice. In hot pressing, enzymes are inactivated and yeast cells are killed off before they have an opportunity to develop, while in cold pressing, yeasts may multiply not only in the juice but also in all types of equipment and by their multiplication produce excessive amounts of enzymes to change the character of the juice. It therefore becomes essential not only to handle the juice as rapidly as possible but also to keep equipment as clean as possible.

Juice from Frozen Fruit. Before leaving the subject of pressing juice, the newer method should be mentioned. Raspberries, blackberries, dewberries, strawberries, cranberries, cherries, and even plums are extracted to better advantage from frozen fruit. Cold pressing usually results in Hot pressed juice of certain fruits has a harsher flavor than when cold pressed, while from others an excessive amount of fruit pulp is obtained. Such fruits when frozen and later thawed may be pressed, yielding almost as much juice as hot pressing, color comparable to hot pressed juice, but the flavor of cold pressed juice. In preparing blends with apple juice the pomace may be reextracated with apple juice at 145° to good advantage.

Deaeration and Pasteurization. The deaeration or removal of dissolved air from juice is a relatively new development which has proven to have definite value in retarding changes in juice. In commercial installations a further advantage has been noted in that less foaming of juice occurs and therefore bottles are more easily filled.

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Flash pasteurization is a definite improvement over holding pasteurization in that the juice is not heated for a long period of time. The juice is passed thru coils by pumping or by gravity. The coils may be constructed from stainless steel, aluminum, block tin or similar suitable non-corrossive material. In studying pastuerization of juices, it has been observed that the more or less tart juices produced in the Northeastern states are ordinarily safely pasteurized at 170° to 175°F., provided the juice is filled into hot containers at and then allowed to stand a few minutes before cooling to insure thorough heating of the container. Actually the microorganisms begin to die when temperatures of 135° to 140°F. are attained and practically all are killed at 155°. Higher temperatures than this are required to completely inactivate the enzymes present in the juice.

New Fruit Juice Blends. There are numerous fruits produced in this section which have a most delightful flavor but which are comparatively expensive. Studies have been conducted to utilize these fruits as juices. Some of the juices were hard to extract, others were unstable and others were too concentrated in flavor.

Juices obtained by either hot or cold pressing of sour cherries are too tart and strong in flavor. When diluted with sugar and water a pleasant drink is obtained but it has a rather thin body. Recently this product has been improved by diluting with apple juice. Montmorency cherries are frozen and held in storage until fall. They are thawed and pressed cold, blended with freshly pressed apple juice in proportions of about 45 to 55 per cent and then clarified and filtered. The blend may need sweetening dependent upon the sugar content of the fruit. This beverage is tart and refreshing. A variation of this may be prepared using some sweet cherry juice with the sour.

The favorite blend, apple raspberry, is also prepared from frozen fruit. Black and purple raspberries in equal proportions are pressed after thawing the fruit. The pomace may be reextracted with apple juice. This is then blended with freshly pressed apple juice in proportions of about 22 to 23 per cent berry juice. Some sweetening is usually necessary. The blend is deaerated and flash pasteurized immediately, clarification being unessential if properly prepared. Red raspberry juice blended with apple, using about 24 to 27 per cent, results in a bright red color when clarified and although it has a delightful flavor it is not as rich as the black and purple berry blend. Blackberries or dewberries may be used in the same way, and they have a characteristic flavor which appeals to many people. Elderberries also blend well and require only about 17 to 18 per cent of the berry juice.

Hot pressed Concord grape juice and related varieties blend very well with apple juice in proportions of about 50 per cent. Strawberry juice when freshly extracted from frozen berries blends very well, but a high proportion, 35 to 45 per cent berry juice, is required to produce a distinctive strawberry flavor. In order to inactivate enzymes rapidly, the best method of extraction is a hot press, the berries being thawed by placing them in hot apple juice. Unfortunately this juice, like so many strawberry products, does not keep well unless stored at very low temperatures, 33 to 35°F. Even then the color fades slowly, although it does not brown.

Prunes and plums do not press well by the hot or cold method. A most pleasing beverage may be obtained with certain varieties such as Italian Prune, when extracted hot, 145°F., with apple juice. The extracted juice contains considerable solids and is improved considerably in texture by "Pectinol" clarification and filtration. From 35 to 50 per cent of apple juice may be used in this blend. Other varieties of plums and prunes are not as satisfactory as the Italian prunes but several varieties may be blended to advantage.

Cranberries after freezing, thawing, and crushing may be extracted with apple juice. The blend is not as harsh as similar blends using water as the diluent. The amount of cranberry juice used depends a lot on individual opinion and whether one prefers the fresh cold pressed juice or the more heavily flavored and colored hot pressed, 145°F., juice. In the latter case 20 per cent of cranberry gives a very distinctive flavor.

Apple juice may be used to good advantage as a diluent for peach, plum, or pear nectars; those products prepared by pressing the fruit thru screens. Ordinarily they are too heavy in texture and if diluted with water are too thin in flavor. Apple juice tends to hold the rich flavor while diluting the texture so a drinkable product results.

Apple juice has been emphasized as the diluting juice in all of these blends. It is not only plentiful and inexpensive but because of its mild flavor it is easily masked in flavor by other juices. Furthermore, it reduces the richness or harshness of other juices without thinning or weakening the body or character.

Storage of Fruit Juice. Regardless of the fruit juice packed, the quality will be retained to better advantage if stored at as low a temperature as possible without freezing. Even though foods do not spoil in the ordinary sense after they are processed, they slowly deteriorate in quality. This is especially noticeable in strawberry products, but all food

changes slowly, especially as the temperature is raised. In recent years, some fruit juices are placed in cold storage until ready for bottling, and others, grape juice, stored without pasteurization at 27° to 28°F. until the tartrates crystalize and the juice is bottled. In most commercial practice considerably more emphasis is now placed upon rapid cooling of juices after pasteurizing in order to retain flavor. These developments have definitely improved the quality of juices.

Preparation of Small Quantities of Juice. Before leaving the subject of juices, some of you may be interested in preparation of these juices on a small scale. We have recently designed a new fruit press, using an ordinary automobile hydraulic jack. This is far more eficient than the ordinary small screw type press. Yields are almost as good as those obtained with large commercial hydraulic presses. After extraction, the juice may be flash pasteurized with an aluminum coil pasteurizer heated in hot water. On a somewhat larger scale, an efficient deaerator and pasteurizer similar to the type used in our experimental laboratory may be used. There are three of these small farm commercial installations in successful use in Central New York at present.

VALUE OF ORCHARD MULCHES AND MINOR ELEMENTS IN SOLVING PRODUCTION PROBLEMS

J. H. GOURLEY
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Uppermost in the minds of those in all sorts of civilian industries is how economies of labor and materials can be effected. How can short cuts be made with the minimum of reduction in quantity and quality of the product? Agriculture shares in these problems and fruits are a conspicuous part of the food supply, just as are grains and livestock. Where can one compromise or substitute and still do the job? These are the questions of a war-time America.

Fortunately fruit growing is an old industry--almost everything has been tried once, and we go back to these experiences for answers to our questions on the one hand, and project new methods on the other. The ingenuity of the fruit grower is impressive and we may confidently expect him to come through.

Many Orchards Need Nutrient Amendments to the Soil. Many, but not all, orchards require more nutrients than naturally occur at any one time for maximum or perhaps even minimum production. What is needed, and the amounts, vary considerably in different areas and more is being learned about these matters from year to year.

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The history of orchard fertilization is fascinating and it may be briefly sketched, as the writer sees it. Extensive experimentation with the fertilization of orchards dates from about 1910. The earlier efforts had to do primarily with increasing yields and the growth conditions of the trees. The outstanding chemical element needed proved to be nitrogen. This was learned by simple "cut and try" methods. As a result, the orchard fertilizer program for a quarter of a century was **nitrogen only.** There were a few exceptions, however, through all this time, as some horticulturists recommended a complete fertilizer of some formula or other. Some advised the regular use of **lime** also. Orchardists also varied in their experience, their practices and their beliefs. As a result there was considerable controversy engendered and those whose business it was to sell fertilizers entered the picture in no modest way. But it would appear that this, like many another controversy, will end with several different views being correct, depending upon the local situation or the native composition of the soil.

At the present time, I believe experimental results will show that nitrogen and moisture are the factors more likely to be lacking in orchards of most of the country than any others. At a recent meeting in Chicago with the War Production Board, this fact was emphasized by all the Central States.

However, there are some rather large areas where this nitrogen program only is entirely inadequate, for both experiments and experience show that potassium is also necessary. There are other sections where phosphorus and calcium also are required for maximum efficiency, and others where magnesium is deficient, and others where copper, zinc, or boron must be supplied. These areas are notable on the coastal plains soils from Long Island southward and extending along the Gulf. In Canada and isolated places in the midwest and west such areas are showing up also.

In other words, a departure from the nitrogen only program is widening, and doubtless other areas will be included as better interpretation of fruit quality and growth of trees is obtained. This situation should not, in the mind of the writer, be interpreted as a general recommendation for complete fertilizers, for he believes that it is still true that nitrogen and moisture are the limiting factors in a larger part of the interior orchard regions. Controversy in these matters is scarcely necessary, but rather a determination of the facts.

Value of Mulches in Supplying These Nutrients. But the particular point which is assigned for this paper is the

value of mulches in supplying nutrients and to what extent such practice could substitute for artificial fertilizers during the war time period.

Investigations along the line have been in progress at the Ohio Station for some time and the results are at least indicative of what may be expected under somewhat similar conditions.

Nitrogen. Since nitrogen has been the only chemical element added to many orchard soils and it has suddenly become the one most difficult to secure due to its need in war industries, its natural occurrence is of special interest. Under what systems of culture can it be obtained "free" or nearly so?

Certainly cultivation, especially when accompanied by the use of leguminous cover crops will provide nitrogen to such as extent that frequently no additional application is necessary. But tillage, especially on rolling land or where erosion occurs, has become less popular during recent years. This is more true of apples and pears than with stone fruits. But even with the latter there is less intense cultivation.

Without further discussion of tillage at this time, let us turn to the possibilities of obtaining nitrogen from a mulch. In the beginning, the chief emphasis for mulching was placed on the conservation of moisture and as investigations continue it would appear that the case for water was not overstated. The maintenance of a favorable moisture supply during dry periods is a paramount importance in many areas. But as time goes on we learn that nitrates also accumulate under mulches even to the extent in some cases that too much nitrogen is available even where none has been applied as a fertilizer. This is far from universal but is striking in many cases. In Massachusetts, Shaw found from four to six times as many nitrates under mulch as in cultivation in some seasons. At Wooster the mulched trees always look somewhat greener and more vigorous that the cultivated ones and nitrates average higher. A legume mulch provides more nitrogen than straw and in some cases it is to be avoided for that reason.

In one orchard at Wooster half the cultivated trees were fertilized with nitrate of soda or sulfate of ammonia and half were untreated. The same was true of the mulched trees. The total production from the mulched and tilled trees was almost the same. The average yield of the mulched trees during the past six years exceeded that for the tilled ones by 95.8 pounds. However, there was no consistent difference where nitrogen had been applied, which indicates that sufficient is made available to supply the needs of the trees.

Organic Matter and Nitrogen. The matter of soil organic matter is one of the principal considerations of soil scientists and the practicing agriculturist. It has always been considered about the top rung of the ladder, the key to soil fertility. Far be it from me to pull it down from its lofty perch, other than to say it is much more difficulty to increase the total amount in the soil than some of us had been led to believe.

Nevertheless, it is doubtless true to say that a soil is "rich" or "poor" pretty largely in proportion to the organic matter it contains. A soil may be productive, however, with an organic matter content far below the point of giving it a darkish color. It is the effort to push the organic matter content considerably above its native content that causes difficulty. Yet I was long taught that we might buy a piece of land that was low in this material and build it up by growing cover crops to plow into the land. I have seen this tried, many times. The results of such a practice are liable to be disappointing and expensive.

In the first place, organic matter is not an inert, stable material that builds up like a "bank account", so that the more you put there the more you have. On the other hand, organic matter breaks down, decomposes, and some if its products may disappear as a gas into the air, or it may leak away in drainage water, and in the end little may be left.

Let us look at nature for a lesson. Where do we find the greatest accumulation of organis matter? Certainly not in the average cultivated field where crop residues and manure have been returned to the land. But rather in peat or muck land which was laid down under water. Next we are likely to find accumulations in forest litter, beneath bluegrass or other sods which have not been disturbed for long periods of time.

For instance, at the Pennsylvania Experiment Station a set of field plots has been under differential treatments since 1881. Here the grass division strips which separate the plots have been in permanent grass since 1867. In 1922 (55 year) a study was made of the organic matter and nitrogen content of the sod soils and also the cultivated plot areas. On an average the untreated grass strip soils contained 79.327 pounds per acre of organic matter and 3,754 pounds of nitrogen compared to 63,028 pounds of organic matter and 2.936 pounds of nitrogen in the fertilized plot soils. The plot which has received a total of 123 tons of manure in addition to the crop residues (roots and stubble) contained 78,480 pounds per acre of organic matter in comparison with the adjacent grass strip which contained 90,-745 pounds.

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HORTICULTURAL DIVISION PS-1

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AMBLER, PENNA.

In our orchards at Wooster we have measured the amount of organic matter in the soil which has been (a) in continuous mulch, (b) in sod, and (c) which has been in cultivation with cover crops since 1915.Under the conditions of these experiments, the organic matter content was about the same under mulch and sod, but it was much lower in the cultivated area, even though a winter and summer cover crop had been used for better than 20 years. We do not conclude that the higher value (about 4½%) under mulch is due entirely to the accumulation of material but rather that there has been a loss of the original content from tillage (1.8 to 2%).

This is a striking lesson to those who have long preached thorough cultivation.

Potash. In 1937 the question rose as to the amount of available potassium that might be found beneath old mulches, sod, and in tilled orchards. An investigation was started at that time which yielded some unexpected results. The first trees sampled were those in mulch which revealed that available potassium was quite high from 24 to 32 inches beneath the heavy mulch in two of our orchards. The entire cultivated area, as well as an unfertilized field plot, was notably low in available potassium. Immediate to these extremes was the amount of available potassium present in the soil beneath the surface of the bluegrass sod near the heavily mulched trees. The soil beneath two of the trees in mulch had a content of approximately 1000 pounds per acre of available potassium at a depth of 24 inches, while the soil beneath a tree 35 feet away in cultivation contained less than 175 pounds.

This would seen to suggest that perhaps no orchard would suffer from potash deficiency if it is kept in mulch regardless of the deficiency of this element in the soil. There could be no simpler way of supplying potash to trees than this, because it seems to be mobile and to distribute both downward and laterally which is more than can be said of potash salt applied to the surface of the soil. At least this is true of the soils with which we have worked.

Since this element is receiving more and more attention and such troubles as Leaf Scorch continue to appear the value of a mulch become more important. Mr. W. B. Farmer of New Hampshire has been using seaweed as a mulch which should solve these problems and be particularly high in potash. Others near the coast use swale hay and other native grasses at a low cost.

Other Elements. In addition to nitrogen and potassium, I. W. Wander, who has made these determinations, has found

that all elements investigated except manganese and lead have been increased in the soil beneath a heavy mulch as compared with adjacent land under cultivation.

Calcium was much higher in the surface three inches of the soil investigated, being 50 per cent higher in one case and 38 in another. Since there are so many surface feeding roots beneath a much this addition of available calcium is significant. Blake of New Jersey, and others, have pointed out that the element calcium is badly needed on many of their orchard soils as a nutrient and not primarily to reduce soil acidity.

Magnesium was much higher in the surface nine inches and the reverse was true at the lower levels. Shaw has found a widespread deficiency of magnesium in Massachusetts orchard soils. Preliminary trials with magnesium sulfate are being made.

Phosphorus was greatly increased in the surface nine inches but not below that level. In the surface three inches readily available phosphorus was 600 per cent higher than in the tilled soil adjacent. Randolph of Texas writes me that phosphorus has consistently given higher yields with grapes than either nitrogen or potassium. "The results were found to be significant for all treatments containing phosphorus when compared with nitrogen plus potassium, the lowest yielding treatment. The 600 - and 900 - found rates of the complete fertilizer treatment were significantly higher than the treatments of nitrogen alone, nitrogen and potassium, and unfertilized vines."

Boron was 50 per cent higher under mulch in the surface nine inches but not affected below that level. As is well known boron has relived a condition in apples known as corky core or drought spot in some areas as well as "brown heart" of certain vegetables.

Conclusion. The foregoing statements have been briefly summarized without submitting the actual data, which appear elsewhere. It can be seen that mulches supply a surprising amount of nutrients to plants in addition to the conservation of moisture and the production of a favorable soil medium. Probably no other system provides so many factors as mulch, but not all fruit trees respond equally well.

SUGGESTIONS REGARDING LOSS OF PRESSURE

In general, trouble with any type of sprayer is indicated by one of two things—either there is no pressure, or, there is a drop in pressure. Neither of these conditions calls for readjusting the spring setting on the pressure regulator. The spring tension seldom changes after it is once set.

When there is no pressure, look for:

1. Air leak in suction piping—drain plug possibly missing.
2. Air leak in suction hose.
3. Frost crack in pump base or intake piping.
4. Completely clogged suction—clogged filter strainer.
5. Plungers so worn and dry will not draw.
6. Valves so worn will not hold.
7. Air lock in valves—release air to correct.

When pressure comes up and then drops when nozzles are turned on, look first at the overflow from pressure regulator back into tank. If this overflow continues, you can be sure the trouble is in the pressure regulator. Look for:

1. Dirt or foreign object lodged under valve ball.
2. Worn parts in top valve of pressure regulator.
3. Stem set too high under ball.

If this overflow stops when nozzles are turned on, you can feel sure that the pressure regulator is functioning and that the trouble is some place else. In the latter case, look for:

1. Too large hole in discharge nozzle discs.
2. Leaking release valve on pipe leading back into tank.
3. Clogged suction line—clogged filter strainer.
4. Worn pump plunger packing.
5. Worn valves—valve gaskets missing.
6. Engine speed below normal.

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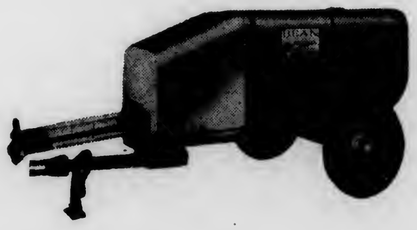

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WHAT MORE CAN WE DO TO CONTROL APPLE INSECTS?

J. O. PEPPER, Pennsylvania State College

We have been at war with apple insects each and every year for many years. We are now fighting a war that affects all humanity throughout the world. We must win this last mentioned war and the sooner we can do it means the quicker we can enjoy our happy way of living. In winning this war and for many years afterwards the people of the world must have food and our apple industry of Pennsylvania will have its part to take in producing apples as a food.

The apple grower in 1943 will no doubt face many production problems and one of these factors will be the use of an efficient and economical spray program in producing a good crop as free of insect injury as possible.

One of the first questions to confront us is the availability of orchard insecticides. It is impossible to make a definite statement on this situation to cover the entire year. However, it can be said that the general outlook is fairly encouraging at this time. Briefly the situation **at present** is as follows:

Lead Arsenate: There will probably be 10 to 15 per cent less than in 1942, but this is 10 per cent above 1941, which means about an average supply for 1943.

Mineral Oils (Dormant and Summer): There seems to be an adequate supply but containers may be a problem.

Fish Oils: Supply appears sufficient.

Dinitro Compounds (Liquid and Powder): The supply is adequate.

Nicotine Compounds: The supply is sufficient with an increase expected over 1942. The containers again enter into the picture with these materials.

Calcium Caseinate: The supply is reported as adequate.

Stickers, Spreaders, Wetting Agents, etc. (Goulac materials, Soybean flour, oils, blood albumen, and commercial preparations). From all reports there seems to be satisfactory amounts of these materials for orchard use.

Paradichlorobenzene: Adequate supplies are reported.

The orchard insecticide situation could change very quickly, but every attempt possible will be made to keep the fruit growers informed of such changes as they may occur.

The second and very important question for the apple grower to consider is his spray program for 1943. It is important that every fruit grower should make a careful investigation into the pest problems of his orchard and contemplate as nearly as possibly his spray materials needs for 1943. As soon as he has this information, orders should be placed with spray material companies. Such foresightedness will help relieve transportation difficulties as well as several other situations. However, there is one very important thing. That is, please do not hoard insecticide materials.

With further reference to the spray program, the writer feels that each individual apple grower or orchard operator should know more about what insect problems he has in his orchard than any other person; therefore, the spray program he uses may be slightly different from his neighbor or it may even vary in different sections of a large orchard. One may then ask about the apple spray information letters that are sent out by the various County Agricultural Extension Associations. It must be remembered that the information in these letters is based on the general conditions for the entire county, and it is the grower's responsibility to use the suggestions in the letter that will help best to control his particular pest problems.

The insect problems vary considerably in the different sections of the State; therefore, this causes quite a different spray program for each section. In general these apple insect problems seem to be as follows: for Central and Western Pennsylvania, aphids, European red mite, Plum curulio and Codling moth and leafrollers in a few scattered orchards; for Northcentral and Northeastern Pennsylvania, aphids, red bugs, plum curculio, and apple curculio, codling moth, apple maggot and European red mite in a few orchards: for Southeastern Pennsylvania, aphids, European red mite, plum curculio, codling moth, white apple leafhopper, and leafrollers, apple curculio, apple maggot, and Japanese beetle in a few orchards.

Specific Apple Insect Spray Schedules for Pennsylvania With Suggested Alternatives.

Insect	Materials and Amount per 100 Gallons	Time	REMARKS
Scurfy Scale	1. Petroleum oil - 4%	Dormant	DN compounds used as for aphids may increase efficiency a little but does not decrease it. DN can only be used to Green Tip stage and with no more than 3% oil.
	2. Petroleum oil - 3%	Green Tip thru De. Dormant	
San Jose Scale	1. Petroleum oil - 2 or 3%	Dorm. thru Del. Dor.	If tar oil should be included for aphids the total percentage of tar and petroleum oil should not exceed 6%.
Aphids Rosy Green Grain	1. Dinitro Powder-1 lb. Dinitro Liquid-1qt.	Dorm.	DN can be combined with 3% oil when both aphid and scale or red mite is to be controlled.
	2. Tar Oil - 2½%	Dorm.	Can be combined with 3% petroleum oil for aphis, scale, and red mite control.
	3. Nicotine sulphate - 1 pt	Green Tip thru Del.	Can be used in combination with petroleum oil in Green Tip - with summer strength lime sulphur in del. dormant.
	4. Tar Oil - 1½%	Green Tip	Should be combined with petroleum oil at this time for aphis, red mite and scale con.
European Red Mite	1. Petroleum Oil - 4%	Dorm.	2. When sulphur fungicide is used in Del. Dorm. be sure to use an oil that is compatible with the sulphur. Uusally better control is obtained in Green Tip and Del. Dormant stage.
	2. Petroleum Oil - 3%	Green Tip thru Del. Dor.	
	3. Summer Oil - 1 to 1½ lbs. 4. DN 111 - 1¼ to 1½ lbs.	When infestation develops in summer usually in July	3&4. The mite development should be checked and when infestations get abundant. Summer treatments should be made before too much foliage discoloration shows.
Red Bug	1. Nicotine sulphate - 1 pint	Calyx to First Cover	Where infestation is heavy the oil should be used and if good kill is not obtained the nicotine should be used as directed to hold the insect in check.
	2. Petroleum Oil - 4%	Dormant	
Plum Curculio	Lead Arsenate - 3 lbs.	Calyx and First Cover	A good coverage of fruits is necessary for best control.
Apple Curculio	1. Cryolite - 4 lbs. Fine Wettable Sulphur- 4-6 lbs. Orthex paste - 1 pint	3 applications Petal Fall 2 more applications at 5-10 day intervals	This is the best schedule we know at present. The Orthex helps build up a heavy deposit which seems necessary to hold this insect in check.
Apple Maggot	Lead Arsenate - 3 lbs.	Usually 3rd & 4th covers	If this insect is abundant in orchard the application should be definitely timed for control.
Codling Moth	1. Lead Arsenate - 3 lbs. (Also see column on Remarks and note below)	4 applications at 10 day intervals. 1st, 2nd 3rd covers plus a special cover	Some kind of fungicide is normally used in 1st & 3rd cover and spreading and sticking agent should be included. Normally no fungicide in 2nd cover and this is a good place to use a deposit builder and spray heavy. In special cover use ½-2-2-100 Bordeaux (as an arsenical injury corrective) 3 lbs lead ars. and 1 gal. summer oil. This schedule if applied thoroughly will kill most of 1st generation worms.

NOTE:—To fight 2nd generation those growers **who can wash their fruit or intend selling to canners** should use in 4th cover 3 lbs. lead arsenate plus Bordeaux. Those growers **who do not wash or sell fruit to canners** should use in 4th cover 1 gal. summer oil plus Bordeaux. Nicotine in various forms can play an important part in Codling Moth control in heavily infested orchards. This suggestions for the use of these materials will be given in spray information letters during the codling moth control season.

THE FRUIT GROWER IN WAR TIMES

J. K. SHAW, Research Professor of Pomology, Massachusetts State College, Amherst, Mass.

We are at war. This means that we are confronted with new situations and new problems. New plans and procedures must be devised to suit the new problems. This applies to the fruit grower as well as to the manufacturer and merchant. He may have to carry on with less labor, less fertilizer, less machinery, and limited supplies of all sorts; and what of these he gets are likely to be less suited to his needs than in normal times.

On the other hand, there are facts that no war and no dictator has ever changed, and none will ever do so. The chlorophyll molecule will require an atom of Magnesium. The laws of osmosis defy the most powerful army. No human power can make an apple tree grow and produce well if its supply of nitrogen or of any other essential element is lacking or seriously deficient. The laws of nature operate quietly and inexorably, completely ignoring the opinion of men. Forty million Frenchmen or 130 million Americans will be wrong if they think or act in defiance or ignorance of nature's laws. The rules of the game in war production of food are similar to those for peace time production. Modification and not revolution is what is required.

I am not going to try to tell you how to manage your orchards. Your own men are better qualified to do that. There is no general, fixed formula for managing all orchards. I am merely going to try and make some suggestions to you based on more than 40 years of earnest, if not always well directed, study of the fruit grower's problems. I hope you may find these suggestions worthy of consideration. We are rationed on food and supplies, but there is no rationing of sound thought and new ideas. We are fighting to make sure that nothing of this kind is imposed upon us. We must study and think over our problems so that our limited supply of labor and materials will be used to produce maximum results.

I shall group the suggestions I have to offer under several headings. First, I will speak of pruning. How can we make our efforts in pruning count most? I have a reputation in Massachusetts of being an advocate of no pruning, at least for apple trees. Those who know me will realize that I am not wholly serious about this. As a matter of fact, when we tried a comparison of young unpruned trees with others pruned in various ways, the unpruned trees produced at least as many apples as any of the pruned trees. The unpruned trees performed very well until they were about 15

years old. Then they became so overburdened with weak wood (perhaps what some call "thin" wood) that the size and color of the apples were poor. This would suggest that, in the present stress, we might omit pruning. But pruning may help out a limited supply of nitrogen. With a reduced top, a reduced nitrogen supply may still be adequate. I would advise the usual pruning if time and the labor supply permit. If pruning has been neglected in the past, it may be very important now with the prospect of reduced nitrogen. Old, weak, thin wood produces poor apples and few of them and we always have too many such.

I think that the only economies that can be practiced in spraying lie in a better directed program. We should not spray to control a pest that is not present (if there is any such), but we cannot afford to let up in our efforts to control those that are likely to do serious injury. Better abandon the orchard and go into war work or growing something else worth while. All fruit growers understand that it is important to spray the extreme top of the trees thoroughly but few do it. There may be much wasted effort in spraying which we should strive to eliminate, but we cannot afford to relax our efforts to control injurious pests and diseases. We, in Massachusetts, have changed from liquid sulfur to wettable sulfur for scab control. Timely applications are equally effective and leaf injury is less. We have begun to use the DN sprays to control red mite in the summer applications.

We are confronted with the prospect of a reduced supply of fertilizers, especially of nitrogen. What can we do about it? Most fruit growers use only nitrogen carrying materials, but the practice of using a complete fertilizer is increasing in New England. We have found that the long continued use of nitrogen alone, in cultivated orchards at least, may bring about a potash shortage. If potash is added, a magnesium deficiency may appear, especially on shallow, poor or eroded soils. Magnesium deficiency appeared in many Massachusetts orchards in 1942. Just why it was so prevalent this year is not entirely clear. Probably it was more common in previous years than we realized. It may have been thought to have been spray injury. Magnesium deficient trees appear perfectly normal until July or early August. Then, rather suddenly, deficiency symptoms appear. Leaves may show a yellow chlorosis or it may be absent or very inconspicuous. Brownish areas appear between the principal veins or along the edges of the leaves. These areas die and many of the leaves fall. In vigorous trees the injury is confined to the older leaves while those near the growing tip continue normal. This distinction is very characteristic. We now realize that magnesium deficiency has been present in some of our Experiment Station orchards

for several years. It does not kill the trees; they may continue to grow and produce quite well, but the destruction of leaf area, even in late summer, amounting to 50% or 70%, must weaken the tree.

The correction of this deficiency seems to be a little difficult. Young trees planted with 10 pounds of magnesium limestone mixed with the soil in the planting hole showed deficiency symptoms the next year though they were less severe than other trees without lime. We have experiments under way in an effort to learn how best to correct this deficiency.

We found in the previous world war that we could get along with a reduced potash supply and the final result was good for us. Can we repeat this in the presence of a nitrogen shortage? If we can get along, it will be in different ways with different orchards. I believe that, even if we have centered our attention too much on nitrogen in recent years, it will always be the principal nutrient in an orchard fertilizer. Several suggestions as to how we can get along with reduced nitrogen have been made.

First, we may be able to decrease nitrogen robbery from the trees by other plants, and utilize some of the nitrogen that has accumulated in the soil. This idea may be carried out in practice by rough cultivation in the spring when trees need nitrogen most. We may plow and cultivate, or better, disk the orchard for a month or two in the spring. This will apply only when the use of machinery is possible and where there is a reserve of organic nitrogen in the soil. If we try any such scheme, we must avoid soil erosion. The greatest lesson that agriculture got out of the recent depression is the importance of preventing soil erosion, and we must not forget this lesson. If we thus reduce the soil nitrogen reserve, we are assured that after the war nitrogen fertilizer will be cheap and aboundant so that we can build up again.

A second possibility is the use of mulches in the orchard. The results that we have obtained from applying a mulch of poor hay to bearing trees growing in a soil depleted of organic matter and soil nutrients are nothing short of astonishing. The trees improved marvelously in growth; leaf area and shoot growth must have been doubled; trunk diameter did not increase more rapidly, the trees put their raw materials into apples. The crop increased about 50 percent. All who saw these trees before and after mulching marveled at the change. I would make it clear that this particular area had been in cultivation without fertilizer for more than 20 years.

Thus, this suggestion may apply to conditions quite different from those discussed. For quick results, mulch materials should be applied to bare soil. If applied in a sod orchard, the benefits of a mulch may not become distinct until the second or third season.

No accurate records have been kept of the amount of mulch applied. This is partly because such records would be misleading because of great variation in composition and especially water content of the mulching material. It has been applied whenever available, most commonly in July and August. It is estimated that the amount has been from 4 to 8 tons of air-dry material annually. It has been applied over all or nearly all of the orchard area except in young orchards where it is obvious that the tree roots have not yet exploited the whole area. It would seem that the mulch should cover all the area occupied by roots. There can be no reason for putting it on areas where there are, thus far, no feeding roots. If only a part of the root occupied areas is covered, the mulch should be of benefit, but the value of mulch lies partly in suppressing grass and weeds which rob the trees of nutrients. Mulch applied in July or August will pack down and suppress grass and weeds during the next spring. It is probable that the amounts we have used are excessive as the trees, previously starved, have made excessive growth by the second or third year and we have had heavy preharvest drop. Color and quality of fruit have suffered a little but not much. Most of the mulched trees have been McIntosh. Some heavily mulched Wealthy trees have had no fresh mulch for the past four years, yet growth and production continue satisfactory. There is still a thick layer of partially decayed hay through which quack grass grows luxuriantly.

I believe that the good results of the mulch are due largely to the nitrogen, potash, and other nutrients supplied to the trees by the decaying hay. There are many small rootlets just beneath the mulch which should catch the released nutrients before they are fixed in the soil. When I had the privilege of speaking to you three years ago, I spoke of shallow soils. I am beginning to wonder if a lack of essential nutrients in such soils may not be in the picture. The trees on soils with a high water table have a limited body of soil to exploit, and eroded soils have been depleted of nutrients. Perhaps if these poor orchard soils were supplied with the needed fertilizing materials they would bear better crops. No one would deny that good crops could be grown on trees in sand or gravel if the proper nutrient solution was applied.

I have mentioned deficiencies of potash and magnesium in our Massachusetts soil. Some of our orchards suffer because of a lack of boron. May there not be deficiencies of other nutrients not yet recognized? It may be that a liberal hay mulch takes care of all sorts of deficiencies, known and unknown, better than commercial fertilizers.

The limiting factor in a mulching program is the supply of material. We have used hay of subnormal value for feeding livestock. Any organic materials should be useful. If it has a low content of fertilizing nutrients, it may be possible to supplement it with a commercial fertilizer. We have many poor orchards or parts of orchards which we feel might well be removed and the land used for growing mulching material for use in areas naturally better suited to apple production. We will do well to put any organic matter that we can get hold of into the orchard and perhaps we can, in many cases, grow mulching material for this special purpose.

A third possibility for meeting the nitrogen shortage is the growing of leguminous crops in the orchard. We had good results some years ago with sweet clover. Once seeded, it persisted for several years by reseeding itself. The trees looked better than others in strip cultivation with no sweet clover. We now have an orchard in ladino clover and the trees do well, but are not equal to mulched trees in the same orchard. There are many other leguminous crops suitable for use in orchards. I believe that where a leguminous crop can be established it will help out.

I understand that mixed fertilizers will be easier to obtain in 1943 than unmixed goods and that goods of only centain formulas will be offered. All these will be too low in nitrogen to please fruit growers, but will contain much phosphorus. I know of no evidence that phosphorus in a fertilizer ever did a fruit tree any good except as it helped maintain organic matter by favoring the growth of a cover crop. A recent report from California showed that, on a soil so low in available phosphorus that many crops utterly failed unless fertilized with this element, fruit trees grew and produced well and were not benefited by the phosphorus even when special methods to get it into the tree were used. We have made some experiments that can be figured so as to show a benefit from phosphorus but the evidence is not convincing. On the other hand, one comparison seems to suggest that, in a sod orchard an N-K mixture was better than an N-P-K mixture. With the latter treatment, there is a heavier sod and it may be that the grass has robbed the trees of nitrogen. The trees received nitrate of soda at the rate of 300 pounds per acre which is considered rather low for a sod orchard. In a cultivated orchard, such an influence

would not be present. In a sod orchard, I fear that a fertilizer low in nitrogen and relatively high in phosphorus would not give good results. Used in an orchard managed on the cultivation-cover crop system, it should be satisfactory.

It seems to me that our efforts to avoid suffering from a restricted nitrogen supply during the emergency should be directed towards drawing on the reserve supply in the soil and seeing to it that what we do have goes into the trees and not into other plants until the needs of the tree are supplied.

The prospective shortage of containers alarms our growers. They use the eastern crate, and box makers are too busy making ammunition boxes to be interested in apple crates. I can offer few, if any, suggestions. You know more about this problem than I do. There were a few fibre boxes with wood frame ends used in Massachusetts last year. We are testing different fibre boxes, such as may be available next year, to see if they will stand up in storage. The suggestion that you think early, often, and earnestly about the container problem must be a good one. Any grower who waits until a month before harvest will be in a tough situation.

Experienced pickers will be scarce, but I feel that the 1943 crop will be harvested somehow if the growers have the containers and are organized to handle the harvest. But one must cope with inexperience by careful organization and competent supervision. It is not difficult to learn how to pick apples though it takes time to acquire speed while doing a careful job. The New England crop, at least, will probably be smaller than the large 1942 crop.

There is one other suggestion that lies a little outside fruit growing, but which I believe to be highly important. We are through with the problem of food surpluses and plowing under crops. We face the gigantic task of feeding, not only our own people including our armed forces, but also half the world. Food may not win the peace, but lots of it maybe a big help. I think that every fruit grower should consider what he can do in producing food, besides fruit, for his own use and for local consumption. Next year people will not grumble because they have to take hamburg when they want a porterhouse steak: they will be glad to get the hamburg. Local food production will not only supplement food supply, but will also relieve to some extent our overtaxed transportation systems. Such a program of local production must be carefully thought out to see that no effort is wasted and only that which can be used is produced.

In every political campaign we hear the country faces the gravest problem in its history, but this time it is no joke.

Our enemies think that we are soft and can't take it. We must prove that they are wrong. We must bend every effort to secure our fruit crop and produce as much supplementary food supply as conditions allow. The farmer does not demand a 40-hour week nor a raise in pay. All he wants is the means to produce crops and enough to pay his bills and keep his farm and family together as a going concern.

PROGRESS OF DEHYDRATION INVESTIGATIONS WITH FRUITS AND VEGETABLES IN MARYLAND

A. LEE SCHRADER, Professor of Pomology, University of Maryland, College Park, Maryland

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In recent months many articles have appeared in magazines and newspapers, telling of the wonderful qualities of dehydrated foods that promise to place such products in a prominent position for common use by the American public in the future. Aiding such thinking and prophetic statements has been the great progress in recent years in the development of machinery for rapid dehydration of foods under controlled conditions. In contrast to present methods, the old style evaporators and sundrying methods had not resulted in high quality of dried fruits and vegetables and demand was not increased in competition with canned and fresh products. In fact, the quality of several million pounds of dried vegetables shipped to our armed forces in France during the first World War was so poor that such shipments had to be dumped and not consumed. Following World War I, relatively little research work was done to improve the quality of dehydrated vegetables although some work was done on fruits. More recently the design of cabinet and tunnel dehydrators, as well as drums and spray types for liquid materials, in which the temperature, humidity, air flow, and food load can be accurately controlled, has stimulated much work on this form of processing and as a result many high quality products can be produced commercially with such machines. Even with such machines available, many problems with fruit and vegetables have immediately come to the fore, including variety considerations, maturity of the raw product, preparation of the raw product prior to dehydration, vitamin loss and change in chemical composition, storage behavior, and determination of specific temperature and humidity requirements during processing;

all of these factors in relation to the quality of the dehydrated product as determined by reconstitution and cooking tests. Of course the immediate objective of any of this research work is to produce sufficiently high quality of dehydrated fruits and vegetables to enable processors to produce a highly satisfactory food for the armed forces and people of the United Nations in this condensed, dehydrated form that saves shipping space many times over. As for any ultimate objective of high-quality dehydrated foods that will create great demand in competition with canned and fresh foods, many observers doubt that a great expansion will result from future domestic consumption in preference to the canned fruits and vegetables. However, the feeding of peoples outside of the United States, following the war, will be greatly facilitated by large volumes of dehydrated foods, which may in turn stimulate a great export demand for our dehydrated foods during normal export trade conditions, if a high quality is maintained. In fact, it is quite logical to predict that our normal export demand for fresh apples will not be built up rapidly after the war, but a similar volume of apples in dehydrated form could conceivably go abroad or even exceed the pre-war volume of fresh apples exported, assuming that the quality of the dehydrated apples approximates that of the apples experimentally dehydrated in recent months at the Maryland Station. As an example of what can happen, it should be pointed out that in the fruit growing district of Nova Scotia several tunnel dehydrators have been installed since 1931 which resulted in the steady increase in dehydrated apples from one million pounds in 1931 to over four million pounds in 1936, a period of relatively low purchasing power for the consumer.

At present time a great expansion of dehydrating facilities has taken place, largely through the efforts of the operators of canning plants that are equipped to handle the raw stock. Such expansion is necessary to meet the needs of Army, Navy, and Lend-Lease, as estimated at a recent Chicago Food Conference. It is predicted that the requirements for vegetables alone in 1943 will be three times greater than in 1942, and such dehydrated products will be apportioned roughly as follows:

White potatoes	134,000,000 lbs
Beets	36,000,000 lbs
Onions	20,000,000 lbs
Cabbage	34,000,000 lbs
Carrots	13,000,000 lbs
Turnips	8,000,000 lbs
Peas	12,000,000 lbs

Soups:

Navy Bean	33,000,000 lbs
Green Pea	27,000,000 lbs
Yellow Pea	27,000,000 lbs
Chick Pea	27,000,000 lbs
Tomato	15,000,000 lbs
Noodle	5,000,000 lbs
Soy Bean Combination	1,000,000 lbs
Tomato Juice Cocktail	1,000,000 lbs

The production of dried fruits in the United States has remained rather steady during the past eight years at about 1,200,000,000 pounds but sharp increases are indicated in 1943 by the Department of Agriculture forecasts of the National Food Situation. With these increases in production for military and lend-lease purposes in prospect, and with newly extablished dehydrating plants in the East, it is imperative to know what can and what should be dehydrated in this section of the country.

Progress at the Maryland Station

Although much detailed data cannot be given at this time while work is still in progress, some results of interest are available. In the work with vegetables, only those crops which are commercially grown in quantity or promising for quantity production in Maryland were dehydrated. Such crops included sweet corn, white potatoes, sweet potatoes, green lima beans, and edible soy beans. Among the fruits, only apples have been used.

With both fruits and vegetables, two dehydrating units have been employed for this work, namely, a small cabinet dehydrator and a tunnel dehydrator, both designed by the Department of Agricultural Engineering of the University of Maryland. In these machines, temperatures could be controlled at different levels during the processing, humidity likewise under control, air velocity constant, and fruit load could be varied at different levels. The cabinet dehydrator was operated with a heat source of electricity which enabled a measurement of heat energy used in the processing. The funnel was heated with steam units. The tunnel as now designed uses parallel flow of air in the primary tunnel, which means hot end loading, and a counter flow of air in a finishing tunnel at a lower temperature.

Very satisfactory products were produced with several varieties of the vegetables listed above, although cooking tests showed that the quality, although satisfactory, was not as high as the quality of canned material from the same lot of raw stock. Reconstitution of some of the vegetables was greatly affected by the temperatures used in dehydrating.

With apples, the varieties to date included Jonathan Grimes, Stayman, Winesap, Ben Davis, and York Imperial. A bushel of apples produced approximately five pounds of dehydrated product, either as rings or as sections. The rings were made from slices 3/16 inch in thickness, and the sections were cut sixteen per apple. As the apple canning plants in this section are equipped to section rather than slice, most of the work is being done with apple sections. Apples were peeled and cored by machine, and the peeled apples and sections were kept from oxidizing to a brown color by dipping for thirty seconds in thiocarbamide solution. Thiocarbamide can be specifically used to preserve fruit color for several hours, and is obtainable from Boyce-Thompson Institute, Yorkers, New York, under the trade name of FRULITE. After sectioning of the peeled and cored fruit, the sections were spread on slatted wooden trays with a load of one and one-third pounds of fruit per square foot of tray surface. The loaded trays then received a sulfur treatment with sulfur dioxide gas in a tight wooden box for thirty minutes. As a result of thiocarbamide and sulfur treatments, a very fine preservation of the natural apple color was obtained with the dehydrated product.

Jonathan and Stayman Winesap failed to yield as high as Grimes, York, or Ben Davis. With Ben Davis, the quality of the dehydrated product was no better than the original poor edible quality of the raw stock, although a very white product is obtained which has attratced buyers in the past. It would not be an apple to recommend for use where edible quality is desired. Cooking tests with dehydrated Jonathan and Grimes have shown very good quality as sauce. With dehydrated York, an exceptionally fine cooked sauce can be made, or pie stock of fine flavor even without sugar added.

Work is in progress on the effects of various temperatures and humidities, as well as time of sulfuring, and the fruit material before and after dehydration and during storage is being studied chemically for vitamin, sugar, and acid changes, bacteriologically for development of micro-organisms, and comparatively for reconstitition and cooked quality vs. the canned samples of similar raw stock. High temperatures and high humidities at the beginning and toward the end of the dehydration period gave some disastrous results in terms of scorching and leaching. Further analysis of the material is necessary before details can be given.

Conclusions

With modern dehydration equipment, vegetables and apples grown in Maryland can be dehydrated to give a very satisfactory product as measured in terms of appearance after dehydration and edibility following cooking.

APPLE SELLING IN WAR TIME

CARROLL R. MILLER, Sec'y-Mgr. Appalachian Apple Service

A large part of Appalachian Apple Service's work this year has been in using the full weight of this 500-grower organization—and all the other weights we could assemble, to get the Apple Industry out of the deep pits into which Government unintentionally, was about to push the Apple Industry. I have wondered sometimes whether these new war-emergency government agencies are thinking of apples as they did when they were boys—when apples were kept mostly in caves and cellars and holes in the ground—whether these men, thinking thus, say among themselves: "Apples—they belong in caves and cellars. Here is a big hole. Let's shove apples into it!"

I'll name just a few of the bigger "holes" that were dug for apples—this year:—Nutrition rating—apples forgotten; metal for packages; the "75-percent Back-haul Clause" for our trucks; tires for our trucks; cold storage charge "ceilings"; apple storage diverted to other products; the problem of tin, for apple juice and for sauce and "slices"; price ceilings for the canners, and for fresh apples abolition of wood packages; and that biggest of all, labor and manpower. Every one of those has been—or is now—a major threat to the apple industry. Every one of them required an organized campaign, to prevent the industry being severely injured.

We are not kicking, and we are not shirking. We are at war. In war, people get hurt. We must expect that. Appalachian Apple Service has tried not to confuse the war effort for the selfish advantage of apples: but to marshal our production to the Nation's real need: to avoid injury to the apple industry where that injury was clearly unnecessary; where it came from ignorance of all the facts; speaking of apples as an important part of the Nation's food.

Incidentally, some growers have doubts as to how "essential" apples are as a war food. They are a little apologetic about their work, as a part of the Nation's war effort. Let those growers consider this, carefully:—

The wheat grower produces an average 20 bushels to the acre. At 60 pounds per bushel, that is 1,200 pounds of food per acre. The corn farmer produces 45 bushels. At 56 per bushel, that is 2,500 pounds of food per acre. The apple grower, averaging 300 bushels per acre, at 44 pounds per bushel, produces 13,000 pounds per acre:—of food that is really needed, for we have found out be experience and test tubes what the Bible taught us long ago:—"Man cannot live by bread alone". The apple grower produces five times as much food, by weight, as the corn farmer; eleven times as

much as the wheat farmer. So you apple growers can throw out your chests, in a military manner. The war right now hinges on food as much as on any other one thing. Apples, peaches, cherries:—all have been declared "essential" by Department of Agriculture.

These are times of great opportunities for the industry; and of terrible possibilities of injury to the industry. The opportunities can be developed, and the unnecessery injuries avoided, by only one thing;—close co-operation. One man—one grower—cannot make his voice heard in the din of world-wide battle today. Things are moving too fast, and the vehicles in which they are moving are too gigantic, to pay attention to the appeals of one grower. And no grower can produce apples and at the same time keep continuous, intelligent contact with all of Washington. If ever organization was called for in the apple industry, it is now.

A clear illustration is Appalachian Apple Service's part in the establishment and maintenance of prices for our canning-stock apples this season. Early in the summer, our own belief was that, in view of all the factors, our canning plants could use as many apples as they did during last season's record-breaking national pack, 8,200,000 cases, both "slices" and sauce. We held that belief almost alone; but kept asking questions. We found a veritable jungle of misunderstanding among all hands, including the canners. This was not to be wondered at, for all these—tin orders, price ceilings, etc., were brand new.

It seems to us that here was one of the big jobs of the apple deal ahead:—to find out how much the canners really would be able to use, and what price levels were in order under Governmental control: for canner prices make the floor for fresh apple prices. If the canner prices were good, fresh apple prices would be good. We kept on asking questions.

To condense this:—at Buffalo, during International Apple Association's convention, in early August, we assembled a little "rump convention" one evening after adjournment; rounded up Dr. W. G. Meal and Ralph Headley of A. M. A., M. E. Knouse for the Canners; Frank Gillan, Henry W. Miller and Billy Young for the National Apple Planning Committee; Truman Nold for National Apple Institute:— a few like that. We boiled the muddy situation down as far as we could, man to man; and agreed to arrange a meeting of canners, growers and Government men quickly. The meeting was called for Martinsburg on August 16th. Truman Nold brought the Government men:—from Department of Agriculture, from OPA, and from WPB. Mr. Knouse assembled

the canners; had, I think, a little more than one-half the total apple canning capacity of the United States there;—all from the Appalachian belt.

That meeting marked a real milestone. Growers and canners stated their needs: presented a factual case to the Government men. At Dr. Meal's suggestion, a joint committee was named, to carry the job through for this area. A meeting was arranged with OPA at Washington, at which most of the canners pledged to pay the growers 30 percent more than they paid last year—to cover increased expenses —If OPA would "up" the price ceiling on the canners' products to cover the increased cost of the growers and canners. OPA granted approximately this increase and those canners who agreed to pay growers 30 percent above last year's lived up to their pledge, throughout the long season. These canners held sufficient tonnage to practically establish the market for canning stock over the entire belt;—at about $1.60 for U. S. No. 1 Canners;—against $1.25 during most of the 1941 season;—or 35 cents per cwt. more.

This in spite of the fact that supplies of available canning apples were more than double last year's;—what with the lack of labor, that drove many growers to the canners with their entire crops; what with the shortage of market-going trucks; the lack of packages; and the bigger crop—almost double last year's in many sections:—and the likelihood that the canners would take fewer. Allowing in full for the cleaner grades of apples demanded by the canners, they could still have gotten plenty of apples at $1, had they so chosen; instead of the $1.60.

Figure out the net difference to you, on your own tonnage of lower grades.

What did it? Co-operation. And I would be a poor salesman if I did not point out that Appalachian Apple Service engineered that co-operation which puts into your pockets the dollars that enabled you to meet the season's high costs.

We did not stop there. Reduced rations of tin were hanging heavily over the deal. The canners awoke suddenly, just before October 1st, to the fact that their tin stocks were very low; that the big clean apples had been using up tin faster than in previous years, when more time and labor was required for the poorer apples. The canners called off their buyers. Our phone began to ring. Growers wanted to know what they were going to do with their canning stocks.

So—we went down to 441 Munsey Building, Washington, and Truman Nold of National Apple Institute and I join-

ed forces, to get more tin for the canners. The canners began working on it about the same time so we joined forces with them. Net results;—an award by War Production Board of 400,000 cases additional tin, to canners in the Appalachian Belt,—not for our selfish benefit; but to provide additional needed food. That allowed our canners to purchase a half-million bushels more apples. They promptly sent their buyers into the field again.

That half-million bushels was for "canned apples" (slices only); did not include apple sauce. Several of our plants make only sauce. So, at the urging of Mr. C. H. Musselman, we joined forces with the canners again in a second appeal for more tin, this time for sauce. Again we had success, although the totals were small compared with the first half-million bushel grant.

This illustrates the point that apple selling in war time offers huge opportunities, and also brings threats of ruinous injury;—and tha these two can be handled only by real organization and co-operation.

Let me note in passing that our canners this year did can more apples than they canned last season. The total pack-out for this Belt will be noticeably above last season's record breaker. My little conviction was justified. But it wouldn't have been except for the spirit of the canners. The leaders among them worked hard to keep on canning; to use up the crops of their growers. Their spirit may have been born of patriotism—and hence to be abandoned as soon as the war is over. It may be that, under stress of national war, we make peace industrially; and when national war has ceased, we again take up the old industrial warfare. That may be —but I doubt it. In this season's work, there have been a lot of eye-opening things. One of these eye-openers is the attitude of the major canners of this Belt toward the growers. You'll find this hard to believe after quarreling with their buyers and agents;—but most of our canners have a very highly developed sense of community responsibility. Apple growers in their areas are "their" growers, and these canners feel themselves, very keenly, responsible for doing the very best they can for "their growers". That seems far-fetched. I happen to know it is true. I feel like saying this: If Appalachian Apple Service has done nothing else in its 7-year life than to get the grower and the canner working together, instead of fighting each other, we have been worth many times what we have cost. The formula is simple:—Get together, as partners. Put your troubles on the table and help each other solve them, honestly, as partners.

In my few remaining minutes I want to mention some of the other jobs we have done and are doing in this wartime apple promotion.

Our main, permanent work-field is with grocers and the public; not with Government. It is the grocers and the public who buy and eat our apples;—not Government. That is something to keep in mind, strictly. Advertising and promotion are cumulative. Stick-to-it-iveness counts as much as any other one thing in advertising. We have made a good start in the past seven years toward getting the public and the grocer apple-conscious: —especially "eastern-flavor" apple conscious. West Coast apples are being sold more and more west of the Mississippi; less and less in the East; which is not only helpful to us, but economically sound and right. Our apples are expanding their market area, further. This year, Appalachain apples have been sold in Texas, Oklahoma, Nebraska, Kansas and Iowa. Distributors who formerly held Eastern apples in a kind of contempt are curious now;—curious enough to order; and then re-order, if they get good fruit. And a part of this curiosity comes from the big savings in freight, per car, which we have kept under their nose at every chance. The Distributor's Apple Book will show what we mean.

We must not let this favorable impression about our apples die out, even though for the period of the war, probably, we have an apple deal which is a "seller's market" instead of the usual "buyer's market". If we keep on telling the trade, the grocer and the public; and keep on doing a better and better job of packing as the trade and the grocer and the public want their apples, we will continue to better our sales, —and prices received.

For the immediate present, we do not have to "strain our suspenders" to get the grocers to handle apples and the public to buy them. Food is scarce.

Since our two wars can hardly terminate before next Fall, and we will doubtless be "feeding the world" for a season thereafter, food will continue scarce, and the "sellers market" in apples will hold for another season or two. But let us never forget that in World War I, our Government encouraged the production of wheat and corn, as the needed foodstuffs; with such huge success that after the war there was a tremendous surplus of wheat and corn; a surplus that almost ruined farming. In this war, the emphasis is not on wheat and corn; but on meat, dairy products, vegetables and fruits. There will doubtless be huge expansion in production of these; and at least two of these are our direct competitors. It looks as though we are in for competition, when things return to normal, that will make pre-war competition

baby-play. It looks like a dog-eat-dog battle to see who gets the consumer's dollar. We are preparing for it; trying to save up a "war-chest".

For the time, we don't have to "bust our galluses" to get the trade and the public to buy apples; and it is a good thing we don't. We just couldn't do it. Twice this Fall I have had trips to the terminal markets all prepared; all reservations made; and have had to cancel the trips, when things broke loose in Washington. First time it was the tin shortage for the canners. The second time it was "the drop" and the need for quick action with the Government, the grocers and tin for the canners.

So this season we are doing a lot of our work by mail. We got out three new books, and a direct-mail series for the grocers;— a series of four cut-out apples, going, one a week for four successive weeks, to 25,000 grocers.

We got out this season the first apple book for distributors ever issued:—aimed at making it big, handsome and impressive. We seem to have succeeded. Volunteered comments have come from many places.

We got out, for the first time, a real Consumer's Apple Book:—something we have needed for schools, home-making classes, etc., as a supplement to our Apple Cook Book.

Speaking of Co-operation—We got a quarter-million "throw-away" folders for nothing, literally. "Throwaways" we call the folders placed on store counters, where customers help themselves. They can't cost much, for wastage is heavy. These literally cost us nothing, through co-operation. Michigan State Apple Commission is using our monthly Apple Service for newspapers; supplies 86 newspapers of Michigan and nearby states with it each month. To supply this to Michigan costs us exactly the price of the three 8x10 photo prints of the apple dishes, $1.50 per month. Michigan thought, properly, that she would pay us for this Service. But is was hard to put a cash value on something that actually cost us only $18 a year, when it was being put to such helpful use. So we swapped. Michigan was making some very attractive "throw-aways". We were out; had exhausted our two-million stock. So Michigan changed their imprint to ours and gave us a quarter million; cost about $500.

While talking co-operation, let me tell one more instance. Appalachian, Michigan and Washington State Apple Commission joined in a big, double display booth at the National convention of the Super-Market operators, at St. Louis in September. The booth cost $600, which we split three ways; got a splendid effect for apples, at one-third the cost for each of us. We are doing a lot of that.

I have not mentioned our two apple movies, with 18 prints in continuous circulation; nor our work at conventions of food and health specialists; nor our general publicity work with both grocer and public; nor our advertising to the trade and the grocers through their leading trade periodicals; nor our work in getting harvest labor lined up for this Belt;—and that in itself was a real job. I have scarcely mentioned the Special Push on Drops which we engineered; not too successfully, because of condition of the apples, mostly; but it moved out some thousands of bushels.

I have only mentioned our Apple Recipe Service. Just the other day we added another big daily to our list—The Philadelphia Inquirer. That makes us 22 big ones:—and about 30 smaller dailies. They are accepting the Apple Recipe Service now as an institution, we find from their letters. It took us four years to reach this status; but it certainly is bringing results in apple publicity;—for us and for Michigan. And we are getting apple cookery into the American cookbook and recipe system. Until now, there has been a sad dearth of available apple cookery data. We are correcting that:—a very important thing, for the young housewife-to-be today learns cookery from classes, cook books, etc., instead of from her mother in the kitchen, as once was. I haven't mentioned our distribution of posters, apple sales helps, the 1943 Grocers' Apple Book, etc., which is a large part of our work. All these can be studied more understandingly at the Appalachian exhibit in the lobby.

We haven't mentioned our work in Peaches. Let me report briefly. We spent $5,700 for peaches this season through Appalachian Apple Service's Peach Division, and National Peach Council. We early in the season foresaw that home-canning of peaches had excellent prospects of moving a big percentage of the gigantic oncoming crop., because home canning was patriotic (to save tin); and because food scarcity, just beginning to loom, brought thoughts of bare pantry shelves—and hunger—this winter. So we pushed home canning;— with the grocers, with the public, and through the Governmental agencies. Our hunch proved correct. The public really canned peaches; bought them in 1-bushel and 2-bushel lots, at $1.89 up to $2.45 per bushel retail in the cities; less in the peach-growing areas. It was the greatest peach-canning bee in many years, we found on factual reports from grocers all over the East. A Kroger produce manager at Knoxville, Tenn., reported that queues of women stood in line to get peaches from the truck as they arrived; in 1-bushel and 2-bushel lots. Home canning made the 1942 peach deal; kept prices from ever going below $1.35, f.o.b. for U. S. One, 2 inch; and sent them up to $3.05 at the close of the season, as women realized that they were almost

too late. We actually didn't have enough peaches. But we had 65½ million bushels;—one of the largest crops in 20 years. Home canning is a thing that can and must be developed, if the 30 million families of the nation are to use the approximate 45 million bushels of "fresh" peaches (excluding about 25 million bushels of West Coast canning peaches), in the 10 weeks of the season. And home canning can only be developed by intensive organized work. Appalachian growers have reason to be proud of themselves in this. They led, handsomely, in supporting the peach promotion work this season;—Pennsylvania first with $1,700; Viginia second with $1,600; South Carolina third with $1,500, and so on.

My time is up. Let me repeat in closing: Today, as never before, the handwriting on the wall spells out ORGANIZATION. Only as an organization can you secure for apples the opportunities presented by Government and this Emergency. Only by organization can you fend off the huge injuries which well-meaning but ignorant and harried agencies in Washington inflict. Only by Organization can you be prepared, market-wise, for the dog-eat-dog competition which will follow the increase in production of vegetables and fruits which is a part of our war-time program, when war's demands have ceased.

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WEATHER FORECASTING UNDER PENNSYLVANIA CONDITIONS

WILLIAM S. CLARK, The Pennsylvania State College

Fruit growers and others engaged in agricultural work find that a knowledge of future weather conditions is of great value in planning many phases of their work. In time and in places where government weather maps and forecasts are not obtainable, it is possible for any one interested to make his own predictions with the aid of a barometer and the study of the wind direction and shifts in direction. While the weather never repeats itself exactly, and while there is no fool-proof system of weather forecasting, yet a little knowledge and practice will enable most people to make their own forecasts with a fair degree of accuracy.

Those interested in studying this subject in more detail should write the Superintendent of Documents, Government Printing Office, Washington, D. C., for Weather Bureau Bulletin No. 42, "Weather Forecasting", Sixth Edition. Price 10c.

Continental Air Movements. The masses of air over the North American continent are steadily drifting eastward. They are not uniform, but are thrown into belts of heavier and lighter air—a belt of heavier denser air followed by a belt of lighter, less dense air, and then by a belt of heavier air. These belts of air may be hundreds of miles in width.

The weight, or density, of the air can be determined by means of a barometer, which is an instrument that measures the weights of the air column above the place of observation. In the older types of barometer a column of mercury rose or fell, depending on whether the air column above the instrument was heavy or light. When the air column was heavy, the barometer was high; when it was light, the barometer was low. The belts of heavier air have thus come to be known as "highs"; and the belts of light air, as "lows"' Under average Pennsylania conditions a mercury barometer at sea level will read about 30 inches, the weight of the mercury balancing the weight of the atmospheric column at this height.

Most of our air masses with high barometer readings, of "highs", come from the polar regions. They are usually cool or cold, relatively dry, and generally bring fair weather. In the summer some of the highs may be located over the North Atlantic Ocean and bring cool, moist weather and sometimes rain. Most of our air masses that are connected with low barometer readings, or "lows", originate in the Gulf of Mexi-

co, or sometimes in the Atlantic Ocean near the West Indies. They are warm, moist, and generally bring rainfall or damp, humid weather.

A high usually follows a low, and then comes another high. In the winter one high may follow another at intervals of about three days. At times the movement is very regular; at other times the whole movement of highs and lows may slow up or even stop for a time; then the movement and succession of highs and lows is much slower. One high may follow another in about four or five days, or it may not come for one or two weeks or more after the preceding high.

In a high, there is usually an area, or center, where the air is heaviest and the barometeric reading highest. In a low, likewise, there is usually a center, or sometimes a long trough, where the air is lightest and, consequently, the barometeric reading lowest. In the highs the air is moving out away from the center and circling with a motion like the hands of a clock, or in a clockwise direction, in the lows the air is moving in toward the center in a counter-clockwise direction much as whirlpools in a stream have their own movement while drifting along with the stream.

If several weather maps are observed, the movement of the air away from a high and toward a low, not directly, but in a circular motion, can be seen by a study of the wind derections around the highs and the lows. Figure 1, represents an approaching high, centered over the Mississippi Valley, with a low passing off the coast of eastern United States. The continuous lines represent the barometric pressure, and the arrows mark the directions of the wind at the leading weather stations. Occasionally a wind direction may deviate from the general trend on account of some local condition, but nearly all stations show that the wind is blowing in a clockwise direction around and away from the high, and in a counter-clockwise direction around and toward the low. Most of the winds noted in Pennsylvania are from the Northwest. As a high approaches Pennsylvania following the passage of a low, the winds are usually west, north-west or north, depending on the position of the high, until the center reaches this state. The weather is usually cold and windy as the high comes on, frequently with squalls of snow or rain, but it clears off as the center of the high approaches, and the wind dies down, with cold, frosty nights and sunny days.

Figure 2 shows the passage of a high off the coast of Northern United States and a low following from the Gulf States. The winds are blowing from the high toward the

low, but there is some tendency for a circular motion of the wind around the low. In the belt of high pressure many of the stations reported a calm, with no wind at all. In Pennsylvania the winds were northeast. The low moved up through the eastern states and was accompanied by heavy snow in Pennsylvania and adjoining states. Most of our heavy winter snows are caused by weather conditions similar to those shown on this map.

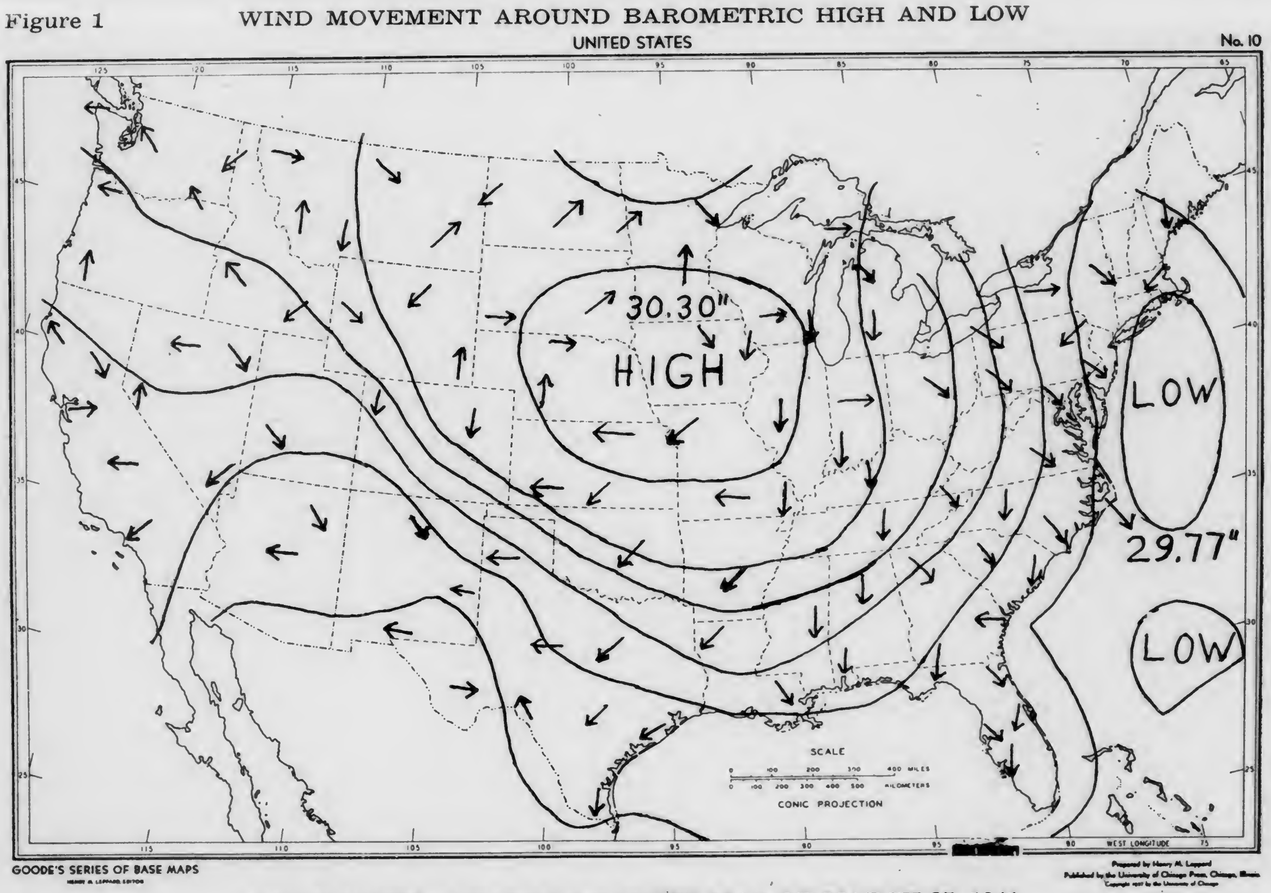
Figure 3 shows a high off the coast of eastern United States and a low passing north of the Great Lakes. This condition is a rather common one, particularly in the summer, but also at other seasons of the year. In this case the winds in Pennsylvania were southerly. The weather had been warm and fair, and it was soon followed by showers and thunder storms, with cooler weather as the low moved eastward and the next high followed it.

By noticing the direction of the wind, the observer can usually tell the position of the high and the low. If he faces the wind, the low will be at his right and a little behind him, and the high will be at his left and a little to the front of him.

When a high moves off, the warm, moist air from the approaching low rises over the receding mass of cooler, denser air of the high; as it rises, it is cooled, and the moisture condenses into clouds and, eventually rain may fall. In the eastern United States the region of heaviest rainfall is usually in the western part of the receding high and in the eastern part of the approaching low. In Figure 2 the high centered over New York and New England passed out to sea, while in two days the low over the Gulf States moved up along the coast to North Carolina and then out into the Atlantic Ocean a few miles off the coast. From the Gulf States up the coast to New England there was a region in which heavy rains and snows fell, the heaviest rainfall or snowfall being south and west of the receding high and north and east of the approaching low; and the precipitation ceased when the low passed well out to sea. In Figure 3 the low north of the Great Lakes moved eastward to New England in two days. To the south of the low was a region in which there were numerous showers and thunder storms. This region moved eastward as the low moved eastward, being centered over the Mississippi Valley on May 7, over the Atlantic States on May 8 and passed out to sea as the low moved over New England.

Figure 1 WIND MOVEMENT AROUND BAROMETRIC HIGH AND LOW

UNITED STATES No. 10



GOODE'S SERIES OF BASE MAPS

Prepared by Henry M. Leppard
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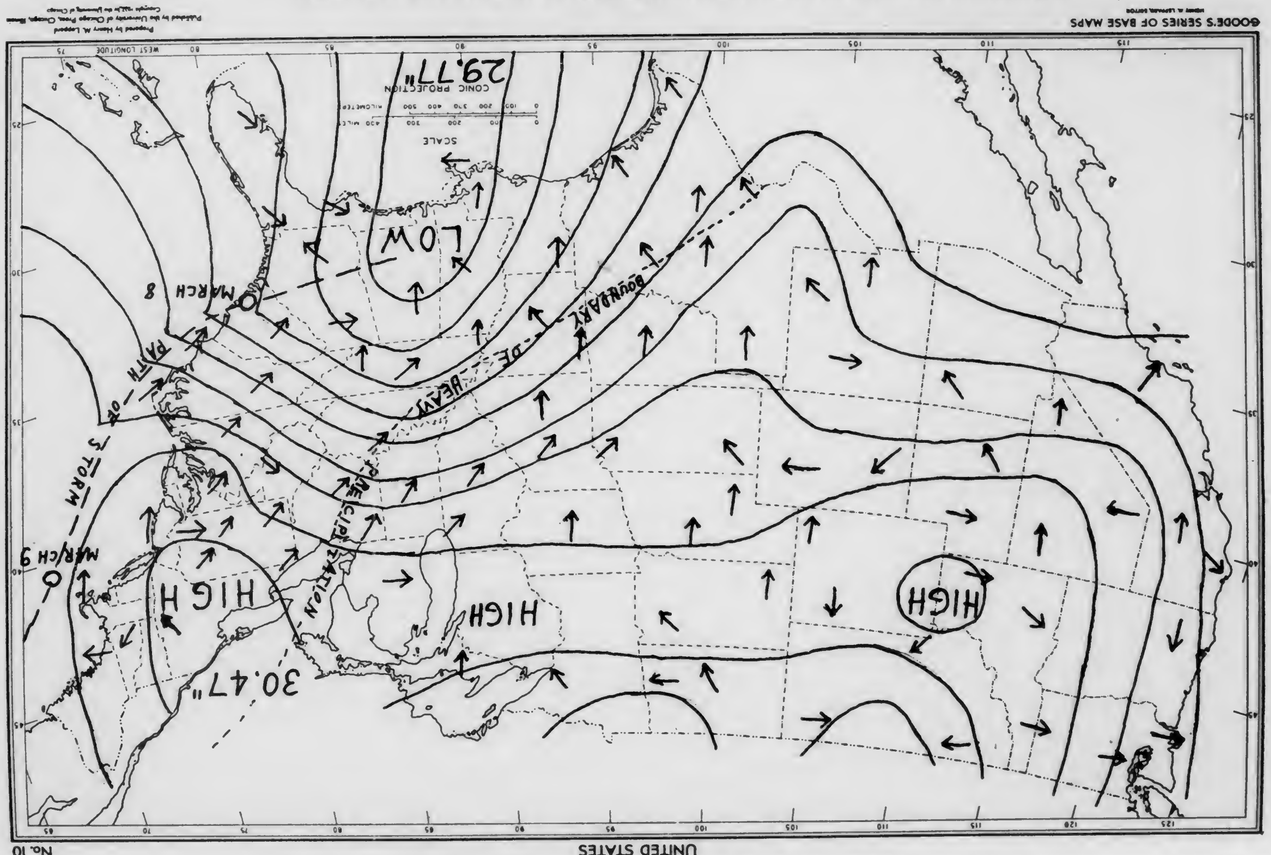
FROM UNITED STATES WEATHER MAP OF MARCH 25, 1941

The solid lines on this map are isobars, or lines of equal barometric pressure. There is approximately 0.09 inch difference in pressure between each line. The arrows fly with the wind.

Figure 2 WIND MOVEMENT BETWEEN BAROMETRIC HIGH AND LOW

UNITED STATES No. 10



GOODE'S SERIES OF BASE MAPS

Prepared by Henry M. Leppard
Published by the University of Chicago Press, Chicago, Illinois
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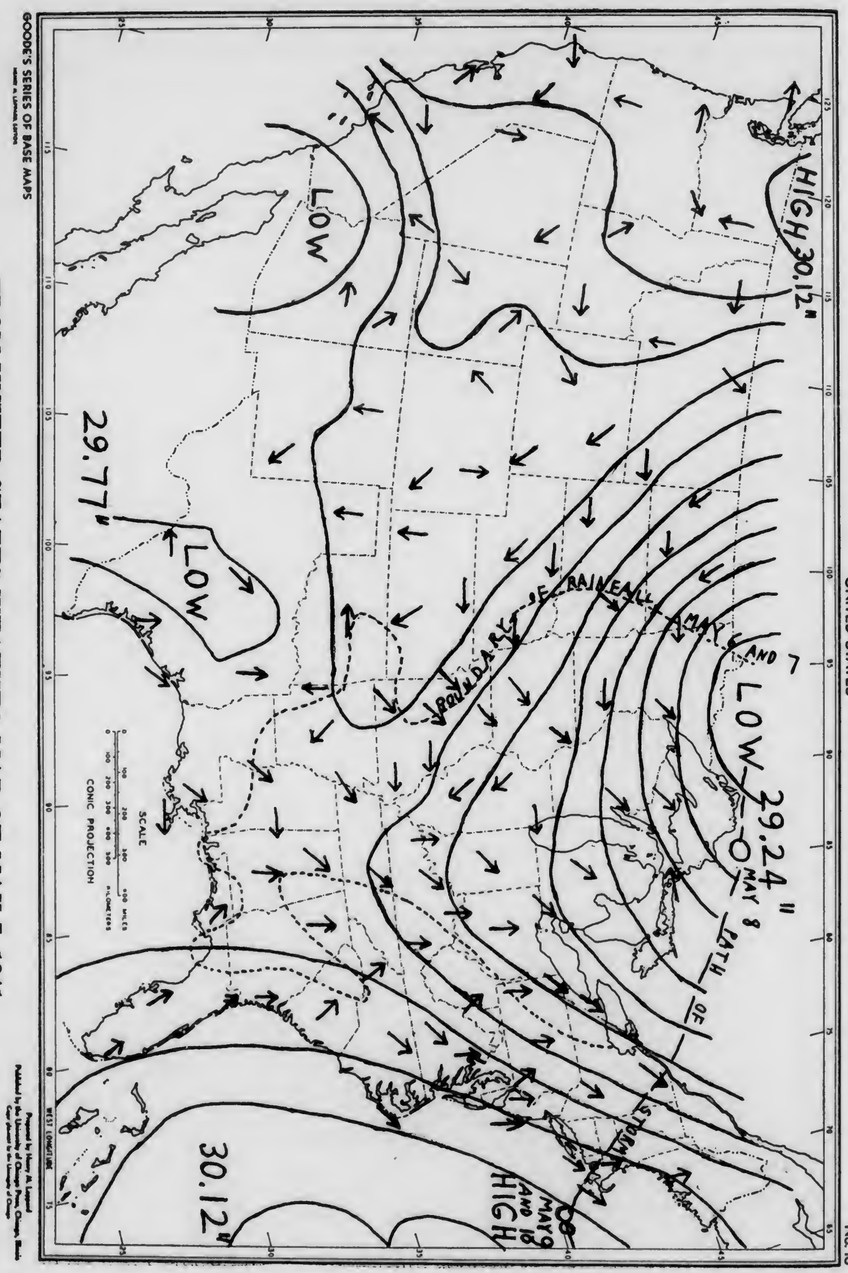
FROM UNITED STATES WEATHER MAP OF MARCH 7, 1941

The solid lines on this map are isobars, or lines of equal barometric pressure. There is approximately 0.09 inch difference in pressure between each line. The arrows fly with the wind.
The dashed line shows the path of the center of the low in the ne xt two days. The dotted line shows the limit of the area of heavy rain or snow during the course of the storm. At 8 a. m. on March 7 the snow was beginning as far north as southern Ohio and Maryland.

Figure 3 WIND MOVEMENT AROUND A BAROMETRIC LOW No. 10



FROM UNITED STATES WEATHER MAP OF MAY 7, 1941

The solid lines on this map are isobars, or lines of equal barometric pressure. There is approximately 0.09 inch difference in pressure between each line. The arrows fly with the wind.

The dashed lines show the path of the center of the low in the next three days. The dotted line shows the limit of the area of rainfall between the morning of May 6 and the morning of May 7. During May 7 the area of showers extended eastward to the Atlantic Ocean, with the exception of parts of New England. Showers continued in the Middle Atlantic States, including Pennsylvania, and in New England until May 10, when the storm passed well out to sea.

Major changes in barometer readings and in wind directions are, thus, indications of the approach of highs or lows and of major changes in the weather.

Instruments for Weather Forecasting. Mercury barometers have been largely replaced by the aneroid type, in which a disc-shaped partially evacuated metal chamber takes the place of the mercury. The thin metal walls move in or out, depending on the air pressure, and a pointer attached to the metal is adjusted to a scale reading in inches corresponding to inches of mercury. In the maps published by the United States Weather Bureau all barometric readings are corrected to sea level readings, as the air pressure diminishes with altitude. With a mercury barometer one must make his own corrections to sea level with a knowledge of his own altitude above sea level. One may consider that the mercury falls one-tenth of an inch for every hundred feet of elevation above sea level. Thus, if one is 500 feet above sea level, and his barometer reads 29.65 inches, its corrected reading to sea level would be 30.15 inches. This correction factor is not strictly accurate, as the true figure of correction varies with the temperature and with the actual elevation, being slightly greater than one-tenth inch at elevations within a few hunderd feet of sea level; but it will do for practical purposes. In order to compare local barometer readings with a weather map, it is desirable to adjust an aneroid barometer to sea level. On many aneroid barometers of recent manufacture the face with the scale readings may be rotated so that it can be adjusted to the actual elevation of the instrument, and the pointer will then indicate the sea level reading without the necessity of any corrections by the observer.

Many barometers of popular make carry inscriptions such as "fair", "changing", "stormy," and others. These inscriptions are often quite misleading in attempts to forcast the weather, as many other factors enter into the judging of the future development of the weather than the height of the barometer at any particular time. The relative movement of the barometer is more important than its actual height; and the direction and shifts of the wind, as well as the present state of the weather, must also be considered in predicting weather changes. There is no single instrument available that can actually forecast the weather.

Some aneroid barometers are made with temperature compensations, so that their readings will not be affected by changes in air temperature. With most barometers, changes in air temperature may make considerable differences in the readings, sometimes more than a tenth of an inch. It is well to keep barometers in a room where temperature changes are

least. Air pressure inside a building soon becomes equal to that outside, and barometers do not have to be kept outdoors.

During planting and harvesting seasons and whenever weather forecasting is essential, the barometer should be read night and morning and these readings entered in a daily diary. At critical times a noon reading aids in detecting rapid changes.

At the same time that the barometer is read, wind direction and velocity should be noted. Wind directions should be taken in the open, away from trees and buildings. Steep hillsides, mountain sides, and narrow valleys also deflect the wind. A wind vane is the best means of determining wind direction. In its absence, the observer may note the direction of smoke from a chimney or stand in the open with his face directly into the wind or blow his breath into the air or use other reliable means. The wind direction is given as the direction from which the wind is blowing.

The direction of the wind is just as important a guide in forecasting the weather as the state of the barometer. The two should be used together in making predictions. Actual observations of the present state of the weather go along with a study of the wind and the barometer; but changes in the wind and in the barometer usually precede changes in the weather. Shifts in the direction of the wind are particularly important and should be noted just as much as the actual direction at the time of observation.

The Weather From Day to Day As Affected by Air Masses. The weather is determined largely by the character of the body of air, or air mass, around us. When a high from the polar region is here, the weather is usually cool or cold, fair, and dry. When a low from the Gulf of Mexico comes northward, the weather becomes warm and moist, with showers or steady rainfall. The barometer indicates the passage of the highs and lows; when it is rising, a low is passing off and a high is approaching; when it is falling, the high is passing off and another low is approaching. The barometer does not foretell the weather directly, but only indicates the movement of the highs and lows. However, it is important as an indicator of the weather because most highs bring fair weather and most lows bring rain or snow.

Most of our rainfall comes when the barometer is dropping, as the high moves off and the low approaches. Sometimes the rain begins shortly after the barometer has begun to drop; at other times the rain may not fall until the barometer has dropped considerably. The amount and duration of rainfall depend on the relative position, point of origin, and rate of movement of the highs and the lows. Some

times we are close enough to a low to have the damp, humid weather or cloudiness, but the rain does not fall in our locality. At times we may receive rainfall as a new high follows a low and pushes upward the moist, lighter air. However, such rainfall, which is sometimes called a "clearing off shower", seldom continues for a long time.

In winter most of the rainfall or snowfall comes while the barometer is on the way down, and usually when the wind is from an easterly direction (north-east, east, south-east, and sometimes south). The rainfall often ceases or diminishes as the bottom or trough of the low approaches. When the high follows, the colder air often rushes in toward the low, producing high winds. Squalls of rain or snow often accompany the on-coming high.

In summer, rain often follows the moving off of a well-developed high, but at this season the highs and lows are generally not nearly so well developed as they are in the winter. Much of the summer rainfall comes as showers or thunder storms near the bottom of the low, just before the barometer begins to rise. At other times the rain may come in thunder showers when the barometer is falling slowly, or even when it is stationary, particularly when there is a south or south-west wind. Such winds in summer bring moist air from the Gulf of Mexico. The heat of the sun causes the air to become hot and to rise during the daytime. Then, as the air cools and the moisture condenses in late afternoon or evening, thunder storms develop. Much of the summer rainfall develops during periods of prolonged south-west winds. Some storms also come when the wind is easterly, but on many occasions in summer the highs move down the Atlantic Coast, where the water is cooler than the land; and easterly winds may bring fair weather as well as storms.

In the winter most of the highs come from the interior of Canada or from the North Pacific Ocean. If they pass to the north of us, they are attended by severe cold and winds swinging from west or north-west to north and then north-east. As the wind reaches the north-east, cloudy weather results, followed by snow. If the centers of the highs pass directly through or near Pennsylvania, they are usually accompanied by westerly winds, a short period of calm, followed by a shift of the wind to an easterly direction. Rain or snow usually comes about one day after the passage of the center of the high. If the highs pass to the south of us, they are usually accompanied by fair weather, often mild, or with a strong westerly wind. As they pass off, the winds usually remain westerly, and there is seldom much precipitation from the following low.

In the summer some highs come also from Canada or the Pacific Ocean, accompanied by west or north-west winds and fair, cool weather. However, many also move southward along the Atlantic Coast. When the centers are near the coast, they are usually accompanied by fair, cool weather, sometimes preceded by a storm. When the centers are some distance off shore, they may be accompanied by a long period of cool, wet weather. These highs usually follow a period of hot weather with westerly winds; and, as they approach, they are often accompanied by thunder storms and sometimes a heavy rain. If the storm does not follow shortly after the shift in the wind, and the barometer rises markedly, there will probably be no storm. If the storm comes and the barometer rises markedly, it will probably clear off in a day or two. However, if the barometer rises or falls slowly or is steady, the wet weather will probably continue for some time, usually until the wind swings back toward the west. The barometer may fall before the wind goes back to the west.

Sometimes, most commonly in the spring and fall, a high becomes stagnant over the eastern states for several days. The weather remains fair and the barometer high; it often rises slowly and then falls slowly. If the center of the high is over New England or the Middle Atlantic States, the winds are usually north-east or east, and the nights are cool and frosty. The fair weather will probably continue until the barometer makes a decided drop, with the winds shifting to south or south-west. If the center of the high is over the South Atlantic States, the winds are south or south-west, accompanied by Indian summer weather. The weather will probably remain fair until the barometer makes a decided drop, with the wind shifting toward the east.

Most lows influencing Pennsylvania weather originate near Alaska and cross North America near the Canadian border, leaving near the Gulf of Saint Lawrence. In the summer these lows usually move slowly and well to the north of the border. There is an air circulation from the Gulf of Mexico toward Canada, bringing warm, moist air over the eastern United States. The winds are usually south, south-west, or west, and showers or thunder storms are frequent. Occasionally the lows move across the United States, with easterly winds and heavy rains.

In the winter the lows may move across the Canadian border, bringing mild weather with light showers, accompanied by west or south-west winds. More commonly than in summer the lows are pushed southward over the middle or southern United States, where they draw in moist air from the Gulf of Mexico. They usually bring considerable rain

or snow and are accompanied by southerly or easterly winds and usually by a very low barometer reading. Sometimes the lows are pushed eastward all the way to the Atlantic Coast, and they bring in moisture from the Atlantic Ocean. They are accompanied by north-east winds and often bring heavy snow or rain to Pennsylvania, particularly to the eastern part of the state.

In late summer and early fall, most commonly from August to the middle of October, a low from a tropical hurricane may move up along the Atlantic Coast, bringing heavy rains and high winds to eastern Pennsylvania. Such a storm is often preceded by one or two days of cloudy weather with a north-east wind before the barometer falls rapidly.

When lows move across the continent far to the north, they are usually accompanied by westerly winds, mild weather, and little or no precipitation. When they move across the continent near the Canadian border, they bring south-west winds and usually showers (or sometimes south winds swinging to south-west). When they move across the continent farther south, inside the United States, they are usually accompanied by south, south-east, or east winds, and often bring heavy precipitation. Storms moving up along the Appalachian Mountains or the Atlantic Coast bring north or north-east winds and cold rains or snow to much or all of the state.

At times the storm tracks and highs move far away from Pennsylvania, and the barometer will show relatively little movement for days or even weeks. Usually the weather will remain steady, with only slight showers for precipitation, and mild without any pronounced cold spells. Occasionally a high will become stagnant over the ocean, and the weather will not change for days at a time. Prolonged periods of cloudy or rainy weather are usually the result of such a condition. In such a case the winds are often easterly and the barometer steady; the weather will probably remain constant until the wind increases in velocity and the barometer drops, or the wind shifts to a westerly direction, indicating the moving away of the high.

Our midsummer weather is often governed by a high out in the Atlantic Ocean, about the latitude of Bermuda, which is more or less permanent at this season. When it is well out to sea, the normal succession of highs and lows move across the United States. In some years it may move westward toward the Atlantic Coast for a week, several weeks, or even months. At such times the warm moist air from the South Atlantic will move around it in a clockwise motion, bringing frequent showers to our Eastern States for a long

period. Usually the barometer does not make pronounced changes, or it may fall slightly with south or south-west winds accompanied by showers, and then it will rise slightly, accompanied by west or north-west winds, and clearing for a day or two. A new period of showers will soon follow. Occasionally the edge of this high pushes inland, and the showery weather visits the Mississippi Valley, while Pennsylvania is visited for a long period of time with hot, dry west or south-west winds. Our summer droughts and heat waves are usually the result of this westward movement of the summer Atlantic high. The hot, dry weather usually continues until the high moves out to sea again, and it may last for one or two weeks or, exceptionally, for more than a month. In extreme cases the high may push inland over most of southern United States, and the whole interior of the country will be visited by a prolonged, searing heat wave or resulting in Inlian Summer in the fall.

Prediction of Frost. In the higher altitudes in Pennsylvania, particularly in the northern part of the state, frosts may occur in any month of the year. In the lower altitudes of the central and northern part of the state they may be expected any time after early September in the fall and as late as June in the spring. In very exceptional years they may even occur during the summer. There is a period in the middle of May when damaging frosts are very apt to occur. In the lower altitudes of southern Pennsylvania frosts are rare after the end of April in the spring and before the middle of October in the fall.

After about the middle of October in the fall and until the latter part of April in the spring, freezing weather may accompany highs moving down from Canada even when the wind is blowing or the nights cloudy. The temperature may be below freezing through much or all of the daytime. After the latter part of April until the middle of October in Pennsylvania the temperature is usually above freezing in the daytime, and freezing temperatures generally occur only at night under certain conditions.

In the daytime the earth and the atmosphere receive heat from the sun, and the air temperature rises. At night much of the heat is lost by radiation. Clouds tend to act as a blanket and prevent much of this radiation, and frosts are unlikely on cloudy nights in the spring, summer, and early fall. Cold air is denser and heavier than warm air, and at night the cold air tends to flow down the slopes of hills and mountains and to settle in the valleys and in the hollows and ravines. Such low places are more subject to frosts than the hilltops and the upper parts of the slopes. On a windy night

the air is stirred up so that the cold air has no opportunity to settle, and the frosts are much less likely on windy nights than on still ones.

Frosts in the spring, summer, and fall are therefore most likely to occur on still, clear nights. The liability of any particular sport to frost is affected by its elevation in relation to the surrounding land. On a cold, still night the lowest part of the valley is usually the coldest; and then the air temperature is progressively warmer with elevation anywhere from a few feet to several hundred feet above ground level. On nights when the frost is light, only the lowest points may catch the frost; when the frost is heavy, only the upper parts of the slope may escape. In many Pennsylvania valleys there is a belt of land about 300 feet above the lowest points of the valley which is relatively free from frosts. The slopes of the hills or mountains bordering the valley and the hills within the valley rising above this mark may escape even the heavier frosts which kill blossoms and vegetation in the lower parts of the valleys.

There is a tendency for the temperature of the air to decrease with altitude. The decrease is an apparent contradiction to the statement that cold air settles in the valleys and ravines. However, this tendency extends up into the atmosphere for several miles, the decrease in temperature being about one degree Fahrenheit for about each 400 feet increase in altitude. The settling of cold air is known as an inversion of temperature and occurs usually only on still nights; its effects are usually limited to about 500 feet above the ground level of the valley, and they are usually limited to individual valleys rather than to the whole region. The decrease in temperature with altitude as it affects the atmosphere in general will explain the fact that mountainous areas are often visited with snow or frosts while the lowlands escape. Valleys where the ground level is at a higher elevation above sea level than other valleys nearby may receive frosts that the valleys of lower elevation may escape.

Water looses heat much less rapidly than land, and it tends to equalize the air temperature near it and thus prevents light frosts. Often the borders of lakes and rivers may escape frosts, while the surrounding country may be severely affected. With larger lakes the effect of the freedom from frosts may extend for some distance, especially on the shore away from the wind, which is usually to the south or the east. The effect may extend as far as the next hill, even though it may be two or three miles away, or even farther. A belt of land south of Lake Erie is famous for its freedom from damage by frost and many of the larger lakes in northern Pennsylvania and in states farther north have important fruit in-

dustries on their borders, particularly on their eastern shores, because of the decreased hazard from frost which the lake affords them.

A frost may be forecast rather accurately for the following morning from a knowledge of the temperature of a wet bulb thermometer at any given time in the afternoon or evening. For any particular locality the difference between the wet bulb temperature at a given time and the minimum temperature the following night is constant. This difference changes at different periods of the year, but it is constant for any given period, such as late September, early November, mid-May, etc. A few observations of the wet-bulb thermomter at the same time of day at any given period of the year and of the minimum temperature during the succeeding night will enable the observer to predict a frost with a reasonable degree of accuracy.

The wet-bulb thermometer is easy to observe. While a special wet-bulb thermometer may be purchased, an ordinary outdoor thermometer, if accurate, can be used. Around the bulb is placed a strip of wet muslin or other suitable material that will keep moist for about fifteen minutes and at the same time allow it to be exposed freely to the air.. The bulb should be wet with very pure water, preferably distilled water such as is used for automobile batteries, as substances dissolved in the water will lower the temperature of the water as it evaporates and produce too low a temperature of the wet bulb. The thermometer should be exposed to the atmosphere outdoors in the shade, but fully exposed to the wind, for about fifteen minutes, or until the temperature is constant. Care should be taken to see that the bulb is still wet at the moment of observation.

The likelihood of a frost, though not its definite prediction, may be forecast somewhat farther ahead by a study of the weather conditions. As previously mentioned, a frost is not likely on a cloudy or on a windy night. If the temperature is such that a frost seems possible, the frost is more likely under the following conditions: If the barometer begins to rise from a low and the wind sets in from a point between north-west and north-east, with clearing skies, there is a likehood of frost the following morning. If the rise in barometer does not set in until late afternoon or evening, the frost may not occur until the second morning; but if it begins to rise in the morning with a northerly wind, frost is likely the next day. If the wind is south-west or west, moving toward north-west, there may be a frost when the wind drops. In this case the frost is more likely to occur the second or third morning after the barometer has begun to rise, but the dropping of a wind, with clear skies, is the most important

sign of frost. In the warmer parts of the spring or fall, frosts are unlikely when the wind is in a direction south of west; and they are most likely when the wind is between north-west and north-east.

The Weather In Relation to Wind Changes

Wind Changes—	Weather—
W or NW through N to NE or E Steady high or rising barometer	Continued fair and cold
W or NW through N to NE or E Falling barometer, after being high	Rain or snow, probably prolonged wet spell
W or NW to SW—Winter Barometer steady or slowly falling	Continued fair and mild; Indian Summer type of weather
W to NW to SW—Summer Barometer steady or slowly falling	Hot weather with scattered thunder showers
W or NW to SW Barometer falling steadily	Rising temperature, showers
W or NW toward S and SE Barometer falling	Mild temperature, rain within 1 or 2 days
NE to SE Barometer falling	Continued snow or rain, rising temperature, clearing probably in 1 or 2 days
N to NE, then to SE or S Barometer falling	Rising temperature, followed by rain in 1 or 2 days
NE to N and NW Barometer rising	Clearing and cold
NE to N and toward W and SW Barometer rising	Clearing with mild temperature
E or SE toward S and SW Barometer falling	Continued rain, followed soon by clearing and colder
E or SE toward S and SW Rising barometer	Clearing and colder
SW to NW, followed by calm or light variable winds, then NE to SE Rising, then falling barometer	Fair for about 1 day, then rain or snow
SW to NW, then directly toward N or NE Barometer low, beginning to rise	In summer, rain or unsettled, and cooler, followed by fair and cool, probably for several days. In winter, probably snow or rain
NE to SE, shifting directly to SW or W Barometer has been high, now falling	In summer, rising temperature, fair followed in 1 or 2 days by thunder showers. In winter, warmer, probably unsettled or showers
NE to SE, shifting directly to SW to NW Barometer low, now rising	Clearing and cooler, often accompanied at first with squalls and wind
Winds light and variable Barometer steady	Continuance of same type of weather

Notes on the Changes in the Barometer and the Wind. The relative movement of the barometer, such as the rate of rise and fall, and the change from rising and falling, is a more important point in forecasting the weather than its actual height.

The speed of movement of the barometer is an indication of the stability of the weather. When the barometer moves rapidly, the weather will change rapidly. When the barometer moves slowly, the weather tends to change slowly and may remain without substantial change for several days.

When the barometer rises in about one day from about 29.80 inches or lower to a point about 30.10 to 30.20 inches and then stops suddenly with a sudden drop in the wind, a storm will probably come within 24 hours.

If the barometer continues to rise rapidly above 30.20 inches and then ceases suddenly, with a drop in the wind, which soon begins to blow again from an easterly direction, a storm will probably come within 24 to 36 hours.

If the barometer slows up or its rise tapers off above 30.20 inches, the fair weather may continue several days.

There is a tendency for an upward movement of the barometer at night, when it is cool, and a downward movement of the barometer in the daytime, when it is warm. The change in pressure may amount to as much as 0.10 inch or even more in the summer. This barometric movement is normal and is due to upward and downward movement of air currents originating from the warming and cooling of the air during the day and night.

If the barometer fails to rise at night, it is often an indication of an approaching storm. If it fails to drop during the daytime, the weather will probably continue fair for at least another day.

The high pressure areas and the storm areas are more marked in the winter than in the summer. For this reason the barometer will rise much higher in winter and also sink much lower than in summer. Changes in the barometer are often much faster in winter than in summer. The barometer may rise to a height of 30.40 to 30.60 inches in the winter, and sometimes higher, while it seldom rises much above 30.30 inches in the summer. In the winter it may drop to 29.50 inches or even to 29.20 inches or lower during a storm; in the summer it rarely drops below 29.70 inches.

When the barometer goes much below 30.00 inches, stormy weather usually accompanies or soon follows the drop in the barometer. When it goes below 29.80 inches, a period

of windy weather follows as it begins to rise. When it goes below 29.60 inches, high winds and squalls follow as it begins to rise. The lower the barometer descends, the higher will be the wind after it begins to rise. Colder weather will accompany the rise of the barometer, but the degree of cold and the duration of the cold weather are determined by the character and point of origin of the approaching high pressure area.

Fair weather most often attends barometric readings above 30.20 inches. However, when the crest of a high pressure area in winter passes over the ocean, snow or rain often begin to fall while the barometer may still be way above 30.20 inches. In the summer a high pressure area over the ocean sometimes brings rain to Pennsylvania even though the barometer may be above 30.20 inches.

A storm is most likely under the following conditions: After a high has passed and the wind, which had been westerly, has swung or shifted to an easterly direction, and the barometer has stopped rising or begun to fall, a thin veil of clouds gradually becomes heavier and thicker, and the sun or the moon eventually disappears. By the time that the sun disappears behind the clouds, the rainfall may be only an hour or two away, particularly if the clouds have thickened in a few hours of time. If they have thickened over the better part of a day or night, the rainfall may be much slower in appearing. The rain or snow in such a storm often lasts for several hours, or even for one or more days. It usually begins while the barometer is still high, or even before it has dropped much. In summer the rainfall is usually heaviest before the barometer has dropped much. and it tends to cease or come only in occasional showers or a drizzle, or it may even partially clear off after the barometer has dropped considerably. In winter the rain or snow often continues as long as the barometer drops and the wind continues from the east, though it may cease, with continued cloudy skies, during some storms.

If the clouds show structure, or if they tend to break away at times, or if the wind is not easterly, increasing cloudiness is not necessarily a sign of rain, as clouds often pass away without rainfall. Other indications of the wind and the barometer should be considered before predicting rain.

In winter the land is colder than the ocean, and when an easterly wind blows, snow or rain usually falls within a few hours, regardless of the height of the barometer.

In summer the land is warmer than the ocean, and highs along the coast may cause easterly winds to blow in Pennsylvania without producing rain. If the type of increasing

cloudiness previously mentioned occurs, rain will probably come. However, with an easterly wind, unless the rain comes as the barometer begins to rise, or shortly afterward, it will probably not rain as long as the barometer is rising or continues steady and the clouds come in irregular masses or broken patches. In most cases no rain will come until the barometer drops and the wind shifts to the south or south-west.

In summer, with westerly winds (particularly with south or south-west, more rarely with west or north-west winds), if the barometer has been steady or is dropping and clouds begin to form during the morning with bright edges resembling snow-capped mountains, thunder showers are likely in the afternoon or evening. If the barometer is low, particularly near or below 30.00 inches, or is dropping steadily, the showers may be widespread, followed by cooler weather.

Similar types of clouds often appear with a rising barometer, particularly in cool weather following a storm, but they seldom bring rain. In the winter, after the passage of a low, clouds of this type gather together to form squalls.

Repairs and Replacements Definitely Are Available

● Repair parts, replacements, all service material needed regardless of year or model are available for reconditioning and maintenance of Hardie Sprayers. Even complete new pumps, new hose, improved guns can be obtained to replace worn out units. New Hardie Sprayers this year will be rationed to growers by County Rationing Boards. Ask any Hardie dealer or The Hardie Mfg., Company, Hudson, Michigan, Portland, Oregon, Los Angeles, Calif.

THE ONLY SPRAY PUMP THAT IS *Completely Lubricated*

HARDIE

DEPENDABLE SPRAYERS

MEMBERSHIP LIST

Pennsylvania State Horticultural Assoc., 1942

Name	Address
Adams Co. Fruit Packing & Distributing Company	Biglerville
Alderfer, N. W.	Fountainville
Allen, F. W.	Harbor Creek
Allen, Howard G. & Sons	New Park
Allen, S. Guy	New Park
Allen, J. R.	North East, R. 1
Allshouse, Oscar	Avonmore, R. D.
Altland, John P.	East Berlin, R. 5
American Potash Institute	1155-16th St., Washington, D. C.
Anderson, H. M.	New Park
Anderson, Ralph W.	Fawn Grove
Anthony, R. D.	State College
Anwyll, Harry L.	Harrisburg
April, Samuel	April Orchard, Millville, N. J.
Artherholt, John	Transfer
Atkinson, D. W.	Wrightstown
Backert, Wm. J.	Tamaqua
Backus, H. E.	North East
Baer, H. S.	Chambersburg
Bailey, M. V.	Pennington, N. J.
Baker, C. J.	North East, R. 2
Balderston, Robt.	Glen Mills
Baldesberger, W. P.	Bridgeville, R. 2
Baltzley, S. L.	Gettysburg, R. D.
Bare, John H.	557 Penn Ave., Sinking Spring
Bard, J. Bert.	Chambersburg
Bard, Walter	Fayetteville, R. 1
Barnard, C. P.	Northbrook, R. D.
Barnard, Richard	Kennett Square
Barr, I. C.	Greencastle, R. 2
Barr, Morris A.	Pheonixville
Bartram, Frank M.	Kennett Square
Bartram, G. Maurice	West Chester
Baugher, Geo. L.	Aspers
Baugher, H. G.	Aspers
Bear, Arthur	York, R. 5
Bear, Jacob R.	York, R. 5
Bear, John W.	York, R. 5
Bear, Paul A.	Mount Wolf, R. 4
Beatty, Robt. H.	6032 Lansdowne Ave., Phila.
Beaverson, Bertha	York, R. 7
Beilchick, Mike	Barnesboro, R. D.
Beitsinger, Henry	Coraopolis, R. 1
Bell, R. H.	Bureau of Plant Industry Harrisburg
Bemis, Arthur	North East, R. 1
Bender, L. J.	Allentown, R. 4
Benner, Roy	Perkasie
Bennett, Henry S.	Barnesboro, R. 2
Bensinger, Clarence	Tamaqua, R. D.
Berger, Elias	Pine Grove
Berk, Irwin	Reading, R. 2
Berringer, B. N.	Cherry Tree, R. 2
Bostwick, Geo. H.	North East, R. 2

Name	Address
Bethany, Orphans Home	Womelsdorf
Bice, Bros.	Hollidaysburg, R. 2
Bidwell, Homer	Lake Ariel, R. 1
Bingham, W. O.	St. Thomas
Bishop, W. S.	Doylestown
Black, Carl	Aspers
Black, John W.	Aspers
Blaine, Geo. W.	North East
Blessing, David H.	Newville, R. 1
Blevins, Lee	Stewartstown
Boak, J. A. & Sons	New Castle, R. 4
Bock, Walter	Crafton, R. D. 8
Bollinger, Geo. H.	New Castle, R. 3
Boltz, Peter R.	Lebanon
Booth, Laura	Gettysburg, R. 4
Bountiful Ridge Nurseries	Princess Anne, Md.
Bovard & Baldwin	655 E. Wash. St., New Castle
Boyd, Paul C .	Delta
Boyer, C. G.	Swineford
Boyer, Ira C.	Middleburg, R. 3
Boyer, Jay	Mt. Pleasant Mills
Boyer, W. W. & Donald	Biglerville, R. 2
Boyertown Fruit Farms	Boyertown
Brace, Harold G.	Dallas, R. 3
Brahm, G. W.	Fayetteville, R. 1
Bream, D. M. Co.	Chambersburg
Bream, John	Orrtanna
Bream, Kenneth	Aspers, R. D.
Breidenbaugh, H. L.	Boyertown
Breininger, Thos.	McClure
Bricker, E. B., Dr.	314 N. Broad St., Lititz
Brinser, Irwin	Bainbridge
Brinton, H. C.	Hanover
Brooker, W. L.	Wexford, R. 1
Brossman, John G.	Ephrata
Brossman, Rudy J.	Mohnton, R. 2
Brown, C. Earl	N. 2nd St., Chambersburg
Brown, H. W.	Allentown, R. 3
Brown, M. H.	North East, R. 1
Brown, N. Bard	Box 285, Waynesboro
Brown, Robt.	Bridgeton
Brown, J. Turner	New Park
Brubaker, Daniel A.	Ephrata, R. 2
Brunton, C. A.	New Castle, R. 6
Bucher, F. S.	Reamstown
Bucher, G. M.	Cashtown
Burch, H. C.	North East, R. 4
Burket, Geo.	Claysburg, R. 2
Burket, J. E.	Hollidaysburg, R. 2
Camp Farms	North East, R. 2
Campbell, Jos.	North East, R. 1
Carey, Otto	Biglerville, R. D.
Carr, B. R.	North East, R. 1
Carroll, Frank	Neshaminy
Cash, Steve	Girard
Chase, Chas. T.	Bala
Cheslock, M. H.	Sugarloaf, R. D.
Clemson, Leonard G.	Halifax
Coates, Paul	Parkesburg

Name	Address
Cobel, Garnet	Gardners, R. D.
Coffroad, L. C.	New Holland, R. 2
Cook, Willis H.	Spring City, R. 1
Cole, Laura M.	175 E. Main St., North East
Coolbaugh, Perry	Dallas, R. D.
Coon, H. F.	Wyoming, R. D.
Coon, John	Wyoming, R. D.
Coon, S. J.	Clarks Summit, R. 2
Cooper, C. A.	1000 Highland Ave., Coraopolis
Couch, Harry	Apollo, R. D.
Coupe, C. H.	331 Main St., Homer City
Coupe, Vernon	Homer City, R. D.
Covert, Budd	Mercer
Cowan, Paul	Martinsburg, R. 2
Cowan, W. H.	Martinsburg
Cox, J. W.	New Castle, R. 5
Craig, Wilkinson	Zionsville
Crawford, Helen S.	Box 346, North East
Creasy, Luther	Catawissa, R. 1
Cressman, C. K.	Barto, R. D.
Crissman, W. R.	Indiana, R. D.
Crist, James D.	Walden, N. Y.
Criswell, R. T.	12 N. 2nd St., Chambersburg
Crossman, P. S.	Court House, Erie
Crouse, E. A.	140 Seminary Ave., Gettysburg
Crowell, A. & T.	Avondale
Crowell, Ralph T.	Buckingham
Cummings, Jos. F.	Sunbury
Curtis, M. C.	North East, R. 1
Davison, Norman H.	Chambersburg
Dayton, Russell S.	Dimock
Debus, Stanley	Breinigsville, R. 1
Decker, H. A.	New Castle, R. 3
Dennis, A. J.	Zionsville, R. 1
DeLong, Cletus Y.	Mertztown, R. 2
Detwiler, D. E.	Penn Run, R. 1
Dibble, Samuel E.	Shelocta, R. 1
Dickenshied, F. S.	Zionsville
Diefenderfer, Dr. Geo.	741 Walnut St., Allentown
Diehl, J. M.	49 N. Jonathan St., Hagerstown, Md.
Dill, R. J.	North East
Dillon, R. S.	Hancock, Md.
Dixon, Billie	St. Thomas
Dow Chemical Co.	Midland, Mich.
Downing, F. P., Planters Mfg. C.	Hamburg, N. Y.
Druck, Albert	Hellam, R. 1
Duke, D. R. & B. F.	166 E. Wash. St., Chambersburg
Duld, John	Perkasie, R. 3
Dunbar, C. O.	Arendtsville
Dunlap, James M.	106 Mooreland Ave.. Carlisle
Dunlap, R. Bruce	Dept. of Welfare, Harrisburg
Dunn, F. H.	Harbor Creek
Dutweiler, Ira K.	Lebanon
Ebel, Clem	Blawnox
Ebling, Aaron	Reading, R. 2
Eddinger, A. G.	Dallas, R. 3
Edgerton, J. Russell	Westtown
Eichner, Mike	Wexford, R. 1

Name	Address
Eisert, W. M.	North East
Enck, Warren K.	Biglerville
Ensminger, J. M.	Dillsburg
Evans, W. H.	Plainsville
Everhart, W. J.	York, R. 3
Fagan, F. N.	State College
Fahringer, Blain	Middleburg, R. 3
Ferris, A. B.	Harbor Creek, R. 1
Fetters, C. L.	Gardners
Fidler, W. B.	Aspers, R. R.
Fisher, Fred M.	Wernersville
Fister, H. Ray	Dalton
Fleming, Harold	State College
Fletcher, S. W.	State College
Flinchbaugh, H. H.	Loganville
Flinchbaugh, J. J.	Seven Valleys, R. 2
Flora, Wm.	Wrightsville, R. D.
Fogelsanger, R. B.	Chambersburg, R. 5
Fogelsanger, W. H.	210 N. Prince St. Shippensburg
Forrester, W. R.	Mercer
Forry, S. E.	Ephrata, R. 1
Fox, Frank	Hollidaysburg, R. 2
Frantz, Ira	Dallas, R. D.
Frantz, S. P.	Trucksville, R. D.
Freed, A. J.	Racine
Freed, W. A.	Racine
Frey, H. E.	Red Lion, R. 2
Fry, John L. c/o C. K. Whitner Co.	Reading
Funk, Sheldon	Boyertown
Gable, Joe B.	Stewartstown
Gackenbach, C. A.	Orefield, R. 1
Gantert, Theo.	152 N. Front St., Reading
Gardenhour, G. W.	Smithsburg, Md.
Garrahan, R. H.	Kingston
Garretson, Donald	Aspers, R. D.
Garretson, Lloyd	Arendtsville
Garrettson, Robt.	Floradale
Garretson, R. D.	Bendersville
Gay, Arthur	Dallas, R. D.
Gehr, Harvey J.	Waynesboro
Geiger, Clinton	Neffs
Geiger, Samuel	Schnecksville, R. 1
Gelwix, Dr. J. M.	Chambersburg
Gibson, Harold	Blairsville, R. D.
Gibson, Vernon	Renfrew, R. D. 1
Gibson, W. F.	Yoe
Gillan, C. F.	St. Thomas
Gillan, G. G.	St. Thomas
Gillan, R. J.	St. Thomas
Gillan, Robt.	St. Thomas
Good, Harvey	Lancaster, R. 8
Goodling, G. A.	Loganville
Goshorn, Taylor L.	Quincy, Box 47
Graybill, Floyd	Richfield
Green, C. A.	North East, R. 3
Griest, F. E.	Floradale
Griffin, Howard	North East, R. 4
Grimshaw, Harry	Girard

Name	Address
Gross, H. S.	York, R. 5
Grove, H. R.	York Springs
Grove, W. E.	York Springs
Grove, A. R.	Indiana, R. 2
Guyton, T. L.	Bureau of Plant Industry Harrisburg
Haase, A. H.	Narrowsburg, N. Y.
Haase, Herman	Narrowsburg, N. Y., R. 1
Hacker, A. L.	Allentown
Haddock, J. C.	Wilkes-Barre
Hafer, Harry D.	Fayetteville, R. 1
Hafer, John A.	Chambersburg, R. 5
Hafer, Roy	Fayetteville, R. 1
Hager, D. R.	Orrtanna, R. 1
Hague, Robt.	North East, R. 2
Haines, Robt. B.	Hereford, Box 56
Haldeman, E. W.	Doylestown
Hall, L. C.	North Girard
Halloran, Frank	North East, R. 4
Halloran, Lee, J.	North East, R. 4
Hankey, Wilmer	Wrightsville
Haring, Mrs. Howard S.	Perkasie, R. 2
Harle, Jos. B.	West Leesport, R. 1
Hartman, Ernest	Biglerville, R. D.
Hartman, L. E.	Cly
Hartman, M. T.	Gettysburg
Hartman, Scott W.	Palm
Hartzok, J. W.	Marion, R. 6
Harvey, Clyde	Northbrook
Harvey, H. R.	Foxburg
Haudenshield, Crist	Pittsburgh, (10) Frank St., 55
Hausman, Geo. B.	Coopersburg, R. 2
Haverstick, Paul E.	1254 Lititz Pike, Lancaster
Hayes, S. B.	Enon Valley, R. 1
Hayman, Guy L.	Northbrook
Heacock, O. J.	Biglerville
Heaps, Marshall	Cardiff, Md.
Heaps, T. Jerome	Street, Md.
Hearne, T. H. (Marvil Package Co.)	Laurel, Del.
Heffelfinger, Henry S.	Myerstown, R. 3
Heinz, Henry	Narrowsburg, N. Y.
Heisey, S. A.	Greencastle, R. 4
Hempstead, Walter	Honesdale
Henderson, Lowrie	Stoneboro
Herb, Ray H.	Orwigsburg
Herhold, J. C.	North Girard
Hershey, H. F.	Hamburg, Box 23, R. 3
Hess, Elam S.	Mount Joy, R. 2
Hess, F. M.	601 Main St., Waynesboro
Hess, Ira S.	Florin
Hess, Paul G.	Waynesboro, R. 2
Hess, R. C.	Waynesboro, R. 2
Hess, Ray B.	Waynesboro, R. 1
Hess, T. S.	Wapallopen, Box 27
Hetrick, A. W.	Beavertown
Hetrick, D. G.	North East
Hetrick, J. Frank	Beavertown
Hibert, Wm.	Indiana, R. D.
Hicks, A. R.	Punxsutawney

Name	Address
Higgins, W. A.	Dallas, R. D.
Hildebrandt, John A.	Dallas, R. 2
Hildebrandt, John E.	Dallas, R. 3
Hile, Anthony	Curwensville
Hileman, W. Carl	New Castle, R. 3
Hill, Wm. D.	North East
Hinnershitz, C. Walter	1255 Buttonwood St., Reading
Hoch, D. R.	Chambersburg
Hoffman, D. M.	Biglerville, R. D.
Hoffman, H. L.	Butler, Star Route
Hood, T. C.	Saltsburg, R. 1
Hoopes, Wilmer W.	West Chester
Horn, W. H.	Chambersburg, R. 10
Horst, J. Morris	Lebanon, R. 3
Hosler, Ralph	Berwick, R. D.
Hostetter, Dr. J. E.	Gap, R. 1
Houck, Clyde	Clymer, R. D.
Houck, Dallas	New Castle, R. 1
Houk, J. M.	New Castle, R. 6
Houser, Jacob R.	Lampeter
Hover, Howard	New Wilmington
Howard, J. M.	North East
Howard, P. H.	Dover, R. 1
Howatt, Mrs. Maude	Coopersburg, R. 2
Huber, E. B.	232 S. Ma'n St., Chambersburg
Huber, Herman	Narrowsburg. N. Y., R. 1
Huey, S. R.	New Castle, R. 3
Hughes, J. N.	Mercer
Hunt, N. M.	New Castle, R. 4
Imswiler, John S.	West Chester
Ingalls, Ben.	Quakertown, R. 2
Ingham, M. M.	New Castle, R. 5
Jacobs, D. C.	Arendtsville
Jaman, John	Bethlehem, R. 1
James, J. E.	Hagerstown, Md., Box 143
James, T. E.	North East
Jersey Package Co., Inc.	Bridgeton, N. J.
Johnson, John	New Wilmington
Johnston, R. S.	New Wilmington, R. 1
Johnston, Mrs. F. C.	Dallas
Johnston, M. E.	Connoquenessing
Johnston, Rolland A.	Hereford
Jones, J. H.	Paradise, R. 1
Jones, Wm. W.	North East, R. 1
Kauffman, Amos L.	Bird-in-Hand
Kauffman, C. B.	Bird-in-Hand
Kauffman, C. E.	Manchester, R. 1
Kauffman, J. B.	York, R. 7
Kauffman, J. E.	Bird-in-Hand
Kauffman, Melvin L.	Bird-in-Hand
Kauffman, Milton H.	Hamburg, Star Route
Kebler, John	North East, R. 1
Keim, Milton W.	Boyertown, R. 2
Keith, C. E.	1513-6th Ave., Altoona
Keller, Ambrose	Freeland, Md.
Keller, Paul J.	c/o Walker Bros.,Chambersburg
Keller, Rudolph	North East, R. 4
Kelso, James	Enon Valley

Name	Address
Kessler, Geo. W.	Tyrone
Kidd, Alvin D.	Hillsdale
King, C. V.	North East, R. 1
King, Elam B.	Narvon, R. 1
Kister, U. G.	Etters
Kleppinger, B. M.	Coopersburg, R. 2
Kline, H. F.	Kintersville
Kline, Wm. C.	North East, R. 4
Knappenberger, Thos.	Zionsville, R. 1
Knelly, Willis	Sugarloaf, R. D.
Knouse, M. E.	Peach Glen
Koch, Marlin E.	McKeansburg
Koehler, Paulus E.	Monaca
Kohl, Geo. P.	Clarks Summit, R. 2
Koller, Chas.	W. King St., York
Komar, John	New Bedford
Kovacs, Rudolph	Orefield
Kratz, T. Percy	Doylestown
Kuenzig, E. J.	North Girard
Kuhl, S. W.	North East, R. 4
Kunkle, B. F.	Tamaqua, R. 1
Kunkel, George	Orwigsburg
Labesky, Geo.	Harbor Creek, R. 1
LaCoe, Nelson	Clarks Summit, R. 1
Lendis, D. M.	Lancaster, R. 6
Lapp, John F.	Ronks, R. 1
Larson, Lee	North East, R. 4
Latshaw, John G.	Marion
Lau, L. B.	East Berlin, R. 2
Laudenslager, Martin	Orefield, R. 1
Lawrence, Lester	Lake Ariel, R. 2
LeBoutillier, Chas.	Wayne
Lehman, S. S.	Girard
Leibhart, Samuel H.	Wrightsville, R. 1
Lengel, Paul	Pine Grove
Leonard, F. E.	Carlisle, R. 1
LePole, Walter	Akron
Lewis, Nelson H.	Pittston, R. 1
Lewis, Norman	Pittston, R. 1
Lewis, S. V.	Wyoming
Lett, E. R.	General Chem. Co., Philadelphia
Lieberknecht, M. L.	Mt. Wolf
Lightner, E. S.	York, R. 5
Linde, J. Eric	Orefield, R. 1
Lingerman, Ralph	New Castle
Linville, Arthur S.	Media, R. 2
Livingood, Mrs. Stella	Robesonia
Lloyd, Stephen	Pottstown, R. 2
Long, John C.	342 E. Lib. St., Lancaster
Long, D. Edward	Fayetteville
Lookenhouse, C. J.	North East
Loop, A. I.	North East
Loop, H. S.	North East, R. 2
Loose, H. H.	Menges Mills
Lord, John	Wyoming, R. 1
Lott, R. C.	Aspers, R. D.
Lott, Robt.	Aspers
Lott, Wm. M.	Gardners
Lucabaugh, J. W.	Hanover, R. 6
Luke, Emery	North East

Name	Address
Luke, Geo. A.	North East
Luke, W. V.	North East
McClelland, J. B.	Canonsburg
McClure, F. C.	New Wilmington, R. 6
McCord, John	North East, R. 1
McCormick, C. M.	Slippery Rock
McCormick, Hugh	New Castle, R. 6
McCormick, James	Harrisburg
McDonald, J. A.	Lake Erie Vineyard & Supply Co., North East
McDonald, R. C.	Shippensburg, R. 3
McFadden, E. C.	Hagerstown, Md.
McFarland, J. Horace	Harrisburg
McFarland, R. W.	New Wilmington, R. 1
McGeorge, Mrs. Katherine L.	Orrtanna
McGinnis, C. R.	605 Col. Trust Bldg., Reading
McHenry, Clarence	Indiana
McIlvaine, J. S.	Fayetteville
McKee, J. M.	Dairy Corp. Sale Co., Century Bldg., Pittsburgh
McKeehan, James	Honesdale
McKibben Orchards	Riddle Road, Chambersburg
McMillen, D. A.	North East
McNitt Fruit Farm	Milroy
McPherson Bros.	Bridgeton
Mackey, Earl	Orefield
MacNeal, Wm. H	Parkesburg
Marcks, Miss Verna	401 Chestnut St., Emaus
Markey, Mrs. Henrietta	York, R. 2
Marion, Ed.	Harbor Creek
Marsteller, Wm.	Stewartstown
Mason, A. Freeman	7432 Sprague St., Philadelphia
Matthews, W. H.	Box 313, Salem, Ohio
Mattern, Chas.	Hollidaysburg, R. D.
Mattern, J. C.	Beaver Springs
Mattern, Jos. C.	Hollidaysburg
Mattern, Richard H.	Hollidaysburg
Mauger, Maurice	Boyertown, R. 2
Maurer, Geo. W.	Barnsville
Maurer, Jay	Hegins
Mayer, Guy S.	Willow St., R. I
Mecartney, J. L.	State College
Meeder, C. R.	Girard
Meeder, F. C.	Girard
Meeder, J. V.	Girard
Meister, K. G.	Chambersburg, R. 6
Melcher, Bennett	Bally
Mendelson, S. Meehan	Newtown Square
Mengel, John R.	West Leesport
Merring, Guy	Cortez
Meyer, Allen	Annville
Meyer, M. A. Jr.	Lebanon, R. 3
Mickels, Joe	Wexford, R. 1
Miller, Amos	Hanover, R. 3
Miller, Christ	Marion
Miller, Erwin J.	Lancaster, R. 5
Miller, Frank	Waynesboro, R. 4
Miller, Frank	Lake Ariel
Miller, G. Elmwood	North East, R. 4
Miller, Harvey	Loganville

FARM BUREAU SERVICES

Supplies The Needs of

Pennsylvania Fruit Growers

With

QUALITY FARM BUREAU CO-OP PRODUCTS **SUPPLIES**

SPRAY MATERIALS—Insecticides & Fungicides
- **Oils**—98% Miscible, 83% emulsions (flowable and pastes)
- **Elgetol**, Tar Oils and di-nitro powders
- **Coppers**—Sulphates in all forms and neutral oxides
- **Sulphurs**—wettable, catalytic, dusting and flotation
- **Arsenicals**—lead and calcium arsenates and sodium arsenite
- **Lime**—Pulverized burnt, agricultural hydrates and spray hydrates
- **Bordeaux Mixture Powder, Yellow Cuprocide and Cupro-K**
- **Nicotine Sulphate 40%, Lethane 440 and NNOR**

FERTILIZERS—Complete and Ingredients
- **10-6-0** Open Formula Fruit Tree Special
- **Superphosphates and Nitrate of Soda**

FUELS—Truck, tractor and stationary engines
- **Gasoline, kerosene and fuel oil**
- **Lubricating oils and greases**

Pennsylvania Farm Bureau Co-Operative Association

Owned and Controlled by Pennsylvania Farmers

3607 Derry Street HARRISBURG, PA.

Name	Address
Miller, Jacob R.	Elizabethtown, R. 3
Miller, John W.	Ephrata, R. 2
Miller, John S.	Somerset
Mimm, Jonathan	McKeansburg
Minnich, C. S.	Reading, R. 2
Mitchell, E. B.	Beaufort Farms, Harrisburg
Mitterling, John T.	Mt. Pleasant Mills
Mohr, Frank J.	Fogelsville
Mohrman, Richard	Narrowsburg, N. Y.
Moon, Henry T.	56 Haddon Ave., Haddonfield, N. J.
Moore, M. A.	Lititz
Moorehead, D. M.	North East, R. 4
Moorehead, Mabel J.	North East, R. 4
Mosser, R. Clayton K.	Mohnton, R. 1
Mowery, H. F.	Mechanicsburg
Mowery, Lee	Newville
Mowery, N. E.	Mechanicsburg
Moyer, J. Lee	Freeburg
Moyer, Joe E.	Middleburg, R. 3
Moyer, Jos. G.	50 N. 8th St., Lebanon
Munn, E. D.	North East
Munnick, W.	5969 Springfield Ave. Philadelphia
Murphy, P. J.	White Haven, R. D.
Mussellman, C. H.	Biglerville
Musser, W. E.	New Bethlehem, R. 3
Muth, Harvey	Allentown, R. 3
National Wooden Box Assoc.	308 Barr Bldg., Washington, D.C
Naugle, Rev. C. E.	405 E. Main St., Roaring Springs
Naylor, H. G.	North East, R. 1
Neces, Harold	Fairview
Neiman, Otto	Dover, R. 3
Neisbet, C. M.	606 Bendermere Ave, Interlaken, N. J.
Neuman, O. Jr.	1000 S. Carolina St., Miller Chem. & Fertilizer Co., Baltimore, Md.
Newcomer, L. E.	Boyertown
Newman, H. W.	New Castle, R. 4
Newton, O. D.	North East, R. 2
Nitchman, C. H.	Aspers, R. 1
Nolt, Harrison S.	Columbia, R. 1
O'Conner, Haldeman	13 N. Front St., Harrisburg
Oldfield, W. T.	114 N. George St., York
Oller, Boyd	Chambersburg, R. 1
Oller, Earl	Chambersburg, R. 2
Orton, F. S.	Ripley, N. Y.
Orton, Floyd	North East, R. 2
Orton, H. S.	North East, R. 5
Orton, J. W.	North East, R. 2
Orton, Maurice	North East, R. 2
Ott, Lloyd	Bedminster
Oyler, George	McKnightstown
Oyler, H. J.	Gettysburg, R. D.
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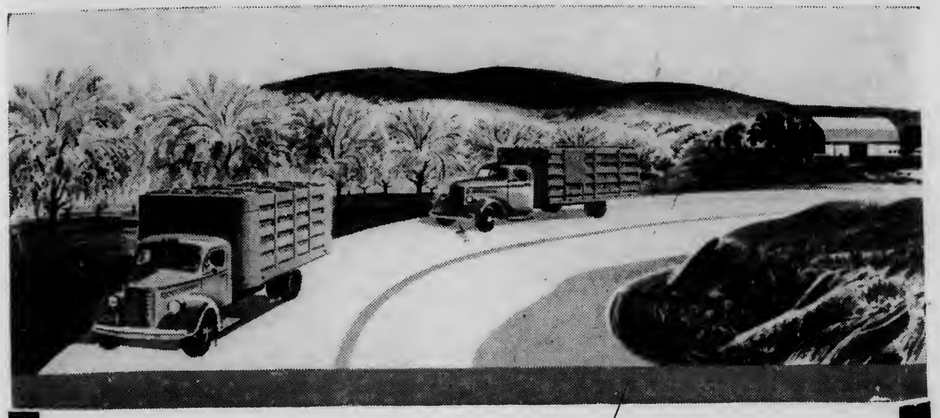

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