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PROCEEDINGS OF THE

Eighty-sixth Annual Meeting

Pennsylvania State Horticultural Association

Chestnut Street Hall Auditorium, Harrisburg, Penna.

January 9, 10 and 11, 1945

State Horticultural Association of Pennsylvania

OFFICERS FOR 1945

President—J Eric Linde, Orefield
First Vice-President—Frederic E. Griest, Floradale
Second Vice-President—Guy L. Hayman, Northbrook
Treasurer—Paul Thayer, Carlisle
Secretary—J. U. Ruef, State College

STANDING COMMITTEES

Executive Committee: R. Johnson Gillan, St. Thomas; H. F. Hershey, Hamburg; H. M. Anderson, New Park.

Legislative - Rep. on Agricultural Council: G. Frank Gillan, St. Thomas; M. E. Knouse, Peach Glen; R. T. Criswell, Chambersburg; W. E. Grove, York Springs; George Goodling, Loganville; Glen Slaybaugh, Gettysburg, R. 5; John Peters, York Springs; Lionel Newcomer, Sec.-Chairman, Fleetwood.

Farm Show - Exhibition: Guy L. Hayman, Northbrook; R. C. McDonald, Shippensburg; R. Johnson Gillan, St. Thomas.

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

Plant Diseases: H. W. Thurston, State College; R. S. Kirby, State College, K. W. Laurer, Harrisburg.

Game Laws: J. A. Runk, Huntingdon; R. D. Anthony, State College; George Goodling, Loganville.

State College Relations: H. F. Hershey, Chairman, Hamburg, Pa.; Francis Reiter, Mars, Pa.; C. L. Packard, Ore Hill, Pa.; William F. Mellor, North Wayne Ave., Wayne, Pa., Guy Smith, Northeast, Pa., J. A. Runk, Huntingdon, Pa.

Resolutions: Sheldon Funk, Boyertown, Pa.; Jack Imsweiler, West Chester, Pa.; Roy Hafer, Fayettesville, Pa.

INTENTIONAL SECOND EXPO

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PRESIDENT'S ADDRESS

J. ERIC LINDE, Orefield, Pa.

Another year has passed since last we met here, a year of many trials and experiences, another year of war and great sacrifices for many. Meeting here a year ago we held strong hopes of being closer to Victory than we are now, with many hard battles to win before we can again live in peace. However, the Victory shall be ours in the future, when we trust we can again take up duties and look to the brighter days for us all in the way of life we were accustomed to, and not be regimented on our farms and in our homes and our every day walk of life.

Fruit growers, have much to be thankful for in the past year, despite a dry season for many, insect ravages beyond past experiences, hail storm damage, and a lack of sufficient and efficient labor. A kind providence smiled on us during harvest allowing us many more days to harvest than in other seasons, so all in all, with fair prices we have come through smiling.

The wives and children of growers, the neighbors and their wives, the school children and everyone who helped so wonderfully deserve our highest praise.

We were forced to use every available source of labor, prisoners of war, Southern negroes, Bohemians and others. and we must look forward to our 1945 harvest now as far as labor is concerned, exhausting every avenue to secure enough help to do a good job. Selective Service will make inroads on our rapidly diminishing labor supply in 1945.

The war must be won at all cost, and I am sure we shall come through in 1945 with our best effort to produce and harvest all the food that is humanly possible.

With O.P.A. setting ceiling prices on fruit of all kinds, classing apples as apples and not on grades, it becomes evident that some growers are going to try and get by with less spraying and general care of orchards as well as letting down on pack. This is a mistake, for as consumer purchasing power rises, they want only the best and are demanding the best irrespective of price. Only the best grades are moving now and come Spring, we shall see many bushels of apples out of condition which will not find a market.

Machinery to produce crops will not be available to any greater extent than in 1944, so see that the very best care is taken of existing equipment in your hands.

There are many things that are very important today, outside of supplies and help. They are: Determination of all to rely on our own initiative and judgment in the production and use of land, and to act for ourselves in the manner we were accustomed to. Help discourage bureaucratic control and the payment of subsidies by the Federal Government, as subsidies paid any farmer are not a farm subsidy, but strictly a consumer subsidy and should be known as such.

Farmers should and today it becomes imperative that they should organize on a national basis so they have a voice in the promulgation of laws and in National affairs beyond their present representation.

Farmers should take advantage of our Co-Operative laws to work out their own salvation, by processing, marketing of crops and purchasing of supplies used on the farm, as Cooperatives have been and will be more instrumental for putting farming on a sounder basis. Prepare now to retire debts, improve buildings and the soil; and above all do not expand your acres as lean years will again appear in Agriculture. So be prepared, place yourself on a safe and sound basis.

It is imperative that the war be won. Victory may not be in the immediate future, but inevitable Victory will be ours, so it becomes increasingly evident that we must soon prepare for reconversion and the changes that will follow that day. I am sure all of us can find jobs that have long been neglected in our operation for many Service Men and war workers, who will be looking for jobs when the war is over.

Marketing will be one of the most important post war problems of our industry. New packages, new methods of processing such as dehydration, quick freezing, transportation and new areas of production will change the marketing problem. We must be alert to these changes and their influence on our markets.

We, as fruit growers, can be thankful to the present organizations fighting our battles on all fronts. They have accomplished many things for us, which as individuals we could not accomplish alone. Our hats off to them, and I wish to mention a few who deserve our greatest support: Appalachian Apples, Inc., New England Institute, National Apple Institute, National Peach Council, International Apple Association.

We need a National Association composed of all Fruit Growers: for with Government Directives, Price Control, Bureaucratic Agencies and what have you, we must be alert to all laws and directives concerning our industry, and one National Association could and would reflect our wishes with more force and effect.

The effect on the fruit industry of conflicting orders and directives and the inability of Government to establish workable plans and orders that are simple and sensible enough for ordinary people to understand and use is deplorable. Today, we have no proper clarification of the Area of Production, and when we do, I doubt if it will be workable.

The cancellation of ration stamps has also undermined confidence in O.P.A. regulations and make us all wonder if O.P.A. is being administered by persons who are fully informed or capable of the administration of so comprehensive a task.

We are not adverse to working with government controls when sensibly administered and will do all in our power to help control inflation and produce all the crops possible to speed Victory, as our trials and inconveniences are indeed small compared to the sacrifices our boys are making in the prosecution of the war in many lands.

Our prayers and our thoughts are with them, so a speedy Victory can be won and they can be back with us at the earliest possible moment.

Let us resolve to make 1945, Victory year, on the home front as well as the battle front.

A GROWER'S PROGRAM FOR THE PRODUCTION OF QUALITY FRUITS.

M. T. HARTMAN, County Agent, Gettysburg, Pa.

During the past 20 years I have had the privilege and opportunity of working with fruit growers in several large fruit producing areas in Pennsylvania. I have also had the opportunity of visiting fruit areas of neighboring states.

I have always been vitally interested in the economical production and marketing of quality fruit. I am happy to admit that I have seen some of the finest quality fruit that one could desire, and I regret to admit that I have seen too much fruit of inferior quality.

Naturally, there are many factors that must be considered, and fortunate or unfortunate, as it may be, the majority of factors that influence quality of fruit are controllable by man. Among the more important factors that are responsible for poor quality in fruit are excessive injury by diseases and insects, spray injury or russeting, off color and size of fruit, and to some extent varieties that are not adapted. It is not only important that we produce quality fruit, it is absolutely necessary to harvest and deliver to the ultimate consumer fruit that has not been bruised and blemished by faulty handling.

It is rather evident that some orchards are located on poor orchard sites, and the logical solution is the reconversion of these areas to other crops.

I believe that considerable more attention must be given to soil management and plant food requirements. Many of our orchard soils are low in organic matter which reminds us of the importance of cover crops. We appreciate the fact that a dense cover crop growth is naturally favorable for mice, and many good fruit trees have been lost because of mouse injury. Orchard losses due to mouse injury can be greatly reduced by properly using mouse bait.

Frankly, I believe that pruning is one of the most important management practices in the orchard and bears a most important relationship to quality production. Observation has shown that excessive pruning is very detrimental, faulty pruning is responsible for considerable damage by sun scald, and insufficient pruning is responsible for poor size, poor color, and provides favorable conditions for insect and diease to multiply unmolested.

The control of orchard diseases and insects is possible if we use a complete and thorough spray program adjusted

to meet local conditions. The orchardist must have an intimate knowledge of the life history and nature of orchard diseases and insects together with the properties of various spray materials. Stating it briefly, I have noticed that when the proper spray materials are carefully mixed and applied in such a manner that provides good coverage at the logical time, satisfactory control of diseases and insects is the result. Material - Method - Time.

I believe that we have available the necessary fungicides and insecticides to do a good job. I am inclined to believe that what the fruit grower needs is confidence in the spray materials that are being used, improvement in coverage and sufficient equipment and help to do timely spraying.

Trying to analyze the situation, I find that we have growers with large acreage that devote full time to fruit growing and growers that have an orchard in conjunction with other types of farming.

Generally speaking, we find the grower with large acreage underequipped, and as a result spraying starts early in the spring and is almost a continuous process. It is physically impossible to comply with the time limitation and a question of sufficient material per tree to secure good coverage.

The grower with less acreage usually has sufficient equipment to comply with time and quantity of material per tree. However, other farm work frequently interferes with and delays the spraying operation.

I believe that more attention must be given to applying sprays on time, and larger quantities of spray material are required per tree to secure coverage.

With due respect for the need of improved spray materials, and we know that improvements are being made, nevertheless I believe that we must comply with the requirements of thorough coverage and timely application if satisfactory control is to be had.

I would suggest that growers keep records regarding the material, time of application, and weather conditions so that when failure to control insects and diseases presents itself, it is possible to study the situation and determine the cause.

For detailed information regrading your fruit problems, may I suggest that you consult your County Agent.

THE CONTROL OF ORCHARD PESTS

J. D. HUTCHISON, County Agent, Wilkes Barre, Pa.

How are we controlling Insects in our orchard?

I know it is the sincere aim of all orchardists to produce the ultimate fruit the cleanest possible. We do so for two reasons alone.

1. To secure more net return for our product—with the result of less sales resistance and less labor.

2. To protect our pride. I know many fruit growers whose feelings are hurt when they have an unclean crop, be it Scab or Insect damage. They are not proud of the resulting crop. I am serious about this last premise, that growers are ashamed to show an unclean crop to their friends.

So much for that—

The Agricultural Extension Association throughout Pennsylvania, in conjunction with the Entomology and Plant Pathology Departments of the Pennsylvania State College, has assumed the responsibility of giving you growers timely information in the form of Spray Letters, that will enable you to secure clean fruit providing you apply **YOUR** labor and judgement to the best advantage during the spraying season.

YOUR on my paper here is in capital letters, for the prime reason that **YOU** must apply to your trees, timely and thoroughly, the materials as recommended.

If **YOU** again, follow out these recommendations you can feel reasonably sure that the ultimate crop will be reasonably clean. I say "reasonably clean" with reservation, for there are instances in some orchards where they may have their own peculiar problems, such as a serious infestation of Plum Curculio or a good build up of Codling Moth due to previous neglects in spraying.

I understand in the southern end of the State Scab is no longer a problem. That may well be, but don't be too assured that it has gone forever. Some year with adequate moisture and sufficient neglect on the part of you orchardists, you may expect an outbreak of apple Scab again.

Well, I am getting over in Dutch Hartman's program, so I will jump back on the Insect problem as we see it in

Luzerne County which may be applicable to most counties in Pennsylvania.

Now as to some of our pests and their control:

I think that most growers the past few years have come to the general conclusion that Aphids, Red Bug, and Scale can be controlled most easily in Delayed Dormant Spray with the combination of a 4% oil and D. N. powder. I know in Luzerne County we feel safe with this combination if applied thoroughly and properly. But we don't feel that this combination has controlled European Red Mite, for in orchards this past year, we were able to find Red Mite on the blossom end of apples about the time of the first cover spray.

Apple Maggott and R.R. Worm we consider a problem no longer if sufficient Cover Sprays are applied.

There are two pests in Luzerne County over which our growers are alarmed and they are Plum Curculio and Codling Moth.

Plum Curculio has been increasing each year for the past ten years in Luzerne County, and this past year, for a county-wide prevalence, it has reached its crest. The Curculio can mar apples just as much as Scab and it has increased seriously in our best sprayed orchards. We have tried Cryolite and other insecticides and still it increases. So in our grower's estimation, this is a problem for our research entomologists to work on.

Codling Moth in our well-sprayed orchards for years has not been a problem, but the past two years, we notice that we are securing a gradual build-up of this pest, and we trust that it will not be as severe as it was in the southern end of the State a few years ago.

Now, this program business is a buck passing business. Johnny Ruef passed the ball to Dutch and me and then we were supposed to pass it on to you, the gullible general public.

You know in Washington they buck-passed the recent O.P.A. ration surprise, when they lopped off the value of certain red and blue points and sugar coupons. Well they had to pass it along to you, because the W.F.A. passed the buck to them.

So here goes the buck!

In Luzerne County at a great many of our meetings we have growers' discussion. Our people like it, for they get this information first hand from growers who are accomplishing the job. So here goes the buck again. We are now about to have a discussion of growers and this program has been unrehearsed.

Unrehearsed, dawn matinee. So if you wish to be with us at this matinee, this will be the only performance.

At this rehearsal, we expect you growers who are leading the discussion to say what you think is on your minds. You growers in the audience, if you disagree, please speak up. I like an argument and if one comes to blows, I trust that the President will be able to swing his gavel sufficiently hard to preserve some semblance of order.

It gives me pleasure to introduce:

N. Y. Lewis, Pittston
William Smith, Berwick, R. D.

Mr. Lewis,, what are your problems in orchard pests and what can we in the Extension Department do to aid in your Insect Control Program?

Mr. Smith: What have you to suggest?

Conclusion:

Maybe we are going along the line of least resistance. We have always used Lime Sulphur. For years we have used Arsenate of Lead.

John Deal - John Pepper:

What have you to add? Have our insecticides depleted the parasitic population and are we beginning to feel the lack of these parasites?

What does D.D.T., the wonder insecticide, hold forth for the fruit grower?

In conclusion, as we talk and discuss here this morning, we think we have problems, but do we? We are all fairly well clothed, none of you look emaciated; most of us don't have physical pains, unless it be from overindulgence. As we think of the suffering of human beings, our sons and relatives on the battlefields of the world, we can give thanks that we are fruit growers producing food, and not soldiers giving our lives, suffering physical pain and exposure. So let's all be thankful and pray that this turmoil may cease at the earliest possible time, when we, as humans throughout the world, may return to our homes and loved ones, and live without fear of aggression and want.

BALANCED SODS IN ORCHARDS

FRED V. GRAU, Extension Agronomist, The Pennsylvania State College, State College, Pennsylvania

What Are Balanced Sods? Balanced sods in the orchard are to the fruit grower what good hay and pasture sods are to the livestock farmer. They represent an advantage by which an equilibrium is maintained between the cash crop and the soil. Continued production consists of maintaining a balance between opposing forces. In the orchard the opposing forces are represented by loss of topsoil through erosion, loss of nutrients by leaching, loss of organic matter by accelerated decay, loss of moisture-holding capacity in the soil, loss of ground cover by poor management practices. These opposing forces are largely balanced by means of good sods which in turn must themselves be balanced against other factors.

Half grass-half legume. According to the best evidence, a truly balanced sod is roughly half grass and half legume. An all-grass sod requires abundant supplies of nitrogen and can make none. An all-legume sod produces nitrogen in excess but builds little organic matter in the soil. By combining the two, the nitrogen-hungry grass is fed by the nitrogen-gathering legume and organic matter is built at a more rapid rate by the union. The production of dry matter of the balanced sod as compared with an unbalanced sod is represented by these figures:

Pounds dry matter per acre:

Grass alone	3000
Legume alone	4000
Grass plus Legume	6000

Climate: The species in a sod must be balanced against the forces of climate if the sod is to be effective. There is considerable overlapping but one would not select lespedeza for Luzerne County orchard sods nor would red fescue, which does so well in Wyoming County, necessarily be selected for southern York or Adams County. Bermuda grass grows well in Delaware County but is not winter hardy in Erie County. Ladino clover seems to be adapted over the entire State the same as alfalfa, red clover, and white clover. The more common widely-adapted grasses include the bluegrasses, the fescues, orchard grass and timothy.

Soil conditions: A sod must be balanced against certain soil conditions. Low organic matter content is a frequent opposing factor in orchard soils. This means lower moisture-holding capacity and poor physical condition of the

soil. Where this occurs it is important to select those species which tolerate these conditions. Red fescue grows better than many other grasses under these adverse conditions. Kentucky bluegrass thrives best where the soil is relatively high in organic matter and holds moisture well. Ladino clover grows best where soils are high in fertility, organic matter and moisture. Sweet clover, birdsfoot trefoil and lespedeza, on the other hand, tolerate the more unfavorable conditions of low organic matter and low moisture holding capacity.

Management. In order to have a balanced sod for different types of management there are two type of sod to consider. First, the temporary sod which is destroyed regularly at a certain season and then re-established; and, second, the permanent sod which is desired to remain productive for many years. With the permanent sod, two types of management are practiced; first, periodic mowing to control seeding of weeds and certain undesirable grasses; and, second, an almost complete neglect of mowing which, with certain species, produces an undesirable, unbalanced sod which largely fails in its intended purpose.

A temporary sod should be one which is readily destroyed by which can be re-established quickly and easily. Ryegrass and lespedeza or ryegrass and vetch are balanced temporary sods which will fill most requirements. Permanent sods which require frequent mowing for best results are Ladino clover-grass mixtures. Where little or no mowing is likely to be done. a better balanced sod may be red fescue and birdsfoot trefoil or bluegrass-birdfoot. It is recognized that Ladino clover is one of the better orchard covers and also that birdsfoot trefoil is as yet practically unknown to orchardists. But from the standpoint of a balanced sod against some of the stated opposing forces, I submit that there may be some of those grass-legume combinations which may be improvements over the sods now in use. In many cases it will come down to a decision as to whether to select a balanced sod which you like and want to grow and then to condition the soil and your management to fit that sod. or whether to select the balanced sod that fits the ready-made conditions. The decision is forever and unalterably one which you, as an individual, must make.

Effect on main crop: Some sods may be better balanced than others in their effect on the main crop—the fruit crop. It is generally agreed that deep-rooting alfalfa may compete too seriously with the trees for moisture during critical periods. The same would be true of sweet clover if it were allowed to grow to maturity. A sod which tends

to become dormant during dry spells, such as bluegrass or red fescue, offers little competition for moisture. Likewise, it has been indicated that certain sod crops harbor diseases and insects of fruits worse than others. Proper balance here would indicate selection of those sods that are least competitive to the main crop.

Thus far, we have discussed those factors which necessitates balanced sods together with some of the advantages of balanced sods. The next step, and the one in which many of you are interested, is that of how to establish and maintain them to the best advantage.

Establishing the sod: Recent experiments on pastures and hay fields prove that the simplest and most effective method of establishing a grass-legume cover is to destroy existing vegetation in the fall by discing. I'm not telling you anything new. You've been discing or ripping your orchard sods with the orchard cultivator and similar tools for years. The important thing is that the lime and fertilizer are worked into the soil in the fall where it is ready to go in the spring. Leaving the trash on the surface prevents erosion and greatly aids in the absoption of moisture. You might think that the rough surface wouldn't be much of a seed bed. If you think that way, you will probably be wrong. When the seed is sown on the frozen soil about the time honeycombing takes place you will find that the seed will find as good a place to germinate and grow as though you used a drill. More than this, the rotting organic matter acts as a tonic and stimulant to the young grass. and the early quick start gets the grass 'way out ahead of the weeds. Spring preparation is all right if you didn't get it done in the fall but the seeding is bound to be later, weeds will be worse, and the live grass cover over winter is bound to harbor mice. I am not advocating the destruction of the ground cover every fall—not by any means. I'm talking to those of you who do not have the "balanced sods" that you need and who may be in the business of establishing a different kind of a sod from the one you have.

Fertilizing during discing: There is little need for me to say much about fertilizers in the orchard after you have just listened to Sam Gray's talk on "Balanced Fertilizers". If your soils are highly productive and your fertilizing program has been of the highest type, you may not need any additional fertilizer. But when sods are thin, weeds are prevalent and the need for fertility is evident, don't waste good grass and legume seed by sowing it on unfertilized soil. It is too precious to waste in these days of three dollar Ladino and seventy-five cent fescue. Where fertilizer

is needed use a recommended fruit fertilizer. A good complete fertilizer will be best for the grass seeding—say 400 to 500 pounds to the acre of an 8-16-16 or 4-12-12. Next best is an 0-1-1 ration (0-12-12 or 0-14-14 at around 500 pounds to the acre. Legumes need ample supplies of phosphorus and potash, especially where no manure can be supplied. The important thing is to get the fertilizer worked into the soil during the discing operation. Experiments have shown that the fertilizer is not lost during the winter when the trash is left on the surface. You may say that a program like this is going to cost money. True, but an orchard can be no better than the cover, and the cover will be the first to tell you when the fertility level begins to drop.

Choice of sods: The selection of the kind of sod to grow is one of the important phases of having balanced sods in the orchard. We have already discussed briefly some of the factors of management but one feature deserves further mention. No matter what you may select in the way of grasses and legumes, mowing will be essential for the good of the sod itself. Young grass and clover plants are easily choked by weeds, and weeds are bound to be present in a good soil. One exception is Orchard grass which seems to be able to survive even under a heavy weed cover. I wonder sometimes if it didn't get its name by the very fact that it was one of the few grasses that could survive the rough treatment and the heavy competition.

Ladino clover seems to be an outstanding favorite among orchardists. It is a newcomer to us but an extremely popular one. It grows well on most of our soils but does best where the soil is rich and moist, or where the frequently-clipped growth is allowed to fall to the ground. Consider now that the leaves and petioles of Ladino clover may analyze as high as 38 per cent protein on a dry basis, which is equivalent to about six per cent nitrogen, and that the total dry matter production of a good Ladino soil in a year may be as high as two tons to the acre Now you can begin to realize that with a balanced sod there is a lot of nitrogen being fed to the trees out of the air by way of the Ladino clover. Better than that the loss of calcium, phosphorus and potash will be small because the roots continue to draw these minerals from the soil and re-deposit them on the surface where the leaves decay and return the minerals to the soil in an available form.

Ladino clover will be most successful under these conditions:

1. A "sweet" or neutral soil.

2. Ample balanced supplies of phosphorus and potash.

3. A solid seed bed.

4. Surface seeding on frozen ground in late winter.

5. Sowing one to two pounds to the acre with **light** seedings of non-competitive grasses like timothy or red fescue (not over five qounds to the acre of the grasses.) Right here I want to say that I have been impressed by the seedings of Ladino clover in the College orchards where a few pounds of sweet clover seed were added. Where the sweet clover was clipped back when it got up to a foot high, it was non-competitive and seemed to greatly assist the Ladino clover.

6. Clipping the growth back with the mower bar set at four inches to leave a good ground cover, clipping frequently enough to **control weed growth** and to **prevent the re-seeding of grasses** at any time. When grasses are allowed to go to seed, from 100 to 400 pounds of seed to the acre go back on the soil. If only ten per cent of these seeds grow it is enough to discourage or smother any legume.

7. Permitting the Ladino clover to bloom freely in July and August and to reseed itself as an insurance policy against winter injury and freezing out in late winter and early spring. Data shows that from 15 to 70 qounds of Ladino seed may be produced to the acre in a good stand where bees are present to work the blossoms. If this program is followed, your first purchase of Ladino clover seed my be your last. Hay cut in August when the heads are full of seed may be scattered and disked into the soil on other areas where you want to get it established. This is like the seed-mulch method used on airfields. It is simple, cheap, and very effective because the hay greatly helps in establishing the seed by holding moisture and by keeping the soil cool and porous. This principle can be used with any grass or legume which you may want to grow. With seeds as high in price as they are today, some of you may want to consider this plan rather seriously.

Choice of grasses with Ladino clover: We have mentioned timothy and red fescue as being relatively non- competitive to Ladino clover. Neither is so aggressive as Orchard grass which is objectionable because of the large clumps that develop with age. If Orchard grass were not so bunchy, it would stand off any other grass because it is a good companion with Ladino clover where it is kept down by frequent clipping. One of its chief virtues is its shade-

tolerance. Fortunately, red fescue is just as shade-tolerant as Orchard grass and it develops a low smooth tough turf that will take plenty of punishment. Creeping red fescue is to be preferred over Chewings fescue because Chewings tends to be bunchy too, although they are neither so large nor so objectionable as Orchard grass.

Timothy has the advantage of maturing seeds late in July so that you have more time to get it mowed before the seeds are ripe. The sod it makes is neither heavy nor tough but makes a good substantial cover.

Kentucky bluegrass does not produce a balanced sod with Ladino clover in Pennsylvania. It tends to smother the Ladino in about the second or third year under normal conditions. On rich soils Kentucky bluegrass tends to come in on its own accord, probably from seeds that are in the soil. This is a natural occurrence that we can't do much about and don't intend to.

Canada bluegrass does not fit too well with Ladino clover because they have different adaptations. Canada bluegrass will do well on poor, thin, dry soils where Ladino cannot be expected to thrive. Otherwise, Canada bluegrass makes a low-growing tough sod that will take a lot of hard wear. We've sowed a lot of it in Ladino mixtures for poultry ranges and have yet to see much of it so there is not much use seeding it in Ladino mixtures.

Other legumes. We have mentioned birdsfoot trefoil but have not recommended it as an orchard legume. But, because of some of its characteristics, it deserves some discussion and, in some orchards I have seen, birdsfoot would be a big advantage over the existing cover, if any. It is a drought-tolerant legume and it is a long-lasting perennial which reseeds itself each year at the rate of 40 to 60 pounds of seed to an acre. During extremely dry seasons I have observed that, under a heavy cover of birdsfoot, the soil stays quite moist. It has the distinct advantage of being able to compete successfully with tall-growing grasses, even though the cover is not mowed. It will grow on soils of low fertility and low organic matter better than Ladino clover. The root system is much more branched and fibrous than alfalfa and it is believed to require less moisture in a dry season. It will grow better in a balanced sod with more of the grasses than Ladino clover. With Canada bluegrass it looks like a "natural." Some of its disadvantages include: (1) difficulty of establishment. (2) taking three years to become fully established. Special birdsfoot inoculant is an absolute requirement and I have found through experience that it pays to double-inoculate with

commercial inoculant and also with soil from old established plants. Lime and fertilizer requirements are lower than for Ladino but it responds to good treatment. A very import ant factor is to seed the very minimum of grass with the birdsfoot and also to destroy the existing cover completely so as to permit the seedlings to start with the **least competition.** So fas as adaptation is concerned, I have seen it growing successfully in Montgomery County, on a gravel pile in Erie County, on rocky hillsides in Susquehanna and Bradford Counties, in Cambria County, Centre County and in Clarion County. Five pounds of seed to the acre is recommended for good stands, but good catches have been obtained with two pounds. It can be seeded in late July or in late winter on honeycombed soil.

I shall say very little about crown vetch except to say that it looks very promising. Some of you have established demonstration plots of this legume through your contacts with Mr. Ruef, Mr. Fagan, Mr. Mecartney and others. The fact remains that no seed is available commercially but plenty of root-crown are available for the digging. It grows well and competes with almost every grass and has a large capacity for taking punishment.

So far as lespedeza is concerned, I think most of you are familiar with the limitations of this legume. It is definitely limited to the southern counties. Being an annual, it must reseed itself each fall in order to persist. The early strain of Korean called 19604 seems to be adapted further north than the common types. Most of this seed is produced in Indiana and there seems to be plenty of it.

Other grasses. In the southern tier of counties two grasses have possibilities as ground cover which, so far as I know, have not been tried to any appreciable extent. One is Bermuda grass, the other is Zoysia. Both are southern-adapted grasses and both are growing successfully in southeastern Pennsylvania. Both are low-growing, tough, sod-forming grasses which have a large capacity for hard wear. Neither can be recommended because they have not been tested but their potentialities are such that they deserve mention and certainly a trial in small plots. One disadvantage is that the adapted strains and species must be established with stolons (vegetatively). A good sod of Bermuda grass is growing right here in Harrisburg on the Capitol lawn. There is a good sod of Zoysia on a golf course in Lancaster County and others in Montgomery County, also in Allegheny County.

Temporary sods: It will probably be a long time before we find a better grass than ryegrass for temporary

cover. The improvement to expect probably is in the selection of a rapidly-growing annual legume which will give us more balanced sod than ryegrass alone. There have been quite a few abortive attempts at this phase of maintaining a 50-50 grass-legume cover where the sod must be destroyed annually for orchard management reasons. It may be neither feasible nor desirable so long as you are getting such good results with ryegrass alone but we can always look forward to improvements so long as research continues to function.

BALANCED FERTILITY IN THE ORCHARD

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Balanced feeding of fruit trees is of equal importance to that of ordinary farm crops or animals. Like animals, fruit trees must be fed if they are to live. They must be fed properly if they are going to be healthy. And certainly they must be healthy if they are going to produce good crops consistently, year in and year out. So as far as I know, the perfect formula for fertilizing fruit trees has not yet been found. That is one reason why we have State Experiment Stations and other research organizations. These research agancies working in closest cooperation wtih each other and with forward-looking commercial fruit growers are making distinct progress in the determination and establishment of the fundamentals of a sound orchard fertility program. Upon the capacity of individual orchardists to intelligently adapt research findings to orchard practice, depends their ultimate financial success.

The fruit grower has learned through bitter experience that the best method of meeting the impact of low prices for his product lies in the production of high yields of high quality fruit. He is deeply conscious of the fact that heavy production depends upon maintenance of favorable growing conditions. His chief interest, therefore, is in finding and adopting a system of soil management that will insure an adequate supply and proper balance of all plant food elements necessary for maximum yields of high grade fruit and at the same time, maximum growth of cover crops, the cheif purposes of which are to control erosion, increase the supply of organic matter and improve moisture conditions in the soil.

Nitrogen, phosphorus and potash are the elements usually thought of as fertilizers for farm crops. These are the elements also that are most often lacking for plant growth in orchards. However, there are eight other min-

erals (calcium, magnesium, manganese, iron, sulphur, boron, zinc and copper) which have thus far been found necessary for successful growth of fruit trees. If the soil lacks any one of these, the trees cannot function properly and definite disorders or symptoms are produced. These disorders which show up in leaf, twig and fruit symptoms may often prove extremely useful in diagnosing the cause of the trouble. In fact, the diagnostic techniques now widely employed by horticulturists are generally recognized as being valuable aids in effecting changes in fertilizer and cultural practices for underprivileged orchards.

During the life of the present generation of fruit growers, the official viewpoint on orchard fertilization has been through a series of cycles. Previous to 1914, fertility was maintained in orchard soils in about the same way as for farm crops. Manure and complete fertilizers were generally recommended and used. Under this system, deficiency disorders such as rosette of peaches due to lack of copper or zinc; chlorosis of citrus fruits indicating lack of manganese or iron, and present day troubles of apples such an measles, drought spot, corky-core and bitterpit were practically non-existent. Such troubles as these are of recent origin and appear to be due in a large degree to unbalanced nutrition resulting from the almost universal adoption of the nitrogen only program of fertilization.

Well defined doubts as to the security of the nitrogen only program have existed in the minds of some investigators for many years. Stewart of Pennsylvania and Voorhees of New Jersey sensing the growing scarcity of manure and tendency to substitute nitrogen, were among the first scientists to point out the dangers of this system in orchards and consistently worked for the development of a balanced fertility concept. Stewart showed by analyses of soils, trees and fruits that even the best soils would be largely exhausted of available phosphorus and potash as well as nitrogen by the fruit trees if the supplies of these elements were not constantly replenished. In the Experiment Orchard at State College established by him in 1908, the results of which have been published in numerous bulletins, there is abundant evidence of the type of fertility exhaustion which he prophesized. Evidence continues to accumulate in the Stewart orchard as well as in numerous outly-orchards in the State where new research has been established, indicating that annual applications of complete fertilizers are the most profitable method of maintaining orchard fertility and high production over a period of years.

From the time Dr. Voorhees became Dircetor of the New Jersey Experiment Station in 1895, he was untiring

in his efforts to acquaint fruit growers with the fundamentals underlying the proper use of fertilizers and manures. He believed that it was sound practice and good insurance to be a bit liberal in the use of lime, phosphorus and potash, rather than to risk a deficiency and to apply nitrogen according to the individual needs of the trees. The most successful growers in New Jersey we are told, have never deviated from this principle of fertilization.

The need for fertilization of fruit trees is nothing now. It has been recognized for a long time in some branches of the industry. Particularly is this true of the principal citrus and vineyard areas of the country. In the Northeast where the fruit acreage is dominated by apples and peaches, the soil management practices have not always been ideal, and there is still much room for improvement. The general practice of clean cultivation in orchards where this has been possible, and the belief that nitrogen was the only plant-food that gave quick and profitable responses have so depleted soil fertility reserves that satisfactory yields and quality are no longer possible in many orchards.

In any consideration of orchard fertility problems, it might be well to point out certain fundamental differences between trees and farm crops. Farm crops with few exceptions, are annual and make their full cycle of growth in a few months. Trees on the other hand, go through a period of development covering 4 to 8 years before harvesting begins. From the first they must increase in size and vigor, and beginning with fruiting there is at once a rapid increase in demand for the plant food elements required for optimum growth.

When the shorter period in which field crops get their food is considered, it can be seen that these crops require larger concentrations of readily available plant-food in any one year than fruit trees. Under normal conditions and on orchards of average fertility, trees during the pre-fruiting stage may even make satisfactory growth without any fertilization, although some plant-food may be advantageous.

Once the root system of the trees have fully occupied the soil and further exploitation is impossible, feeding of the trees becomes extremely important. Failure to anticipate the increasing demands for plant-food of trees approaching maturity is unquestionably the primary cause for poor tree growth, indifferent production, inferior quality, and frequently physiological disorders associated with improper feeding.

Under normal conditions field crops and soils get the benefit of carefully planned rotations. Shallow-rooted crops alternate with deep-rooted crops, heavy feeders with light feeders, and invariably there is a sod or rest period. With the orchard there is continuous occupation of the soil, except as in the early years, interplanting with cash crops is sometimes the practice, or as in our well managed orchards which are far too few in number, cover crops are grown. Year after year the bearing orchard makes its demands for plant-food, and this order is pretty much the same with regard to the proportions of the essential elements, only in increasing amounts each year.

Investigations conducted by Dr. L. L. Van Slyke, formerly Chemist at the New York Agricultural Experiment Station, Geneva, New York, show wide variations in the amounts per acre of the important plant-food elements used by different fruit trees in full vigor of bearing. While these figures may not indicate the exact amounts of the essential elements that one must apply in the form of fertilizer, they do serve to indicate the ratio and amounts of these elements which must be present in the soil in available form in order to satisfy the minimum requirements of the trees.

AMOUNTS OF PLANT-FOOD USED PER ACRE

Kind of Fruit	Trees per Acre	N Lbs.	P_2O_5 Lbs.	K_2O Lbs.	CaO Lbs.	MgO Lbs.
Apple	35	51.5	14.0	55.0	57.0	23.0
Peach	120	74.5	18.0	72.0	114.0	35.0
Pear	120	29.5	7.0	33.0	38.0	11.0
Plum	120	29.5	8.5	38.0	41.0	13.0
Quince	240	45.5	15.5	57.0	65.5	19.0

The above figures are concerned only with the plant-food elements used by fruit trees as such. They do not contemplate the need for plant-food necessary for satisfactory production of cover crops, which today are recognized as an essential part of any sound soil fertility program. A fair idea of the additional requirements for plant-food of the cover crops normally grown may be secured from the book "Fertilizers and Crop Production" by Van Slyke, some typical figures from which are herewith given.

NUTRIENT CONTENT OF COVER CROPS

Crop	Yield	Nitrogen Lbs.	Phosphoric acid Lbs.	Potash Lbs.
Alfalfa	3 tons	140	35	135
Clover-Red	2 tons	80	20	70
Clover-Sweet	5 tons	185	45	165
Cow Peas	2 tons	125	25	90
Soy Beans	2 tons	125	40	60
Timothy	1.5 tons	40	15	45
Wheat	1.5 tons	50	20	30
Lespedeza	3 tons	130	30	70

Since the growing of cover crops to prevent erosion, maintain supply of organic matter and improve moisture conditions is a recognized fundamental necessity in any sound orchard management system, fertilization to insure its miximum growth becomes of equal importance to that of fertilization of the tree itself. Sod orchards or cover crops fertilized with nitrogen only, do not ordinarily produce a heavy growth unless the soils are naturally well supplied with the minerals lime, phosphorus, and potash. Orchard sods permitted to develop by natural means may be composed of any or many sorts of grasses and weeds. Soil conditions with respect to moisture and fertility will determine which grasses or weeds will prevail regardless of what species may have been seeded. In practice, however, it seems logical to plant only those kinds of plants which research has shown to be best adapted and to supply them with the most favorable fertility conditions for their maximum growth and development.

But why should we be content with just grass or weed sods as covers. Their growth increases the need for nitrogen fertilizer at a time when nitrogen is going into the manufacture of explosives for winning the war. To meet the temporary shortage of this plant food, orchardists everywhere are being urged to conserve and utilize every possible nitrogen by-product on their farm. This means that leaves, weeds, straw and other plant materials containing nitrogen should be saved, and incorporated in the soil whenever possible. Farm manures too, should be used when available in sufficient quantity.

There is another side to the picture which has received far too little attention by orchardists. It is what some call indirect nitrogen fertilization, and is defined briefly as the doing of anything which will increase the amount of nitrogen fixed in the soil by leguminous and other free fixing organisms. Leguminous crops are especially important at this time because the organisms which grow on the roots of the plants gather nitrogen from the atmosphere and fix it in the root nodules, thus greatly increasing the supply of this nutrient and releasing fertilizer nitrogen for war purposes. Mineral fertilization plays an important role in the successful growing of legumes and on many orchard soils, liberal applications of lime, phosphorus and potash are absolutely necessary.

The legumes alfalfa and clover take more minerals from the soil than the non-legumes, timothy, orchard grass, oats and similar crops. Unless supplied, they will not thrive and therefore cannot function efficiently as nitrogen gath-

erers. Some idea of the quantity of nitrogen added to the soil by legume crops grown under optimum fertility conditions is indicated in the following table compiled from the results of Lyon and Bizzell at Cornell University.

NITROGEN FIXATION BY LEGUMES

Crop	Nitrogen of soil, gain or loss in 10 years, lbs. per acre	Average Annual nitrogen fixation, lbs. per acre
Red clover alternated with rye or barley	532	146
Alsike clover alternated with rye or barley	595	136
Alfalfa alternated with rye or barley	607	241
Sweet clover alternated with rye or barley	420	163
Soybeans alternated with rye or barley	-42	102
Field beans alternated with rye or barley	-100	57
Rye, barley or oats	-52	17
Alfalfa each year	505	268

Studies on the effect of different cultural practices and soil nutrients on soil moisture, erosion control and soil organic matter have been conducted over a period of years by agricultural authorities. Various legumes and non-legumes used in these studies have indicated several things of value to the commercial orchardist. For example, Dr. R. H. Sudds of the West Virginia University makes the following observations. "Korean lespedeza is not adapted for use in orchards on the limestone soils. It cannot compete with weeds and bluegrass on our better soils, although it will do so successfully on poor, shaley soils." He points out, however, that Ladino clover—a large type of Dutch white clover was found outstanding as a low-growing legume which thoroughly protects the soil from erosion and water losses. It adds nitrogen and apparently competes very little with the food and moisture supply of apple trees. On the Hagerstown soil series, Ladino seedlings are not able to compete with grass and weeds as well as on the less fertile soils.

Dwarf sweet clover and crown vetch have shown promise in certain areas. Dr. Sudds says Dwarf sweet clover has resulted in an excellent sod of lessened competition with the trees than ordinary sweet clover. It is easy to get a stand to catch and can be mowed in dry weather to check its growth without permanent injury. Crown vetch is a comparatively new legume for orchard use, and it is long lived. Although it will endure heavy shade, low soil fertility, fairly high degree of acidity, and severe abuse resulting from orchard operations, it is extremely difficult to secure a satisfactory stand, and seeds or crowns are hard to obtain.

Among all the desirable features of cover crops in orchards, one of the most interesting is their ability to translocate plant nutrients from the surface to the subsoil where they are made available to the tree roots. In work

at the New Jersey Experiment Station, it was found that deep rooted legumes like sweet clover and alfalfa translocated phosphorus and potash equivalent to that contained in approximately 100 and 350 pounds of a 5-10-5 fertilizer respectively. Similarly, tree roots were also found to translocate nutrients in amounts adequate to maintain good root activity in the subsoil, even where the respective nutrients may be entirely lacking at that level. Thus if the subsoil is in good physical condition and contain no interfering substances or layers, good root growth may be maintained by surface application of nutrients if satisfactory moisture conditions are maintained. This was conclusively demonstrated in the case of phosphorus, potash and calcium.

Several years ago, Professor R. C. Collison of the New York Agricultural Experiment Station at Geneva made a special study of plant roots as they aid apple trees. He concluded that because plant roots are underground and out of sight they are generally overlooked. The proportion of roots to tops was found to vary enormously in different plants, ranging all of the way from 5% in rye to 33⅓% in red clover and alfalfa. Some of the beneficial things that roots do, are to leave in the soil plant-food elements which have accumulated in the roots during the growth of the plants; to absorb plant-food from the lower depths of the soil and bring them to the surface, also conveying plant-food from the surface to the lower depths; to make channels for drainage which may be especially valuable in soils with impervious subsoils, to add organic matter in the lower depths; and to mix organic matter in the soil thoroughly by their habit of growth. Much of the benefit from leguminous cover crops, says Professor Collison is undoubtedly due to their very extensive root system. For example, figures obtained in the Geneva experiments show that for cereal crops such as wheat, barley, and oats, nearly all of the roots are to be found in the upper 30 inches of soil. In the case of alfalfa, however, more than 40% were below the 30 inch level, while 15% of the red clover roots were below 30 inches. Thus the amount and distribution of the roots of any crop are important to consider in selecting cover crops for orchards. If, as some experiments indicate, phosphorus and potash when applied in fertilizers are absorbed and retained by the surface layers of soil, deep rooting legumes may take some of these materials to the lower root zones of fruit trees, and in many cases with distinct [redacted]

Whether or not the commercial orchardist fully understands or appreciates the reasons for changing practices, the trend in the Northeast is quite definitely in the direction of sod culture, cover crops, mulches and with increas-

ing emphasis on balanced fertility. Clean cultivation and the use of nitrogen only are rapidly giving way to a saner soil fertility program; one involving the use of phosphoric acid, potash, lime and certain minor elements, in addition to nitrogen. It is this type of orchard fertility program based on careful consideration of the nutrient needs of the tree, the soil, and the cover crop that Northeastern orchards have long needed, and which in the postwar period will go a long way toward insuring efficient production and more satisfactory economic returns. This concept of balanced fertility in the orchard is truly worth working for. It is the best guarantee of success for those who plan to make orcharding their chief source of income.

THE PERFORMANCE OF THE SPEED SPRAYER IN 1944

H. J. MILLER, F. N. FAGAN, D. E. H. FREAR, State College, Pa.

Results in the past season indicated that the speed sprayer when operated properly would build up an adequate spray deposit in the tops of large trees, especially if they were pruned heavily. In getting a better deposit in the tops, however, an excessively high residue was left on the bottoms, indicating that there should be a reduction in the number of nozzles on the bottom and a larger number on the top. One-third more material was required to get coverage in the tops equal to the high pressure machine.

Speed at which the machine is driven as well as operation of the valves are important factors governing the coverage. This is illustrated in the attached data on deposit showing that the tops of the McIntosh had a much higher deposit than the tops of the Stayman although the latter trees are only two-thirds the size of the McIntosh.

It will be noted that the deposit in the tops with the standard high pressure rig was low for the first two cover sprays. This is due to the fact that it was necessary to use a low capacity pump in these applications while a larger outfit was used in the last two sprays. This illustrates the need for larger high pressure machines if adequate coverage is to be obtained

[redacted] shows a marked improvement in scab control and spray deposit where the trees were pruned heavily. More spray injury was correlated with the higher deposits. Scab control was better with the speed sprayer on the McIntosh while the high pressure sprayer gave better control on the Stayman.

1944 Test Spraying McIntosh and Stayman—Broom spraying vs. Speed sprayer spraying.

	20 gal. Bean pump broom (400 lb. pressure)		Speed sprayer	
1st spray-delayed dormant—4/26/44 L. S. 3 gal.—100	2 men 55 min.	725 gal. 69 trees Time per tree 0.80 min	2 men 1.55 min.	3000 gal. 159 trees 19 per tree Time per tree .9 min.
2nd spray-Pre-pink to Pink—5/2/44 L. S. 1.5 gal.	2 men 58 min.	775 gal.-69 trees 11+ per tree Time per tree 0.84 min.	2 men 120 min.	2700 gal. 159 trees 17- per tree Time per tree .8 min.
3rd spray-Pink—5/5/44 L. S. 1.5 gal.—100	30 gal. Bean pump (600 lbs. pressure) 2 men 93 min.	975 gal.-69 trees 14+ per tree Time per tree 1.6 min. (93 min. spraying)	2 men 172 min.	3100 gal. 159 trees 19.8 gal. per tree Time per tree 1.1 min.
4th spray-Petal Fall—5/15/44 L. S. 1¼ gal.+3 lb. hydrate lime 3 lb. lead-100 1 part nicotine-800	2 men 83 min.	1100 gal. 69 trees 16 per tree Time per tree 1.20 min. (100 min. spraying)	2 men 185 min.	3600 gal. 159 trees 19 gal. per tree Time per tree 1.2 min.
5th spray-First cover—5/24/44 L. S. 1¼ gal. 3 lb. hydrated lime 3 lb. lead-100 1 part nicotine-2000	3 men 100 min. (1 man spraying from ground)	1175 gal. 69 trees 17 per tree Time per tree 1.4 min.	2 men 130 min.	4400 gal. 159 trees 28 gal. per tree Time per tree 0.9 min.
6th spray-Second cover—6/5/44 Bordeaux 1-3-100 3 lb. lead-100	3 men 108 min.	975 gal. 69 trees 14 gal. per tree Time per tree 1.60 min.	2 men 127 min.	4500 gal. 159 trees 28 gal. per tree Time per tree 0.8 min.
7th spray-Third cover—6/15/44 Bordeaux 1-3-100 3 lb. lead-100	3 men 85 min.	1140 gal. 69 trees 17 gal. per tree Time per tree 1.20	2 men 131 min.	4510 gal. 159 trees 28 gal. per tree Time per tree 0.8 min.
8th spray-Fourth cover—7/3/44 Bordeaux 1-3-100 3 lb. lead-100	3 men 105 min.	1150 gal. 69 trees 17 gal. per tree Time per tree 1.5	2 men 138 min.	4700 gal. 161 trees 30 gal. per tree Time per tree 0.90 min.

Note (a) All trees were sprayed with dormant Tar-Lub. oil spray, using the Speed-sprayer. No time or gal. record for dormant spray.

(b) In sprays 1-2-3-4 the Speed sprayer used about 5 to 8 gal. more of spray per tree than did the broom spraying. Broom spraying had 1 man on tank using an 8 nozzle broom and 1 man as tractor driver. In 5-6-7 and 8th sprays a 3rd man was used with the broom out-fit. He was using a single gun from the ground, and in these sprays the gals. per tree are increased.

In spray 5, gal. per tree were 11 gal. more with the Speed sprayer.

In sprays 6-7 and 8, the Speed sprayer gals. per tree increases 9 to 14 gals.

(c) The time per tree of actual spraying (not counting time for broom sprayer going to filling station) is about equal for each method, in sprays 1-2-3 and 4 when both outfits were using 2 men (no spraymen on the ground). In sprays 5-6-7 and 8 with the 3rd man added to broom outfit (one spraying from the ground) it took about twice as much time per tree as did the Speed sprayer.

(d) During the 1-2-3-4 and 5th spray periods, 4/26/44 to 5/24/44 many rainy days marked the period. There were 15 rainy days. With the number of times it rained between 4/26/44 and 7/3/44 the speed up in spraying of the Speed-sprayer made it possible to cover the entire 100 acres in fruit in a manner that resulted in a satisfactory crop at harvest time. We had 28 rains in this period of time.

(e) The McIntosh are large trees (planted in 1917). 1944 harvest, 1024 bu. per acre.

The Stayman are not as large but the same age. 1944 harvest, 520 bu. per acre.

NOTE: It is necessary to make a statement regarding the packing house culls. Due to the fact that any U. S. grade of apples was ruling at a high price during the fall of 1944, packing house labor was instructed to sort out every speck and place it in the packing house cull pack. We felt that if prices for U. S. grades continued at a high figure throughout the season we wanted to be sure that our commercial pack was a pack of good clean apples. Much of our pack was not sorted for color and was marked U. S. Commercial. About half of the sorters were green help so we had to insist that any blemished apple was a packing house cull as far as we were concerned.

A RECORD OF THE COMMERCIAL PACK OF McINTOSH

Broom Spraying—

334 orchard boxes dumped
301 bu. packed
33 bu. lost to pack—9.9%
26 bu. ciders (under 3 1/4 inch) ---------- 8.6%
90 bu. packing house culls ----------29.9%
185 bu. U. S. grade above utility ----------61.5%

Speed Spray Spraying—

249 orchard boxes dumped
226 bu. packed
23 bu. lost to pack—9.2%
17 bu. ciders (under 2 1/4 inch) ---------- 7.5%
79 bu. packing house culls ----------35.0%
130 bu. U. S. grade above utility ----------57.5%

Due to a freeze late in October followed by a strong wind, we had so few apples left on the Stayman trees it was impossible to make a commercial pack with the Stayman crop in this test.

McIntosh appled in the pack had to show some color. All apples of no color were put in the packing house culls. Many apples placed in packing house culls could have been packed utility grade.

Scab was very light with both methods. There was no codling moth, apple maggot or other insect damage.

Both types of spraying seemed to give good results when compared with an unsprayed row of McIntosh, Stayman, Baldwins, and Gallia 1700 feet away. The fruit on this unsprayed row 100% damaged with codling moth, apple maggot, curculia, leaf roller, green fruit worm and apple scab.

Summary of Data on Lead Residue, Scab Control and Spray Injury for 1944.

McINTOSH

		Speed		Hi-Press	
		mgs Pb/m²			
		Top	Bottom	Top	Botton
Pb-Leaves	5/24	113.6	129.8	54.6	109.5
Pb-Leaves	6/5	137.2	175.6	68.2	107.2
Pb-Leaves	6/15	174.1	242.2	125.7	132.4
Pb-Leaves	7/3	143.7	238.3	112.3	142.0
Ave. Pb-4 Covers		142.2	196.5	90.2	122.8
Pb-Fruit	9/5	(Not Sampled)			
% Scab Leaves	7/17	6.2	2.3	26.8	8.7
% Scab Fruit	8/4	2.2	0.1	12.8	1.2
% Leaves Injured	7/17	27.1	46.2	10.9	25.6

STAYMAN

		Speed		Hi-Press	
		mgs Pb/m²			
		Top	Bottom	Top	Botton
Pb-Leaves	5/24	132.1	163.1	132.6	139.9
Pb-Leaves	6/5	72.4	148.3	91.3	119.6
Pb-Leaves	6/15	120.5	207.8	112.4	182.2
Pb-Leaves	7/3	106.0	247.8	213.6	200.1
Ave. Pb-4 Covers		107.8	191.8	137.5	160.5
Pb-Fruit	9/5	16.8	38.3	26.4	34.1
% Scab Leaves	7/17	16.2	1.4	11.7	3.3
% Scab-Fruit	8/4	28.0	2.2	6.5	0.7
% Leaves Injured	7/17	9.1	23.4	13.3	19.1

McINTOSH (Unpruded)

		Speed		Hi-Press	
		mgs Pb/m²			
		Top	Bottom	Top	Bottom
Pb-Leaves	5/24	125.3	134.2	110.2	126.5
Pb-Leaves	6/5	105.2	155.8	39.1	93.8
Pb-Leaves	6/15	112.5	194.6	73.4	146.7
Pb-Leaves	7/3	106.9	212.1	109.1	147.8
Ave Pb-4 Covers		112.5	174.2	83.0	128.7
% Scab Leaves	7/17	13.8	3.7	23.4	4.8
% Scab-Fruit	8/4	14.8	0.2	17.8	0.2
% Leaves Injured	7/17	10.7	23.6	9.3	18.1

SUMMARY OF GALLONS USED AND TIME REQUIRED - 1944

SPEED SPRAYER

Spray	Date	Gals.	Time (Min.)	Men	Gals. per tree	Gals. per min.	Gals. per min. per Man	Time per tree
D. D.	4/26	3000	150	2	18.9	20.0	10.0	0.94
P. P.	5/2	2700	120	2	17.0	22.5	11.3	0.75
Pink	5/5	3100	172	2	19.5	18.0	9.0	1.08
P. F.	5/15	3600	185	2	22.6	19.5	9.8	1.16
1st C.	5/24	4400	130	2	27.7	33.8	16.9	0.82
2nd C.	6/5	4500	127	2	28.3	35.4	17.7	0.80
3rd C.	6/15	4500	131	2	28.3	34.3	17.2	0.82
4th C.	7/3	4700	138	2	29.6	34.1	17.1	0.87
Ave.		3812.5	144.1		24.0	27.3	13.7	0.91

HIGH PRESSURE SPRAYER

D. D.	4/26	725	55	2	10.5	13.2	6.6	.80
P. P.	5/2	775	58	2	11.2	13.4	6.7	.84
Pink	5/5	975	93	2	14.1	10.5	5.3	1.35
P. F.	5/15	1100	83	2	15.9	13.3	6.7	1.20
1st C.	5/24	1175	100	3	17.0	11.8	3.9	1.44
2nd C.	6/5	975	108	3	14.1	9.0	3.0	1.57
3rd C.	6/15	1140	85	3	16.5	13.4	4.5	1.23
4th C.	7/3	1150	105	3	16.7	11.0	3.7	1.52
Ave.		1001.9	85.9		14.5	11.9	5.1	1.24

PRESENT INSECTICIDES AND FUNGICIDES, WITH SPECIAL REFERENCE TO NEW PRODUCTS

HARRY F. DIETZ, Entomologist, DuPont Experimental Laboratory, Wilmington, Del.

Before the first World War, there were many persons who believed that our major pest control problems were solved. In the field of chemical control, we had available, lead and calcium arsenates and Paris Green as stomach insecticides; lime-sulfur solution, kerosene emulsions, nicotine sulfate and pyrethrum or Persian insect powder as contact insecticides; and lime sulfur solution, certain wettable and dusting sulfurs, Bordeaux mixtures, and certain modified copper sprays such as Burgundy mixture and ammoniacal copper carbonate as fungicides.

The advances in chemistry during and following the last war were reflected into the control of insect pests and plant diseases. Better and more effective materials were needed in order to produce better and cleaner crops. All of the old materials had certain faults. Sometimes, they failed to control pests which assumed importance as our agricultural and horticultural operations spread to new areas or increased and concentrated in old ones. For example, it was found that lime-sulfur, although effective against certain scale insects like San Jose Scale, was ineffective against the lecanium scales like terrapin scale or the European fruit lecanium. It was necessary to use oil sprays against lecanium scales. Lime-sulfur and wettable sulfurs, although effective against such diseases as apple scab and sooty blotch, were ineffective against apple blotch and bitter rot. It was necessary to use Bordeaux mixtures against the last two diseases. Besides this, the sulfur sprays and Bordeaux mixtures caused certain types of plant injury, often at critical periods, depending on weather conditions. The sulfurs often caused severe burning in hot, humid weather, or when used in combination with lead arsenate. Bordeaux mixture caused very severe fruit russetting when used in early cover sprays, or when used in periods or in areas where cool, humid weather is the rule. Likewise, it also was slowly recognized that materials which are satisfactory against light or moderate infestations of insects or plant diseases may fail to give adequate control when severe infestations occur as a result of weather or other conditions which favor the development of particular pests. As excellent example is found in lead arsenate, which in many areas and under some conditions, still gives adequate control of codling moth with only three or four cover sprays, and in other regions, may fail to produce a commercially clean crop with as many as ten cover sprays.

We have learned through experience that pest control operations are not as simple as we once thought. We know that the insect and disease complex as a whole, the plants on which they occur, and the regional conditions where they occur must be considered. Besides this, the materials which we use, the way in which we use them, and the time of application are equally important.

The objective which not only growers, but all investigators concerned with crop production, are constantly striving to attain is a miximum yield of a clean, untainted crop, with a minimum number of treatments for controlling insects and diseases.

It is this objective which inspires the efforts of entomologists, plant pathologists, horticulturists, agronomists, agricultural engineers and others in the constant search for new, useful chemicals and better ways of applying them.

The period between the two World Wars has produced improved lead and calcium arsenates. There has been the development of the fluorine compounds, particularly cryolite, of ground rotenone-bearing roots, especially derris and cube, and fixed nicotine compounds like nicotine-bentonite, and Black Leaf 155 as stomach poisons.

As contact insecticides, rotenone-bearing ground roots and extractives, standardized pyrethrum extractives and impregnated powders, highly concentrated nicotine dusts like Black Leaf 10, the thiocyanate compounds, dormant and summer oil sprays and the dinitro phenol or cresol (DN) compounds were developed, improved or standardized.

Among the fungicides, wettable sulfurs and dusting sulfurs have been greatly improved, particularly in the way of much finer particle size than was dreamed of in 1916. Flotation sulfur paste was found useful and its ease of handling constantly improved. A wide range of low-solubility copper compounds, including the cuprous oxides, basic sulfates, silicates, oxychlorides, oxychloride-sulfate, and tetra-copper calcium oxychloride were developed and found to be safer in sprays to many plants than Bordeaux mixtures, and more useful for dusts than monohydrated copper sulfate.

Not all of this imposing array of chemicals are extensively used in the control of insects and diseases affecting Pennsylvania's major fruit crops: apples, peaches, cherries and grapes, in which you as fruit growers are primarily interested. Most of the materials mentioned are available

in adequate quantities, both for such use as you and basic food crop growers may require.

For example, the supplies of both standard and basic lead arsenate, fluorine compounds, dormant and summer oil sprays, "dinitro" (DN) compounds, lime-sulfur, most wettables sufurs, copper sulfate for Bordeaux and most of the low-solubility copper compounds are adequate.

The notable exceptions are the cuprous oxides, pyrethrum and rotenone products, nicotine compounds and flotation sulfur paste, the supplies of which are limited.

Since nicotine compounds have assumed a most important role in codling moth control both in non-washing programs and in combination with lead arsenate-oil sprays, the effect of this limited supply may be keenly felt. Certain areas and orchards in Pennsylvania are no exception in having a serious codling moth problem due to hot, dry weather and other conditions most favorable to codling moth activity for the past several years. Hence, many growers are anxious to improve their control programs, and doubtless will want to turn to nicotine compounds as a means of doing this. A representative of the manufacturers of Black Leaf 40 and Black Leaf 155 is being given the opportunity of discussing this situation.

As a possible substitute for nicotine in improved codling moth control programs, relatively new insecticide has been suggested. No, it is not the much publicized DDT, but phenothiazine.

In the late 1930's this product had been extensively investigated as a possible substitute rather than a supplement for lead arsenate in codling moth control. When used alone, its performance in some areas, even at one pound per 100 gallons of water, was better than that of the best lead arsenate combinations. In some areas, 2 lbs. were required, and in other regions, 3 lbs. barely equalled the best lead arsenate sprays in effectiveness. In early season sprays, it was more effective than later. In other words, the weather and other conditions in the different apple-growing areas had a marked effect on its performance. It was known that under certain conditions of air, light, temperature and moisture, it underwent rapid chemical change, just as rotenone does, and its effectiveness was altered by these conditions. Under hot and dry conditions, its deposits which turn black in color often had an adverse effect on fruit coloration, especially on yellow varieties. However, in most areas, the color of the foliage was superior to that of other treatments. Foliage loss from spray injury or

scab was negligible. In regions where adequate summer rainfall occurred, fruit coloration was superior to that of most other treatments. It was found also that the size of the particles was most important in its performance, only the most finely divided or Micronized material being effective. When used alone, it has proved to be just good enough to be tantalizing, and just variable enough in performance to be unusable. Therefore, entomologists still recognize phenothiazine as a purely experimental material. However, the Pennsylvania Fruit Research Laboratory, in the past two years, has found that if 2 lbs, of unconditioned Micronized phenothiazine is used with 3 lbs. of lead arsenate in 100 gallons of water and applied in the second, third and fourth codling moth cover sprays, during the peak of first brood activity, excellent control of this insect has been obtained. These first brood sprays may be followed by either lead arsenate-Bordeaux mixture or nicotine-bentonite-oil sprays for controlling the second brood. This program takes advantage of the early effectiveness of phenothiazine and the important residual effect of lead arsenate, which phenothiazine, used alone, lacks. In hill orchards like those in Adams and adjacent counties, where spraying, at best, is not an easy operation, and where spray water, manpower and equipment are presently often inadequate, this feature is of considerable importance. It allows for some lengthening of the interval between first brood sprays. Besides this, the phenothiazine-lead arsenate program has not favored any build-up of either European red mite or red spider, which occurs in the Shenandoah-Cumberland Valleys. This too, is important in any area or under conditions where spraying is difficult and an extra spray or sprays for mite control becomes necessary. As has already been mentioned, failure to consider the insect and plant disease complex as a whole, or ignoring any one of the essentials of proper timing, applying adequate gallonage of sprays and maintaining an effective coverage of the proper materials, defeats the objective of producing maximum yields of a clean crop. The use of the lead arsenate-phenothiazine combination does not permit neglecting any one of these essential requirements. There will be available the unconditioned Micronized phenothiazine for those who wish to try it on the basis of the results that they have seen. However, it is being provided with the distinct understanding that it must be used in strict accordance with such directions as are being provided for its use by Pennsylvania investigators.

Therefore, if you are one of those who are going to try phenothiazine, be sure to obtain the unconditioned Micronized material. The kind used for animal medication won't do. Then use it according to direction provided by

your state investigators. Avoid, insofar as possible, getting covered with or inhaling the spray drift or the dust. Such handling of a finely divided material like phenothiazine may lead to certain discomfort similar to that of sunburn, even though the material is relatively non-toxic otherwise.

All of you have read the publicity regarding DDT. When we speak of DDT, we really mean compositions containing DDT which may be used in sprays, dusts or other ways. It cannot be used unmodified. It must be prepared for use. Some of you probably believe that it is the answer to all of your insect pest control problems, and the "insecticide to end all insecticides", as has been said. There is no doubt that DDT is a remarkable new insecticide. Some of the things it does to certain insects like mosquitoes, flies, lice, bedbugs, leafhoppers, many kinds of caterpillars, including codling moth, and Japanese beetle seem too good to be true. Yet, on the other hand, it does not control plum curculio as well as basic lead arsenate, and in all experiments throughout the country where it has been tried for codling moth control, its use has favored the development of mites rather than controlling them. Its long residual effect against household insects is not maintained out-of-doors. All that can be said at the moment is that we do not know enough about its use even to suggest the best way to use it. At present, no DDT is available for agricultural crop use. Military requirements come first. Its remarkable performance in eliminating blood-sucking insects which transmit such deadly human diseases as yellow fever, tropical malaria, bubonic plague, typhus fever and others, may require even greater quantities of this phenomenal material as our forces continue to move farther and farther into regions where all these diseases occur.

Suffice it to say that sufficiently large quantities of DDT are being made available so that all investigators who are interested in testing it will have this opportunity. Out of this intensive and coordinated effort will come the necessary information on which directions for using it to the best advantage with regard to concentrations, compositions, combinations and number of applications can be based, and any human hazard involved in residues resulting from its use determined.

If one studies the list of fungicides for use on growing plants available before the war, it is noted that all of them are either inorganic sulfur or copper compounds. The faults of these materials already have been mentioned, namely, that the inorganic sulfur fungicides may cause severe foliage and fruit burning in hot, humid weather, whereas the copper compounds cause injury when it is cool

and wet. Again we must refer the interrelationship of materials and the pests which we are trying to control with a minimum injury to our plants. Under eastern conditions, we must always use combinations of insecticides and fungicides in the control of fruit-tree insects and diseases. To find the most suitable combinations is not always easy. For example, we cannot point our program toward the control of codling moth alone, no matter how serious a pest it may be, and ignore scab, bitter rot and sooty blotch altogether. Neither can we ignore other pests like the mites by developing a program directed solely against codling moth, curculio, cedar rust, scab and other diseases. Until recently, one of the barriers to the best use of lead arsenate-oil-nicotine, or oil-nicotine-bentonite programs was the fact that such programs of necessity had to omit disease control because no fungicide was available which was compatible with both nicotine and oil. Sulfur cannot be used with oil, nor can oil sprays be safely applied to foliage and fruit where even relatively light sulfur residues are present. A common admonition to the use of oil sprays is never to apply them within two weeks after sulfur has been applied, but in dry years, two weeks is too short a time for the sulfur to disappear, and oil-sulfur injury has occurred even after a lapse of three weeks between the last sulfur and the first oil spray. Bordeaux mixture is quite compatible with oil sprays, although the effectiveness of both oil as an ovicide and the Bordeaux as a fungicide may be somewhat reduced when they are combined. But Bordeaux mixture is not compatible with nicotine-bentonite, Black Leaf 155 or nicotine sulfate (Black Leaf 40). All these nicotine compounds are referred to as fixed nicotines because the volatility of the free base nicotine is reduced or fixed. It is well known that free base or nicotine alkaloid is released from these compounds by alkaline materials and the excess lime used in the preparation of Bordeaux mixture to make it safe for use on apples is an alkaline material. Low-solubility copper compounds without lime are not usable because the nicotine forms soluble copper complexes which cause fruit russetting and foliage injury.

During the middle and late 1930's, certain organic sulfur compounds, the heavy metal salts of certain organic acids, particularly of dithiocarbamic acid, were found to be potent fungicides as well as repellents for such destructive leaf feeding insects as Japanese beetle. The iron salt, called ferric dimethyldithiocarbamate, and "FERMATE" fungicide for short, appeared to be particularly promising, because of its wide range of safety to plants and its compatibility, particularly with nicotine and oil, as well as with lead and calcium arsenates, the wettable sulfurs, pyrethrum

and derris compositions and others. It does not burn fruit or foliage in hot weather, nor russet the fruit in cool, wet periods. Since it reacts with lime to form the water-soluble calcium salt, its use with lime is not suggested, except where high initial effectiveness is desired at the expense of a longer-time residual efficiency. It is the first fungicide which can safely be employed immediately preceding summer oil sprays or in combination with oil-lead arsenate or in oil-nicotine program. It is the only fungicide available which can be so used. It has been widely tested and found to control cedar-apple and quince rusts, apple scab, Brooks spot, apple blotch, bitter rot, black rot leaf spot or frog eye, cherry leaf spot and brown rot on sweet cherries, and recently, black rot of grapes. The concentrations at which it should be employed will depend on those factors which have been stressed so frequently this morning. As examples, there are two, developed by your own state plant pathologists. In the control of cedar-apple and quince rusts, usually five applications of ½ lb. of "FERMATE" have been recommended during the period between the pink and first codling moth cover sprays. However, it has been found that where growers can only apply three sprays, ½ lb. is not enough to give maximum control. One pound should be used. A similar situation has been found with regard to apple scab. One and one-half pounds is adequate for controlling this disease on many varieties, but inadequate on McIntosh in certain parts of Pennsylvania. It should be borne in mind that "FERMATE" is a protective and not a curative fungicide. It must therefore be applied before infection periods or rains, not after. It will not burn out scab as lime-sulfur does. The difficulty with lime-sulfur as a curative spray is that its action does not always stop after the scab lesions have been killed. It may injure the healthy tissues as well, ofter causing heavy defoliation.

"FERMATE" is available only in very limited quantities, and its use should be restricted to cedar-apple and quince rust control or to the change-over spray on apples where lead arsenate-oil or nicotine oil programs are employed. Where a lead arsenate-phenothiazine program is being employed, "FERMATE" is not necessary.

Mention of several other new organic fungicides which are under investigation, some in Pennsylvania, others in other apple growing regions, have purposely been omitted. They are in the same position as DDT. Just how to use them most effectively has not been determined. This is another way of saying that we don't know how the use of these materials fits into that complex interrelationship of insect and disease control.

Deviations from directions for using insecticides and fungicides often are responsible for their failure to perform. That may have been the fault with some of our previous schedules with other products. A grower who required more days to cover his orchard than the recommended spray interval most certainly could not follow such recommendations if he did not have both the necessary help and the additional equipment. But growers can and should always follow the directions regarding the mixing and use of materials, and see that adequate and thorough coverage is obtained. Poor, ill-timed applications mean poor control where such insect pest and disease complex as rosy aphis, red mite, codling moth, plum curculio, leafhopper, cedar rust, scab, sooty blotch, bitter rot and black rot are concerned.

It cannot be overstressed that codling moth must be controlled by the first brood spray program and scab by the time the second cover spray is applied. Otherwise, even the most strenuous measures, in a season favorable to either pest, may fail completely.

No attempt has been made to suggest the exact concentrations or combinations in which any of the materials mentioned should be used. Pennsylvania is a large state and the conditions in the fruit-growing sections in Erie County are quite different from those in Adams or York Counties. Only those who are conversant with these conditions can advise you how best to use any pest control chemical or combination of chemicals. These are your state investigators and extension services.

The present lack of certain important chemicals, manpower and equipment tend to make us pessimistic. Many new insecticides and fungicides more potent than any now available are in the making. New and previously unthought of methods of applying them more rapidly and thoroughly are being studied. A brighter future in more effective pest control lies ahead.

REPORT OF LEGISLATIVE COMMITTEE

Your legislative committee attempted to guard the interests of the Fruit Growers of Pennsylvania during the past year by representing them at industry meetings, following legislation and making representation in their behalf when deemed necessary.

At the time of this meeting a year ago telegrams were sent to our United States Senators, opposing consumer sub-

sidies. A letter from Senator Davis indicated that he voted as we requested.

Mr. Johnston Gillan and the secretary of your committees represented Pennsylvania Peach Growers at the meeting of the National Peach Council at St. Louis. At this meeting a permanent organization of practically all of the important peach growing states was formed. (For a comprehensive report of the activities of this organization read Carroll Miller's report "Appalachian's Work on Apples and Peaches.")

Your secretary represented the Fruit Growers of Pennsylvania at a meeting in Washington with Selective Service, War Man Power, and War Food in an effort to reduce the units per man for orchards. A similar meeting was later held in Harrisburg with the result that the units were reduced from thirty-two to twenty. Though the unit system was discarded, the Draft Boards are still using these values as a "yard stick" in determining essentiality of farm labor.

On two occasions small meetings were arranged through the Secretary of Agriculture with Selective Service in an effort to bring about better understanding of our mutual problems. We feel that these meetings were highly successful and that all Fruit Growers in the State have derived benefit from this work.

At the annual meeting of the National Apple Institute your secretary represented Pennsylvania. The Institute has done much to secure favorable ceiling and other favorable legislation and rulings in Washington. For a more detailed report of this work we again refer you to Mr. Miller's article.

The most recent activity of your committee was in protesting Administrator Metcalf's proposed definition of "Area of Production" and in supporting the proposed definition as suggested by Appalachian Apple Service, International Apple Association, and National Apple Institute.

Respectfully submitted,
Lionel E. Newcomer, Chairman.

REPORT OF COMMITTEE ON PROMOTION AND EDUCATION

Your committee recommends that the President of the Pennsylvania State Horticultural Association appoint a committee to serve for the year 1945 to be known as the Promotional and Educational Committee.

We further recommend:

1. This committee be composed of the present directors of the Pennsylvania Division of the Appalachian Apple Service, Inc., the Pennsylvania directors of National Peach Council and such additional members as may be desirable, to include other fruits.

2. This committee ac as a formative body to develop plans and functions for a permanent committee to be elected at the next annual meeting to carry on promotional and Educational Services for the Fruit Growers of Pennsylvania.

3. The temporary Promotional and Educational Committee be empowered; (a) to collect and disburse funds for Promotional and Educational work for members of the Pennsylvania State Horticultural Association and others who may desire to cooperate; (b) such funds as are collected are to be kept separate and distinct from funds collected for membership in the state association; (c) to collect and disperse market information and other information that may be of help in promoting orderly marketing of the crops of the members of the association; (d) to employ as Assistant Secretary-Treasurer in the person of Mr. John Mengel of Leesport, Pa. to keep all books, records, and funds of the Promotional and Educational Committee and to carry on the work now being done of the Pennsylvania Division of Appalachian Apple Service and such additional duties as may be necessary to support the National Peach Council and the Appalachian Division thereof.

4. We recommend the the Chair insist that the County Organizations appoint active committees to assist in Promotional and Educational activities through personal solicitiation for new members and by giving short educational talks and reports on the work being done by the regional, promotional organizations.

Respectfully submitted

Johnston Gillan, Chairman
John Mengel
Lionel E. Newcomer
Harry Anderson
Harvey Raffensperger
M. E. Knouse
Fred Greist
Committee.

REPORT OF THE STATE COLLEGE RELATIONS COMMITTEE

For many years our industry has looked to the School of Agriculture and especially to the Department of Horticulture for help. Now, your Committee believes that the time has come for the Industry to help the Horticultural Department at the College.

We find that their staff is woefully undermanned and cramped into a small portion of their building. Furthermore, the only two key men in the Department of Pomology are slated for retirement in the near future. This all comes at a time when the need for leadership in Research is most urgent so that we may attain higher yields of quality fruit in order to reduce production costs and thus be better able to meet the crisis which will surely come in the post war period.

The duties of the Teaching Staff will be increased with the return of a normal student enrollment and by returning Service Men who will take advantage of the G.I. Bill of Rights. The Department which represents our $50,000,000 industry must be made attractive to students and take a leading role in its place on Agricultural Hill as well as to disseminate valuable information received from aggressive Research.

Therefore we recommend:

1. That the new Horticultural Building be kept high on the list of Post War buildings.

2. That all vacancies on the staff be filled as soon as possible with the best men available.

3. Additional necessary personnel should be secured for both the teaching and research staffs with the thought in mind of providing suitable and capable men to work with the present key men so that they can retire, when they see fit, with the feeling that the work to which they have given so many years of faithful service, will be carried on.

4. We recommend that the Department of Horticulture be allocated its full share of funds in order to help solve urgent problems for our Industry. Incidently, we feel strongly that the money earned as net profit from the orchard, vegetable and flower departments should not revert to the general College maintenance fund but should be used to further the work in these departments.

5. There are apparently sharp lines of demarkation existing between the various departments and your committee suggests that a spirit of unity and cooperation should prevail before we in the industry will get the help and information which we should have.

6. This year, our good friend, Dr. S. W. Fletcher expects to retire as Dean of the School of Agriculture. We reccomend that a strong aggressive administrator be selected by the Board of Trustees and that they should make a nation wide search, if necessary, to secure the very best man available for this key position in the School of Agriculture. We further recommend that the Board of Trustees give him sufficient authority to carry on his work as he sees fit.

7. It has been suggested and we recommend that a Secretary be added to the staff of the Arendtsville and North East Stations. This would greatly increase the efficiency of the Research men by relieving them of the routine work of typing, filing and answering the telephone and would allow growers to contact the Stations when the Research men are away from the office.

8. Many members of our Association wonder why we have not received more definite and timely information regarding Research work from the College and the Arendtsville and the North East stations. We find that the data for numerous reports has been collected but its publication has been delayed unduly through lack of personnel. The remedy is, of course, filling all personnel vacancies and also additional personnel should be added to help an overworked staff.

9. We further recommend that a copy of this Report be sent to the President of the College, The Dean of the School of Agriculture, the Director of Research, the Head of the Department of Horticulture and to the Agricultural members of the Board of Trustees.

H. F. Hershey, Chairman,
William W. Mellor
C. L. Packard.

FINANCIAL REPORT
PENNA. STATE HORTICULTURAL ASSOCIATION
FINANCIAL STATEMENT

State College Account — J. U. Ruef, Secretary

1944 Receipts

Jan.	15	Bank Balance	$711.32
		Dues Harrisburg Meeting	165.00
	22	J. Walter Thompson Co.—Adv.	10.62
		Franklin County Hort. Assn.—Dues	6.00
		Franklin County Hort. Assn.—Dues	38.00
		Thos. H. Beasley—Dues	1.00
		Lehigh County Hort. Assn.—Dues	23.00
		California Spray Chemical Co.—Adv.	20.00
	27	Franklin County Hort. Assn.—Dues	7.00
Feb.	2	Franklin County Hort. Assn.—Dues	9.00
		Franklin County Hort. Assn.—Dues	6.00
	3	G. Wm. Gardenhour—Dues	2.00
		Bucks County Hort. Assn.—Dues	17.00
		Harold Steele—Dues	2.00
	5	Schuykill County Hort. Assn.—Dues	15.00
		G. S. L. Carpenter—Dues	2.00
		C. O. Dunbar—Dues	2.00
	18	Franklin County Hort. Assn.—Dues	26.00
		Berks County Hort. Assn.—Dues	9.00
		Albert C. Roemhild—Adv.	7.50
		Blair County Hort. Assn.—Dues	13.00
		J. G. Kuester and Associates—Adv.	10.63
	20	Lehigh County Hort. Assn.—Dues	6.00
		Lawrence County Hort. Assn.—Dues	31.00
	23	Franklin County Hort. Assn.—Dues	7.00
		Allegheny County Hort. Assn.—Dues	20.00
	24	Luzerne County Hort. Assn.—Dues	42.00
	28	Franklin County Hort. Assn.—Dues	2.00
		Adams County Hort. Assn—Dues	36.00
Mar.	1	Barber Orchards — Dues	2.00
	3	Franklin County Hort. Assn.—Dues	5.00
		Daniel Rice — Dues	2.00
		Rowland — Dues	1.00
		W. E. Musser — Dues	2.00
		Jno. N. Huff — Dues	1.00
		Venango County Hort. Assn.—Dues	9.00
	10	Franklin County Hort. Assn.—Dues	2.00
		Lehigh County Hort. Assn.—Dues	12.00
		Hort. Dept. "Flower Fund"	5.00
	18	Wayne County Hort. Assn.—Dues	24.00
		Franklin County Hort. Assn.—Dues	3.00
		E. J. Todd — Dues	2.00
	25	Lehigh County Hort. Assn—Dues	2.00
	27	Franklin County Hort. Assn.—Dues	2.00
		Mercer County Hort. Assn.—Dues	8.00
	28	Chester-Delaware Fruit Growers—Dues	34.00
Ap.	3	Lebanon County Hort. Assn.—Dues	9.00
		Franklin County Hort. Assn.—Dues	1.00
		Indiana County Hort. Assn—Dues	35.00
	29	Fox and MacKenzie — Adv.	8.33
		Central Chemical Corp.—Adv.	7.50
		Pa. Farm Bureau Coop.—Adv.	12.50
		Jas. R. Fuller — Adv.	12.50
		B. G. Pratt Co. — Adv.	12.50
		Chipman Chemical Co. — Adv.	15.00

		Rice, Trew and Rice — Adv.	10.00
		Franklin County Hort. Assn.—Dues	5.00
		Chas. A. Rawson and Associates—Adv.	10.63
May	5	Ardiel Adv. Agency — Adv.	41.65
		J. Haden Twiss — Adv.	10.62
		A. Woodward Smith — Dues	1.00
		F. A. Read — Adv.	12.50
		Wm. H. Flora — Dues	2.00
		Ketchum, MacLeod, Grove — Adv.	10.42
		MacManus, John and Adams, — Adv.	10.41
	11	Berks County Hort. Assn. — Dues	3.00
		Lehigh County Hort. Assn. — Dues	5.00
		Franklin County Hort. Assn. — Dues	1.00
		Anthony Hile — Dues	2.00
		Iron City Produce Co. — Adv.	7.50
	22	J. Walter Thompson Co. — Adv.	10.63
		Albert Sidney Noble — Adv.	10.62
		Beeson-Faller and Reichert Inc. — Adv.	10.62
		Franklin County Hort. Assn. — Dues	2.00
		Victor Panonic — Dues	2.00
June	12	Eschner Adv. Agency — Adv.	12.50
		Bucks County Hort. Assn. — Dues	5.00
		Adams County Hort. Assn. — Dues	12.00
		Adams County Hort. Assn. — Dues	7.00
		Indiana County Hort. Assn. — Dues	2.00
		Franklin County Hort. Assn. — Dues	1.00
July	10	J. Hayden Twiss — Adv.	10.41
		J. G. Kuester and Associates — Adv.	10.42
		Pa. Farm Bureau — Adv.	12.50
		J. Walter Thompson Co. — Adv.	10.41
		Fox and Mackenzie — Adv.	8.33
		Iron City Produce Co. — Adv.	7.50
		F. A. Read Inc. — Adv.	12.50
		J. G. Kuester and Associates — Adv.	10.63
		Rice, Trew and Rice — Adv.	10.00
		Wick and Bro. — Adv.	10.00
	18	James A. Fuller — Adv.	12.50
		Albert C. Roemhild — Adv.	7.50
		Chipman Chemical Co. — Adv.	15.00
		B. G. Pratt Co. — Adv.	12.50
		Macmanus, John and Adams — Adv.	10.41
		Chas. A. Rawson and Associates — Adv.	10.63
Aug.	23	Berks County Hort. Assn. — Dues	3.00
		Adams County Hort. Assn. — Dues	4.00
		Adams County Hort. Assn. — Dues	3.00
		Beeson-Faller Reichert Inc. — Adv.	10.41
	23	J. Walter Thompson Co. — Adv	10.63
Oct.	7	Chipman Chemical Co. — Adv.	15.00
		Jas. F. Fuller — Adv.	12.50
		E. I. du Pont de Nemours and Co. — Adv.	20.00
		Luzerne County Hort. Assn — Dues	8.00
		Franklin County Hort. Assn. — Dues	1.00
		Franklin County Hort. Assn. — Dues	1.00
		Rice, Trew and Rice — Adv.	10.00
		Central Chemical Corp. — Adv.	7.50
		F. A. Read Inc. — Adv.	12.50
		Chas. A. Rawson and Associates — Adv.	10.42
	14	J. Walter Thompson Co. — Adv.	10.63
		Iron City Produce Co. — Adv.	7.50
		Pa. Farm Bureau Federation — Adv.	12.50
		MacManus. John and Adams — Adv.	10.41
		J. G. Kuester and Associates — Adv.	10.42

Nov. 3	B. G. Pratt Co. — Adv.	12.50
	F. E. Schumacher Co. — Annual Report	2.00
	Albert C. Roemhild — Adv.	7.50
Dec. 5	American Potash Institute — Dues	2.00
	Cornelius Bros. — Dues	2.00
	R. J. Wood — Dues	2.00
	Ralph D. Whiting — Dues	2.00
	Harry J. Fitzgerald — Dues	2.00
	Rice, Trew and Rice — Adv.	40.00
	H. G. Baugher — Adv.	50.00
	Kelly Bros. — Adv.	10.00
7	Walter C. Drones — Dues	2.00
16	A. Socci — Dues	2.00
	Henry K. Buns — Dues	2.00
	John Goss — Dues	2.00
	Total	$2,176.16

Expenditures—1944

Jan. 29	Philipsburg Ledger Co. — Dec. News	$161.21
	C. E. Dutton—National Apple Institute Dues	10.00
Feb. 7	Philipsburg Ledger Co. — Membership cards	7.25
8	State College Floral Shop—Flowers Members	15.70
7	L. P. Batjer—Expenses Harrisburg Meeting	26.00
	F. W. Parker—Expenses Harrisburg Meeting	27.17
	Postage, telegrams, telephone	8.49
	Porter R. Taylor—Expenses Harrisburg Meeting	21.68
Mar. 25	Mary E. Ruef—Steno. Annual Report	78.50
	John U. Ruef—Transportation Philipsburg (4)	10.40
30	Franklin County Hort. Assn. Refund	1.00
Apr. 5	Berks Lehigh Coop. Fruit Growers (Lionel Newcomer's expenses '43)	150.00
May 7	Philipsburg Ledger Co. — Annual Report	556.05
	Telephone and Telegrams	1.92
	Paul Thayer—Expenses Harrisburg Farm Organ.	3.00
	J. U. Ruef—Transportation Philipsburg (2)	5.20
June 1	Postage Deposit	10.00
3	Philipsburg Ledger Co.—Envelopes and Letterheads	46.40
29	Mary E. Ruef—Steno.—Telephone	31.62
Aug. 19	Philipsburg Ledger Co.—June News, Envelopes	208.30
	J. U. Ruef—Transportation Philipsburg	2.60
	Postage Stamps	6.00
22	Sylvia F. Meeker — Steno.	35.00
Sept. 27	Mary E. Ruef—Steno Sept. News	26.75
	J. U. Ruef—Transportation Philipsburg (2)	5.20
Oct. 16	Philipsburg Ledger Co.—Sept. News, Labels and Supplies	132.80
Nov. 3	Telephone—Oct. $1.88. Sept. $1.75	3.63
21	J. U. Ruef—Transportation Philipsburg	2.60
Dec. 5	Telephone and Telegrams	5.50
7	J. U. Ruef—Transportation Philipsburg	2.60
9	J. U. Ruef—Expenses Va. Meeting	9.90
27	Nancy Jane Ruef—Steno. Dec. News	27.50
29	Telephone and Telegrams	5.65
	Total	$1,645.62

FINANCIAL STATEMENT, JANUARY 6th, 1945

Total Receipts	$ 2,176.16
Total Expenditures	1,645.62
Balance	$ 530.54
Bank Balance, First National Bank, State College	$ 530.54

FINANCIAL STATEMENT FOR 1944—PAUL THAYER, TREAS.

Jan. 18	Balance	$ 38259
Feb. 25	Dues, Dr. Elizabeth Bricker	1.00
	Dues, Lancaster Co. Hort. Sec.	2.00
	Dues, York Co. Fruit Growers	46.00
June 1	Interest	3.34
Dec. 1	Interest	2.73
Balance, Farmers Trust Co., Carlisle, Pa.		$ 437.66

Assets

Cash Balance — State College	$ 530.54
Cash Balance — Carlisle	437.66
Two U. S. Savings Bonds, Series F.	1,480.00
Total	$ 2,448.20

We the undersigned committee have examined the above statement and found it correct.

Charles L. Boutillies,
John S. Imswiler
Carl Schoellkoff

APPALACHIAN'S WORK ON APPLES AND PEACHES

CARROLL R. MILLER, Secretary, Appalachian Apple Service, Martinsburg, W. Va.

The past year has been a busy one in both apples and peaches for Appalachian Apple Service. Results have been notable. May we check off quickly a few of the larger jobs done for our Appalachian Area crops?

FOR PROCESSING APPLES: Appalachian Apple Service last May began working on this,—with National Apple Institute, informed Government chiefs, and the Joint Appalachian Industry Committee of Growers and Processors. Surveys indicated that last year's price schedules for processed apples should be continued this season. Six conferences were necessary, in our Belt or at Washington, between June 1 and Sept. 15th. Appalachian arranged and conducted these. By remarkable cooperation between our processors and our growers, the goal was finally reached.

The Price Schedule was secured at exactly last year's; $3.10 cwt. and downward; and **not** a ceiling, which was most important to us. A 5-man Appalachian Committee spent half of each of 2 weeks in Washington in early September; succeeded in pushing through the Price Schedule, unchanged. Without this organized grower-processor cooperation, it is impossible to say what prices our processing apples would have brought under the prevailing adverse crop conditions. But it is conservative to say they would have averaged **one-third lower:** $2 base, instead of $3. How much hard cash does that mean to YOU?

CEILINGS, FRESH APPLES: Leadership in the work on apples for **processing** fell squarely on Appalachian. In **Ceilings** for fresh apples, the job was done by the National Industry; the Fresh Apple Industry Advisory Committee, National Apple Institute, International and the "Regionals". Appalachian had a large and active share in this: preliminary conferences by our leading growers to establish **our** needs and policies; many personal visitations with OPA chiefs and sub-chiefs; factual and other aid covering our section for Industry Advisory Committee and OPA; attending many sessions: interpretations of the ceiling for our growers via bulletins, phone and letters; and helping iron out bad spots in the ceiling with OPA. As a result of real teamwork by the whole Industry, a ceiling order was produced which was a large improvement over 1943's.

Some other major activities in Apples during 1944-45 season included:

1. Securing Harvest Labor: includes 3 major conferences at Washington which emphasized labor needs of **this** Belt.
2. Securing Cold Storage Space: worked successfully with Crow and Currant of WFA to clear our storages of war items.
3. Securing Equipment for Growers: priorities & approval secured for many growers, machinery, storage, equipment, etc.
4. Securing DDT: supplies seem assured for growers really needing it.
5. Securing Tin for Our Processors: aided Processors to secure needed additional tin; may total 315,000 dozen: saved that much fruit.
6. Lower "Points" on Apple Sauce: dropped from 50 to 30 points shortly after our conference with OPA.
7. Posters to Grocers: demand strong for our apple selling aids: 11,000 "sets" sent out, on request, so far **this** Fall, only.
8. Apple Recipe Service: monthly to 63 dailies; Michigan & Ohio State Apple Commission using ours and sharing cost.
9. Our Apple Movie: total audiences for 19 prints 262,808 July 1.
10. Workinf with Publcations: LIFE, NATIONAL GEOGRAPHIC, DAILIES, etc.
11. Advertising: modest schedules in Grocers Trade Papers, mostly.
12. Initiation of a National Advertising Program.
13. Bulletins to Growers: Information on market and ceilings: Labor: additional storage space; general information.
14. More Water for our orchards? A survey.
15. Helphing quash Vinson Directive 24, to change apple marketing system.
16. Wage-Hour "Area of Production" hearings.
17. Putting processors of this **& other** sections in touch with supplies of our apples.

18. Work to move out too-heavy, slow-selling stock of "below USONE" apples, by: (1) getting organized push on apples by the nation's retailers: (2) an apple advertising campaign in our own markets to support this; (3) working with WFA to secure School Lunch Purchase Program. (This was rejected.) Instead WFA and "all hands" are working hard to get the low grade fruit into the processing plants in large quantities by enlargement of canning-processing programs; (4) aiding processors to secure fruit, tin and glass for this; (5) seeking increased Armed Forces buying of apples from this area.

We believe you will agree that the above 20 jobs constitute a resultful work-schedule. There have been many, many smaller jobs "too numerous to mention".

Did The National Peach Council Pay Dividends? You will remember that in early 1943, OPA called a series of regional meetings of peach men. At each of these five meetings, OPA received a different set of wishes as to ceilings. The growers didn't agree, OPA did about as it pleased.

Obviously, the tactics were against the growers. National Peach Council determined that this should not happen again. We issued a call to the leaders of the peach industry to get together and "carry the ball' ourselves in 1944. We arranged a meeting with OPA in early February, and five of us spent 2 days with OPA at Washington;—studying what they had to offer; and acquainting them with our needs. It was fairly clear then that OPA's ideas for a peach ceiling were around $3, f.o.b.

The 5 of us, plus a couple of OPA men, carried this data to St. Louis in late February, where National Peach Council had arranged the first nation-wide gathering of peach men ever to assemble, so far as we know. We had 18 peach states; representing 77 percent of the U.S. Peach crop.

The St. Louis Conference adopted, after long discussion, a national peach program, for ceilings; for support programs; for some other problems.

In ceilings, we asked for a $4 top, fob. We asked that weighing and stamping be abolished; asked a couple of other improvements over the ceiling then in force for other fruits. The Peach Industry agreed upon these. Let me repeat that OPA's ideas were for about a $3 ceiling, at the time.

The Fresh Peach Industry Advisory Committee was formed a little later. The National Council was consulted freely in naming this Committee. Most of the Industry

Committee had taken part in the St. Louis meeting. The Industry Committee, and the National Council's officers, worked right straight down the line for the St. Louis program, with OPA, WFA and the Government bodies concerned.

You know the results: a $4 ceiling for the freeze-hit South; $3.66 per bushel, fob, for the other Eastern states; no weighing-and-stamping required; in fact, the simplest and best ceiling order yet written. Compare that $3.66 fob for peaches with $2.87 for apples; $2.15 per **bushel** for oranges; $1.57 for grapefruit. It is clear that the Industry Committee and leaders did an excellent job. Peaches are the most perishable of all major fruits. For many reasons familiar to all of you, they require a higher ceiling than the more stable fruits with longer marketing seasons. But those facts had to be developed to OPA.

That was the No. 1 job done by National Peach Council in 1944. The Council, was almost wholly responsible for the practical, reasonable, single program adopted by the Industry; the program which all hands got behind, and pushed; and obtained, practically speaking. Has the National Peach Council paid dividends? You figure it up.

ORGANIZING THE GROCERS. But we had some 75 million bushels of peaches coming on. It wasn't enough to have a good ceiling. Those 75 million bushels were a huge crop. There was plenty of potential trouble ahead in marketing them.

The national Peach Council called together, at Philadelphia, key men from the biggest grocery-store outfits in the East: American Stores, Safeway, A. & P., Krogers, Penna. State Grocers: such organizations as that. We fed them well; then told them, effectively, when the peaches were coming, where they were coming from; when to be ready for them in greatest volume; and the profits to **them** in handling a big volume of peaches for **home-canning.** It was a good meeting. We followed it up with letters and bulletins. We supplied them with natural-color peach posters. It all helped, considerably, in the very, very effective job which the retailers did last Summer with that big crop of peaches.

The National Council did a lot of other smaller jobs. Those two were the biggest. Did the Council pay dividends in 1944? Well, the work was done on a total income—to the National Council—of three thousand eight hundred dollars. That $3,800 is the sum of the state-members' fee payments: $100 for the small peach states (less than one

million bushels); and $300 for the larger peach states (over a million bushels production).

We couldn't have operated on anything like that $3,800, normally. We used peach posters left over from 1942. No salaries were taken by anybody for doing the peach work. Next season, we've got to have new posters, and some of these times we're going to have to pay salaries, of course.

But, for 1944, we got along on $3,800. We'll have something left over, as a nest egg for the next season, in fact. Dividing that $3,800 into the 75-million bushel peach crop which the revised USDA records say we had shows that the National Council cost **less than one-hundreth of a cent per bushel,** for the national crop; one hundred bushels for one cent!

APPALACHIAN PEACH COUNCIL'S WORK: I want to report briefly, too, on Appalachian Division of the National Peach Council. That is our 4-state group; the same area as with Appalachian Apple Service.

A big job, and a perpetual job, for Peaches is this:—the Public and the Retailers, must be told each year, **every** year, **when** peaches are coming; **where** they are coming from in most volume; what the varieties are best suited for, and such things. For peaches are "The Forgotten Fruit". Nine long months each year stretch between peach seasons. The housewife gets her first peaches in July; her last in late August, over the East generally. From September **to** July, nine months, the public and the retailers never hear of fresh peaches. In this day of a thousand foods and a million distractions, nine months is a long time. They forget about peaches. They have to be told about them again, each Summer. That is one of the basic things in marketing peaches, we have found; the ignorance of both Mrs. Consumer and Mr. Retailer as to the when, where-from and what-for of peaches.

To inform the retailers was the reason for the Philadelphia conference held by The Council, of which we spoke earlier. Informing the Public is a larger job. It can be partly done by the retailers; but we cannot—and should not—depend on them.

So . . . with last Summer's big crop coming on, we took $2,500 worth of newspaper space and radio time up and down this Appalachian marketing area to tell the public, first, that our "tree-fresh" peaches will be in the stores in a few days; and then, "They are here!"

$2,500 ADVERTISING IN OUR MARKETS. We took double-column space 4 inches deep, twice a week for two weeks, in twenty-one dailies, and 1-minute "spots" on twenty-five radio stations, in fifteen cities: starting with Roanoke, Va., Charleston and Bluefield, W. Va., about Aug. 1st; moving right up the belt as the bulk of the harvest went to market: Charlottesville, Richmond, Pittsburgh, Martinsburg, Reading and Allentown. The last ads went into the Reading and Allentown dailies and radio stations on August 28 and 30. We marched right up the Belt as the peaches came on in volume. We heard a lot from the program. Unquestionably, it helped. The housewives arranged with their grocers for canning peaches.

It cost us just about $2,500, with some accompanying emphasis in the grocers' trade magazines. It is paid for. Those peach growers of this 4-state belt who are carrying this Industry job paid in about $3,500. Nobody took any salaries—excepting Mrs. Lewis, Appalachian Apple Servise's home economist, who turned her attention and competent energies to peaches for two months and was paid $200 therefor. So we have a little nest-egg, a few hundred dollars. We can't do the job as cheaply another season. We are now out of posters; must have some more of these. We cannot expect much longer to get the job done without paying somebody some salary.

I spoke of "next year's work". Have you stopped to realize that this Summer we just narrowly missed a 90-million peach crop? We had 75 million bushels, says USDA. The freezes over The South took at least 10 million. The drouth over the East and Midwest cut a quarter-inch from packing size, and reduced the crop by almost another 10 million bushels. So . . . except for the rough but wise hand of Old Mother Nature, we would have had 90 million or 95 million bushels, instead of 75 million.

What does 90 million bushels mean? We can cut off 30 million bushels (that's the outside limit) for commercial canning. That leaves 60 million "fresh". Perhaps 20 million of that 60 are either Southern or Northern peaches; marketed before August 1st or after September 1st. That leaves about 40 million bushels of fresh, highly perishable peaches to be sold in the 27 week-days of August. That, my friends, means one million four hundred thousand bushels of fresh peaches to be sold every week-day during August!

We have never touched that. Last Summer, we averaged to market just a little better than one million bushels

per day during August; about 28 million bushels in 27 week-days.

Nature won't always step in and save us. Some of these seasons we're going to have 90 millions, or 95, bushels to market. The ten-year average peach crop has been 58 millions. The average for the coming ten years will be way above that; perhaps 70 million bushels. Are you going to have your markets ready when the peaches come Or are you going to sit still and hope; hope for a bad freeze somewhere else: hope for a Government hand-out; hope that the public, and the grocers, will buy them? The market-building machinery is ready. It needs only fuel—your half cent-per-bushel. You can have it or not. It's up to you.

MARKETING FRUIT THROUGH WHOLESALE CHANNELS

GUY L. HAYMAN, Northbrook, Pa.

Several months ago your Secretary asked me to participate in this discussion, speaking from my experience as a grower whose outlet for his fruit has been almost entirely thru wholesale channels, when the official program reached me I found the subject was to be "The Wholesale Outlet and its Requirements". Since I am not a marketing specialist I feel poorly qualified to do justice to that subject. But having used a variety of outlets during the past twenty-five years we have had a corresponding variety of experiences.

The sum of these experiences indicate that any wholesale outlet requires a product of such quality and in such condition that every medium thru which it passes to ultimate consumption can expect a profit in the handling, and in the end the consumer must be satisfied.

Since we grow and pack for the fresh fruit market, I shall limit myself to that angle.

The produce market is a highly sensitive one, so that a grade and pack acceptable or in demand one year—very likely will move slowly and at a much lower return the next year. So requirements are greatly modified on the basis of supply.

Generally speaking the market is only interested in varieties that are currently accepted as standard. The next consideration is quality, and a pack that suits its particular needs. Finally the market must be assured of a continuity

of supply. The buying side of the market looks to the broker and the commission man to maintain this supply.

Most No. 1 fruit finds its way into retail trade, with restaurants getting a fair portion. This store trade demands well colored, medium to large size apples, 2¾ in. and UP preferred, 2½ in. and UP accepted—and 2¼ in. to 2½ in. not wanted. Some dealers insist type of package makes little or no difference, provided the fruit contained therein meets specifications. But we find that boxes-having once been used and offered, are expected thereafter. When-for any reason we return to a basket pack—we expect to be penalized.

Some chain buyers are interested in having the grower put up a consumer size package. Our own experience in rendering this service was not entirely satisfactory. It is a time consuming and costly job, and the advantages are top heavy in favor of the buyer.

Sales to Army and Navy have proved very satisfactory. Supply officers accept a No. 1 pack—provided the inspector certifies it as No. 1. On the other hand, the store buyers expect a No. 1 pack to run mostly fancy in color. Some years ago—large fruit 3¼ in. to 3½ in. and larger apples brought substantial premium. Under present conditions, these move along same levels as medium size fruit.

The outlets for Utility grades are not very attractive, a limited amount can be sold thru retail outlets, but consumers as a rule fail to appreciate their value. Lack of color condemns them rather than minor allowable defects The bulk of sales of this grade are made to peelers, bakers supply houses or other processors. Most seasons, the prices realized from these sales barely cover cost of production and handling. Supply is the determining factor as to what this market requires—as to size and condition.

Culls of course have no place in the fresh fruit market. But they get there any way. The juice plants are a partial solution to this problem, but even they must draw the line at some of the stuff that is offered. So far we have failed to find a profitable wholesale outlet for culls.

The number of varieties desired on our normal markets is limited, and covers a seasonal range—our earliest variety is Duchess, which is just about tolerated. Gravenstein with size and same color are worth while, and Wealthy of fair size move during a limited season. During recent years there have been increasing calls for Summer Rambo. Mc-

Intosh is, of course, accepted as standard of its type and Jonathan is in good demand during its season. Delicious U.S. 1 grade or better, probably move more freely than any other variety on our market, but Utilities of this variety are unwanted. Stayman is the all purpose favorite for this area, and can usually be sold any time any where. Rome is in good demand after mid-winter, and Utilities of this variety probably excell all others in marketability. Paragon is acceptable as one of the standards. Other varieties appear and some do very well but most of them are accepted only at a discount.

Bulk shipments have been mentioned as a help to the container situation. We have no experience to draw from in this field, but it does not appeal to us, even as a emergency measure. Wholesale buyers, looking for No. 1 fruit, do not expect to find it in second hand, moldy, stained and broken packages, of miscellaneous types and condition. Such packages are discounted before they are opened. One of the newer types of package appearing on the market is a fibre board container known as the Friday box.

Before ordering our shooks for the season I asked the opinion of our broker in New York regarding this Friday box. He expressed only limited interest in the Friday and wrote as follows regarding boxes:—"The main argument in favor of western wooden boxes, especially for the varieties you have, is that you can go a lot of places with the western boxes that you cannot go with any kind of paper box. The fruit stand type of trade and even some of the chain stores, like the Friday box, provided the apples are very fancy. It does give the fruit protection. All of the same trade, however, will take a western box and pay just as much or more. In addition to that, you have steamship, export, Army and Navy, and other trade that can use **only** the wooden box. Those growers who had their apples wrapped in wooden boxes this year were able to move them at top ceiling as fast as they wanted to sell them.

Normally the trade prefers the western net bushel box with a strictly western pack. But they have now become used to getting eastern wrapped apples in 1 1-8 bushel box for a wrapped pack if you maintain the same sizes as in the **western** box.

We hear of many complaints of bad bruising in some types of bushel baskets, and it is reported that one chain buyer in Philadelphia will not touch baskets except of solid bottom, export type.

Utilities as a rule, are sold on basis of packages returned so a few old containers can be used up in this part of the deal.

In summing up my observations on this subject, it seems to me that wholesale outlets can dispose of anything in the shape of fruit, that may be sent to it. But what it really requires is good fruit arriving in good condition, sized and packed to meet the needs of the market and best serve the purpose for which it is purchased.

FRUIT PACKING ERRORS AS OBSERVED BY THE INSPECTION SERVICE

D. M. JAMES, Harrisburg, Pa., Federal State Inspector

Quality of apples sold during past 2 years not up to usual standards. Market analysts claim apple standardization program has been retarded many years. Number of factors contributed to this condition.

1. Heavy infestation of Codling moth has caused excessive worm damage in form of worm holes and stings. Better control measures essential. Must produce good quality in order to pack and sell a high quality product.

2. Price ceilings during past 2 years have not induced quality packs since no compensation for premium grades, larger sizes or better varieties. This has encouraged selling of off-grade packs since ceilings just as high as on best fruit.

3. Labor shortages have contributed in causing production and grading schedules to be curtailed or poorly done such as pruning, spraying, thinning, picking, grading and packing.

4. During past few years more Pennsylvania fruit has gone to commercial canneries than to fresh market. Although canners prefer best quality crops and pay premiums for top grades under inspection, there may be a tendency to curtail sound production programs. "The fruit is just going to the cannery." Growers are heard to say, "why bother to spray for scab when I get just as much for scabby apples?" Then on the other hand this remark is also being heard. "The cream of the crop now goes to the canneries and the by-products goes on the market"—which is somewhat contrary to the idea that canneries are intended merely to take care of off-grade material. Either way you look at it, the quality of the fresh market apples suffer.

Observations of the Inspection Service under many varying conditions lead us to make the following recommendations for the improvement of Pennsylvania apple packing. Having produced a good crop the grower must pick, pack it properly and also do a good job of marketing. The following items are important:

1. Picking.

a. Pickers should not ride bags against ladders, should not fill crates too full or carelessly from standing position. Good crops are ruined by careless pickers.

b. Fruit should be picked at proper maturity to secure maximum flavor, keeping quality, highest color and freedom from scald. Because of high color Red Romes often are picked too early because of advanced color. Stayman picking time short. If too green color and flavor sacrificed and hanging too long deadens finish and endangers heavy loss from drop. When any variety ready, pick at full speed—stopping packing operations if necessary.

2. Grading.

a. Many grading machines are improperly constructed for handling apples without bruising, especially the softer varieties such as Jonathan and McIntosh. The principal faults are poorly padded bins, steep bins, causing too rapid or too great a fall of the fruit, too much crowding of fruit at bottle-necks or in bins and chain damage from looseness of chain or poor construction.

b. Feeder ofter cuts or bruises apples by resting the crate on apples in hopper or on belt. Should feed regularly for even flow.

c. Grader should not be over crowded for correct sizing.

d. Speed of grader ofter too fast. Easier to grade on a full belt moving slowly than on a speedy belt half full.

e. Should have sufficient graders on picking table to insure an average of No. 1 fruit in bins.

f. Runners should check all fruit in bins before opening gate. Then should fill tub half full, pick out defects and shake. Recheck bin and fill. Sufficient oil paper should be distributed uniformly throughout basket. Half enough oil paper is money wasted and will not check storage scald.

g. Facers should make face tight and uniform in size, grade and color. Overfacing is no longer approved by the

trade and it never was approved by the public. Don't overface—the best packers don't do it.

3. Packing and storing.

a. Packed wrapped apples in western type bushel box gaining greatly in favor with the trade. Supermarkets, chain stores and large institutional buyers much prefer because count is uniform as marked, grade is better and easier to stow and to handle. Growers state that fewer apples used more than offset the added cost except in years of very cheap fruit.

b. Segregate lots in storage. Where storage lot numbering system is not on daily basis, use some system to divide lots so small out-of-grade lots do not ruin larger lots which are in grade. Date stamp each basket so that scald may be regregated.

c. Place fruit in a cold temperature as soon as possible after picking. Tests have shown that one day delay in removing orchard heat from fruit may cause one week earlier scald in storage.

d. Individual consumer packages for apples have been tried but have never clicked with the grower or with the public. The cotton mash sack holding approximately five lbs. is being used considerably but is not proving too satisfactory because it offers no protection against bruising—packing cost is high—quality of fruit used not good enough.

e. Pennsylvania quality label has not been used on Pennsylvania apples for a number of years. If Pennsylvania fruit growers are to regain the reputation for high quality apples which they once had, it might be advisable to revive this state approved quality labeling program or some other converted, state-wide action to sell the public on the merits of well picked Pennsylvania apples.

"CANNERS' REQUIREMENTS FOR QUALITY PACK"

M. E. KNOUSE, Peach Glen, Pa.

The quality of the processed product cannot be any better than the quality of the raw material used for processing. Also, there are some varieties which do not lend themselves for all processed products.

I would like to discuss the effect of variety on quality and the reasons for same. All fruits have a just-right degree of ripeness for top quality. If fruits are intended for fresh consumption, the degree of ripeness should be fully

matured and ripened. If intended for processing, the fruit should be slightly on the green side, as processing has a ripening effect and over-ripe fruit does not produce a quality product.

Poorly handled fruit does not effect the taste of the processed apple, but it does effect the appearance considerably and cannot be overlooked. Size, in most cases, does not effect taste—although in a few cases it may. Defects, bruises and size very definitely affect the cost of production and should be carefully studied by growers, because they definitely affect the prices they will get for their apples.

Variety of apples for processing is very important. Yorks are tops for all kinds of processed products and will hold from sixty to ninety days in common storage before getting too ripe. Golden Delicious apples are of equal quality but will not hold in common storage more than thirty days. Stayman, Grimes, Romes, Jonathan and Baldwin will hold only about fifteen days in common storage. Black Twig or Paragon will hold about sixty days, but are at the bottom of the list as far as quality is concerned. The best quality of processed apples is always produced when apples go directly from the orchard to the can.

The use of refrigeration must be emphasized in connection with the processing of apples. Yorks and Golden Delicious will hold in the cooler satisfactorily until April. Stayman and Romes can be held in storage satisfactorily until March, Grimes until November and Jonathan until December. Therefore, a successful processing operation should be tied in with storage facilities.

Last, but not of least importance, is the need for growers to have more orchard boxes in all large crop years. This becomes a very critical problem.

PRACTICES THAT RESULT IN THE SALE OF FRUIT THROUGH WHOLESALE AND RETAIL CHANNELS

F. G. REITER, Manager Treesdale Farm, Mars, Pa.

Fruit Growing is a long time business, one cannot jump in and jump out as in some other branches of agriculture. Therefore, practices leading to sale of fruit should be carried on year after year to build up prestige.

Leading all other factors in building up sales is the quality pack. Sticking to a quality pack was a little dis-

couraging during the depression years when one could not get cost of production for fruit. Again, it was a little discouraging last year when the crop was exceedingly short and the ceiling price covered any quality judging by some of the packages on the market labeled **U. S. No. 1.** However, these discouragements are soon overcome on a year when there is an abundance of fruit and the quality package is in demand while the so-called U. S. No. 1 package begs for a market. Probably our packing laws are not stringent enough. However, we believe the grower is the one affected by the quality of the package and he is the one who should be sure it meets the U. S. Standard requirements as labeled.

Factors leading to the quality pack begin with pruning during winter and spring. The trees must be opened up to let in light and facilitate spraying. A carefully planned spray program must be followed through. Fruit must be free of disease and insect injury to make a quality package.

Thinning is generally well worth while if help is available.

Picking should be done when the apples are at the correct degree of ripeness for the variety. That is learned by experience.

Grading and packing are quite an important part. Train your workers carefully and follow through personally or have a skilled helper follow through. Few workers seem to realize the care required to put out a quality package. However, with some training they seem to appreciate and enjoy packing the better package. The container is important. Whether basket or box it should be neat, clean and attractive.

For repeat sales, know your pack and describe it well but don't over-rate it. During these times of labor shortage much of the crop can be sold by phone if your buyer knows your pack will be just as you describe it.

A quality pack brings quality buyers either wholesale or retail and those are the customers we want.

COOPERATIVE FRUIT PACKING AND THE IMPROVEMENT OF QUALITY.

JOHN PETERS, Gardners, Pa.

Fruit growing has long been recognized as an important branch of agriculture. The Bible makes frequent reference to fruits and their growers. Our earliest settlers frequently referred to fruits they found in this new land and to those fruits which they brought along with them from the Old World.

Just as business and other forms of agriculture have become specialized, so fruit growing itself has become highly specialized. We here in Pennsylvania generally grow apples and peaches and some cherries to the exclusion of pears and plums. The grape growers have become specialists as have the small fruits growers.

In some sections of the country the various operations on an orchard have become so specialized that growers may have performed for them contract cultivating, contract spraying and even contract harvesting.

The co-operative theory of a mutual self-help organization, one operating on a non-profit basis, naturally appeals to farmers generally. The farmer, that famed individualist, has always banded up with his neighbors, whether it was to fight Indians or thresh his grain. So it is natural for the specialist—the fruit grower— the individualist who could still join his common interest for common good, to unite to perform that part of his work which he could not well do by himself. The large fruit grower, the man with sufficiently large production each part of his production schedule economically and efficiently, may be able to pack his fruit successfully. However, where we have the centralized fruit producing areas with attendant competition for labor; and where the production of fruits exceeds the possible local demand and where the average size of the individual orchard holdings tend to be small or moderate in size, there we believe co-operative packing associations to be helpful to fruit growers.

The fruit grower, as you well know, is a heavy user of surplus labor during the harvest season. In a concentrated area, labor at harvest really becomes a problem. Roughly speaking, it takes just about as much labor to pack a crop as it does to pick it and get it in out of the weather. An efficient packing operation really becomes a major problem to the grower who has barely enough help to pick his crop. Labor much prefers to work steadily throughout the season

at one packinghouse to packing or picking or odd jobs or work in several orchards and packinghouses. We find it much easier to maintain a steadily employed packing crew in a co-operative packinghouse than to maintain a similar crew where the work varies as to type and location.

In the case of any but the largest growers, the problem of maintaining up-to-date, efficient packing equipment is an expensive problem. Where the grower really counts all of his costs, he is astonished at the total expense per bushel which it costs him to pack. Where the grower can sell all of his fruit at his door at his own price—well, that is my idea of a grower's Paradise. However, practically speaking, mostly a grower has to get himself a buyer and then get the harvested fruit ready to sell. For that man, the man whose neighbors are also his competitors, that man is wise to unite with those neighbors insofar as packinghouse operation, overhead and equipment are concerned. The co-operative packing association provides the advantages of the largest grower for any grower and solves his problem of packing help and facility maintenance.

The grower expects to sell all of his fruit. He used to put it all into the same barrel, even if it took a stove pipe to help some of the little ones in. Nowadays, we still sell them all but we don't put them all in the same barrel. We observe so many, many times that while the grower does not sell them all in the same package today, one buyer gets all the packages. One of the greatest advantages to the grower in a co-operative packing association is the fact that the sizes and grades as well as the varieties can be separated and fed to the proper markets, and in pool packs they can be held in volumes sufficient to attract the best buyer of those sizes, grades and varieties.

The demands of the market vary from year to year. The grower who has a few packages of this or that size or grade just doesn't have them and the fruit sell at the price of the lowest grade or size. If he does have them properly separated, they are not in sufficient volume to get the proper market. The volume of fruit handled through a co-operative packing association justifies and develops the experience necessary to separate and direct the different sizes and grades into the most desirable packages for the most desirable markets.

The question of quality. There is such a thing as production quality, another thing of recognizing quality and still another of maintaining quality. No packing operation, co-operative or otherwise, can produce one bit of quality in

fruit. The grower alone is responsible for size, color, maturity, finish and condition in fruit up to its delivery to the packinghouse platform. There can be no quality in any package which was not with the fruit as it was delivered to the packinghouse. A great many growers have the mistaken idea that ordinary fruit can be dressed up and become a quality product if the package is shiny. Many growers think a big, red apple is fine. Pride of ownership also colors the vision of quality for many growers. Then again, the grower may not realize that he really does have fine quality in his fruit. The packing facilities and large volume operation which go with co-operative associations include fair and impartial judgment of quality. This judgment may protect one part of these men from themselves and the other part can be helped to get the true value of their fruit.

The owners of young orchards, those orchards which can't help producing high quality in the first few crops, are usually relatively fortunate in handling their crops. However, these orchards all become old. In fact, a majority of all of our bearing orchards are those orchards twenty years old and older. The owners of these latter orchards have a great many problems, including, among others, the maintenance of quality production. These crops, where quality and grade are varied, need the most impartial judgment in preparation for market. It is almost impossible for the individual grower to give such crops enough of his time to accomplish this in his packing operation. If the grower has done everything possible, including the packing of a high quality crop of fruit, to meet present day necessities, it is almost imperative to have this fruit so packed that it meets Federal-State grade requirements. In any but large individual packinghouses, this is impractical although it is the accepted practice in almost every co-operative set-up.

The advantages of co-operative packing proceed from here directly into the handling and marketing of fruit since it appears in practically every case that marketing is even more of a problem than packing and that once the grower has delivered his fruit from his farm, he is most anxious to have it sold for him. We might point out that every good reason for and advantage in packing fruit co-operatively continues and expands in the marketing of the same fruit. We have properly kept from touching on any of the aspects of marketing, however, in order that we may give Mr. Hershey a greater field.

EXPERIMENTS WITH DDT FOR CODLING MOTH CONTROL AT THE VINCENNES, IND., LABORATORY [1]

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The Bureau of Entomology and Plant Quarantine conducts research on the codling moth at five laboratories in the United States. The Vincennes, Ind., laboratory is concerned with the development and improvement of control measures that are applicable in the fruit sections of the Mississippi Valley. The results obtained at Vincennes are not necessarily applicable to other regions, because climatic conditions, cultural practices, varieties, apple diseases, and other factors exert extremely important influences on the effectiveness of a control program. A program that is successful in one locality often requires modification before it can be safely used in another; further modifications are often necessary as growers adapt the program to their own situations.

Our work with insecticides includes tests of several types. In the first tests the apples are sprayed and infested in the laboratory. These tests are followed by laboratory-field tests, in which apples are removed from orchard plots that have been sprayed and taken to the laboratory, where newly hatched worms, or larvae, are applied. From tests of this type we obtain the figure referred to in this discussion as larvicidal efficiency. This figure usually underestimates the effectiveness of a treatment under practical field conditions, since it does not fully measure all effects that occur in the orchard. Along with the laboratory-field tests are conducted the usual small-plot field tests. Such tests are not entirely reliable because of interplot migration of moths, parasities, and predators, and as a rule they place the better treatments at a disadvantage. The results of small-plot tests do not indicate the full effectiveness that might have been obtained if the treatments had been used on extensive acreage. A final type of test, which is essential before a new treatment or program can be evaluated finally, is a large-scale comparison of insecticides under practical orchard conditions, arranged in cooperation with an interested grower. Circumstances at Vincennes have permitted us to make several of these practical tests, and a great deal of valuable information has been obtained.

[1] Informal discussion given by L. F. Steiner before the joint convention of the American Pomological Society and the Virginia State Horticultural Society at Roanoke, Va., Dec. 7, 1944, and repeated at annual meetings of the State Horticultural Societies of Illinois, Indiana, Kentucky, Missouri, and Tennessee.

During the past year much of the attention of the Vincennes Laboratory has been devoted to the new insecticide DDT (2,2-bis(p-chlorophenyl)- 1,1,1-trichloroethane) following very favorable indications in 1943. A discussion of the work to date may be of interest.

The codling moth situation in the Middle West was extremely serious in 1944. The infestations ranged up to 100 percent of the crop despite full spray program, and there was an average infestation in the third-brood area of more than 50 percent despite the use of 2 or 3 more sprays than usual, or 8 to 14 cover sprays altogether. In one orchard plot the standard lead arsenate program gave 56 percent of wormy apples in 1944 as compared with 21 percent in 1943 with fewer applications. In another plot the standard nicotine bentonite treatment gave 22 percent of wormy apples in 1944 and 9 percent in 1943. Twenty bait traps caught 18,800 moths in 1944, compared with 9,000 in 1943. This extreme abundance of the codling moth was the result of two consecutive, extremely favorable, dry seasons, and an unusually heavy carryover of worms from 1943. Contributing factors were a light crop of apples in 1944, a reduction in sanitary measures and banding because of labor shortages, and in many instances the employment of inexperienced spray men.

Processing of DDT for Use in Codling Moth Sprays

DDT does not wet readily with water, and to obtain a satisfactory spray mixture it is necessary to use some accessory material or to process it in some way. Most of the tests at Vincennes were made with DDT that had been ground in a ball mill, either with water or with talclike material known as pyrophyllite. Some of the dry mixtures are difficult to wet, but tests have indicated that wetting agents, even at the minimum useful quantities, reduce the resistance of the deposits to weathering. [2]

Small percentages of DDT can be dissolved in certain solvents, such as kerosene, summer-spray oils, and soybean oil; the material is soluble in larger proportions in benzene, xylene, and ethylene dichloride. Aqueous emulsions of DDT solutions in such solvents may prove useful, but thus far our test results have been unfavorable. Such mixtures also may be more injurious to spray than water suspensions of DDT.

The different batches of DDT received at Vincennes have varied considerably in particle size and in the size and

[2] Steiner, L. F., Summerland, S. A., Arnold, C. H. and Fahey, J. E. Tests of DDT mixtures against codling moth larvae. U. S. Bur. Ent. and Plant Quar. E-628, 17 pp. 1944.

hardness of the tiny lumps or agglomerates formed from the particles. As a consequence the preparation of the material for spraying was complicated and the results varied considerably. Much remains to be done before the formulation most suitable for codling moth sprays can be definitely established. The DDT that is now being produced primarily for the armed services may be quite different from that which will be found best suited for use on fruit trees. There is every reason to believe, however, that with further experimentation a satisfactory product will be obtained.

Results of Tests With DDT in 1943 [3]

In laboratory-field tests on Grimes Golden and Winesap apple trees in 1943, technical DDT (DDT concentrate) at strengths as low as 1 pound per 100 gallons gave outstanding results. It was possible to span the second-brood and part of the third-brood period with only three sprays of DDT, at a strength of 1½ pounds per 100 gallons in one spray and of 1 pound in the other two, and still maintain an average larvicidal efficiency well above 90 percent.

DDT was used successfully when mixed with mineral oil, bentonite, or bordeaux mixture, but the resultant efficiencies were no higher than when DDT was used alone. It was also highly effective when applied over deposits of either lead arsenate or nicotine bentonite. DDT permitted large increases in the population of the European red mite, apparently by repelling or poisoning the small lady beetle **Stethorus punctum** (Lec.) Mite injury caused considerable defoliation on all Grimes Golden trees sprayed with two to five applications of DDT. Trees of the Winesap variety were not defoliated.

In field tests on heavily infested Winesap trees (15 worms and 34 stings per 100 apples on July 22) previously sprayed with lead arsenate, 3 applications of a 1.1 DDT-pyrophyllite mixture at 3 pounds of the mixture per 100 gallons, without supplements, stopped a heavy worm attack for the remainder of the season. The infestation at harvest on October 2 was only 12 worms and 56 stings per 100 apples with drops included, whereas on plots sprayed only with lead arsenate the number of worm entrances increased to 85 and the stings to 104 per 100 apples. Where the DDT-pyrophyllite mixture was used at only 1½ pounds per 100 gallons, the fruit averaged 31 worms and 51 stings per 100 apples.

[3] Steiner, L. F., Arnold, C. H., and Summerland, S. A. Laboratory and field tests of DDT for control of the codling moth. (Scientific Note.) Jour. Econ. Ent. 37: 156-157. 1944.

Larvicidal Efficeincy Tests on Grimes Golden in 1944

In 1944 laboratory-field tests were conducted on Grimes Golden to compare the larvicidal efficiency of DDT treatments with the standard lead arsenate-bordeaux and nicotine bentonite programs. The trees were given a uniform salyx spray of lead arsenate, lime and wettable sulfur, followed by eight cover sprays of the material tested. In the lead arsenate program the trees also received an application 7 days after the calyx spray. On an average 30 gallons of spray mixture per tree were required for each application. Two plots were dusted with 2½ to 3 pounds of 5 percent DDT per tree, on the same schedule as the sprayed plots. The eight applications were made between May 19 and August 14, during which time the rainfall totaled 5 inches (about 40 percent of normal). Between August 14 and harvest (September 1) the rainfall totaled 5.67 inches, or nearly three times the normal rainfall for this period.

Samples of 60 apples each were taken from the trees before and after each spray, beginning with the second

cover, as well as at harvest. Each sample was exposed to the attack of 600 newly hatched larvae.

The results of representative tests are shown in table 1.

Table 1—Average larvicidal efficiency of lead arsenate, nicotine bentonite, and DDT treatments applied to Grimes Golden apple trees. 1944.

Plot	Cover	Treatment [1] (Quality per 100 gal.)	0-2 day after application	7-18 days after applications	At harvest
			Percent	Percent	Percent
Sprayed		Lead arsenate:			
A	1	4 lb. + bordeaux	64	52	50
	2-4	4 lb. + bordeaux + mineral oil 2 qt.			
	5-8	3 lb. + bordeaux			
		Nicotine sulfate (40 percent nicotine):			
B	1	1 pt. + Miss. bentonite 8 lb + soybean oil 1 pt.	94	82	73
	2	1 pt. + Miss. bentonite 8 lb. + soybean oil 1 qt.			
	3-4	1 pt. + Miss. bentonite 8 lb. + mineral oil 2 qt.			
	5-7	2/3 pt. + Miss. bentonite 5 lb. + mineral oil 2 qt.			
	8	2/3 pt. + Miss. bentonite 5lb. + soybean oil 1 qt.			
		DDT (technical):			
C	1-5	1 lb. + pyrophyllite 9 lb.	97	85	60
	6-8	3/4 lb. +pyrophyllite 6 3/4 lb.			
D	1-2	1 lb. + pyrophyllite 1 lb.	97	82	59
	3-5	Water paste, 1 lb.			
	6-8	Water paste, 3/4 lb.			
E	1-5	1 lb. + pyrophyllite 1 lb.	97	81	46
	6-8	3/4 lb. + pyrophyllite 3/4 lb.			
F		Same as E + mineral oil 1 qt. + Wyo. bentonite 1/4 lb.	99	90	94
G		Same as E + bordeaux	99	89	85
Dusted					
H	1-4	5 percent in talc, pyrophyllite and oil (5 percent)	81	41	32
	6-8	5 percent in talc and pyrothyllite			
I	1-8	5 percent in walnut-shell flour	87	48	30

[1] The bordeaux mixture used in plot A was ½:1.100 and that used in plot G was 1:2:100.

On all plots the DDT appeared superior to lead arsenate and nicotine bentonite up to 2 days after application. After longer periods of weathering and at harvest most of the DDT spray treatments were superior to lead arsenate, but only the DDT-pyrophyllite-oil-bentonite (F) and DDT-pyrophyllite-bordeaux mixture (G) were superior to nicotine bentonite. Both formulas gave outstanding results and were highly resistant to the heavy rains late in August. The dusts rapidly lost their effectiveness between applications.

As usual after each of the early sprays, all formulas sustained substantial losses in efficiency. The rate of loss, however, became less as the season advanced, partly because of a declining rate of fruit growth, better distribution of deposits, and the build-up of heavier deposits from additional applications. Since fruit growth thins deposits so rapidly early in the season, it has been found more economical, and also safer for the fruit and foliage, to apply sprays at shorter intervals than to apply fewer sprays of double or triple strength. It has been possible to reach and maintain higher efficiencies early in the season with DDT than with any other insecticide tested in this manner in the past 10 years. During this time some 4 million newly hatched larvae have been used in laboratory-field tests of hundreds of promising formulas. The deposits of the DDT-pyrophllite-oil-bentonite treatment, the most effective of the different programs tested in this series, were nearly twice as heavy as those of any other DDT treatment.

DDT was more toxic to beneficial insects in dust form than in spray form. Both forms, however, knocked down lady beetles, chrysopids (larvae feed on codling moth eggs), syrphid flies (larvae feed on aphids), and an important anthocorid mite predator. The more effective treatments also appeared toxic to the small lady beetle, an important predator of mites, which is very abundant and active from July until after harvest.

On most of the DDT plots the European red mite increased at a rapid rate during June. Table 2 shows the average population of mites and unhatched mite eggs per leaf on certain treated plots at different times during the season.

Table 2. Average population of mites and unhatched mite eggs per leaf on plots treated with lead arsenate, nicotine bentonite, and DDT at different times during the 1944 season.

Treatment	Plot	July 4	July 28	July 31	Aug. 18
Sprays:					
Lead arsenate	A	18	—	—	11
Nicotine bentonite	B	35	—	—	11
DDT-pyrophyllite	E	65	357	161	—
DDT-prophyllite+oil+bentonite	F	10	90	52	47
Dust:					
DDT, 5 percent, in talc and prophyllite	H	238	104	50	—
Check	X	55	68	121	3

Bronzing of the foliage, characteristic of severe mite injury, appeared on the dusted plots late in June, on the E

plot in mid-July, and on the untreated plot late in July, but on the F plot, the treatment of which included oil, no bronzing was evident. Only a small number of mites reached the adult stage in the F plot.

Defoliation began in August in dusted plots, where the mite infestation reached its peak earlier than in sprayed plots. All the sprayed plots except A, B, and F were completely defoliated by late October. Plot F retained more foliage on December 1 than any of the others. The amount and time of defoliation were directly associated with mite infestation, and bore no relation to the amount of DDT residue on fruit and foliage.

Neither the European red mite nor the common red spider, though generally present in most southern Indiana orchards, normally cause any noticeable damage to apple foliage where standard lead arsenate or nicotine bentonite progrms are followed. If DDT is to be used, however, adjustments in the spray schedule that will assure control of these pests will become necessary.

Small-Plot Field Tests in 1944

Field tests were conducted on 30 single-tree replicated plots on the Turley, Ben Davis, and Rome Beauty varieties. The trees were approximately 25 years old, of average size, and well pruned. Each tree required from 25 to 35 gallons of spray material per application.

The average yield on the Turley variety approximated 2,000 apples per tree, and on the Ben Davis and Rome Beauty 1,900. Ten cover sprays were applied between May 16 and September 1. The plots treated with lead arsenate were also sprayed with 4 pounds per 100 gallons between the calyx and first regular cover sprays. Sprays were applied from tower and ground and from the inside as well as the outside of the tree.

Infestation data for the DDT, standard lead arsenate, and standard nicotine bentonite treatments are summarized in table 3. All drops and picks are represented.

Table 3. Codling moth infestation data from lead arsenate, nicotine bentonite, and DDT spray treatments applied to Turley , Ben Davis, and Rome Beauty varieties. 1944.

Variety and plot	Cover sprays	Treatment (Quantities per 100 gals.)	Clean apples	Wormy apples	Worms and stings per 100 apples
			Percent	Percent	Number
Turley					
1	1	Lead arsenate 4lb.+bordeaux [1] + soybean flour 4 oz.	24	56	208
	2-4	Lead arsenate 4 lb.+bordeaux + mineral oil 2 qt.			
	5-10	Lead arsenate 3 lb. + bordeaux			
2	1-5,9-10	DDT-pyrophyllite [2] 2lb.	72	11	40
	6-7	DDT-pyrophyllite 1-1/3 lb. + bordeaux+mineral oil 2 qt.			
	8	DDT-pyrophyllite 1-1/3 lb. + bordeaux			
3	1	Nicotine sulfate [3] 1 pt.+Miss. bentonite 8 lb.+mineral oil 2 qt.	67	22	40
	2-5,9-10	Nicotine sulfate 1 pt. + Miss. bentonite 8 lb.+mineral oil 2 qt.			
	6-8	Nicotine sulfate 2/3 pt.+Miss. bentonite 5 lb.+mineral oil 2 qt.			
4	1-2	Same as Turley 3	83	9	20
	3-10	Nicotine sulfate ½ pt.+Miss. bentonite 4 lb.+mineral oil 2 qt. +DDT-pyrophyllite ½ lb.			
Ben Davis					
1	1-10	Same as Turley 1	10	73	359
2	1-10	Same as Turley 2	70	9	41
7	1-10	Same as Turley 3 except soybean oil 1 qt. substitute for mineral oil	56	30	63
Rome Beauty					
1	1-10	Same as Turley 1	12	76	301
3	1-2	Same as Turley 1+DDT-pyrophyllite ½ lb.	50	34	82
	3-4	Lead arsenate 2 lb.+bordeaux +mineral oil 2 qt. + DDT-pyrophyllite ½ lb.			
	5-10	Lead arsenate 2 lb.+bordeaux +DDT-pyrophyllite ½ lb.			
6	1	Nicotine sulfate 1 pt.+Miss. bentonite 8 lb.+mineral oil 1 pt.	60	33	52
	2-5,9-10	Nicotine sulfate 1 pt. + Miss. bentonite 8 lb.+mineral oil 2 qt.			
	6-8	Nicotine sulfate 2/3 pt.+Miss. bentonite 5 lb.+mineral oil 2 qt.			
11	1-5,9-10	DDT-pyrophyllite 1 ½ lb.			
	6	DDT-pyrophylitte 1 lb.+Wyo. bentonite 4 oz.+mineral oil 2 qt.			
	7	DDT-pyrophyllite 1 lb.+Wyo. bentonite 4 oz.+mineral oil 3 qt.			
	8	DDT-pyrophyllite 1 lb.			
12	1-5,9-10	DDT-pyrophyllite 2 lb.	67	18	45
	6-8	DDT-pyrophyllite 1 1/3 lb.			
13	1-5,9-10	DDT-pyrophyllite 3 lb.	90	2	12
	6	DDT-pyrophyllite 2 lb.+Wyo. bentonite 4 oz.+mineral oil 2 qt.			
	7	DDT-pyrophyllite 2lb.+Wyo. bentonite 4 oz.+mineral oil 3 qt.			
	8	DDT-pyrophyllite 2 lb.			
14	1-5,9-10	DDT (water paste) 1 lb.	46	33	85
	6-8	DDT (water paste) 2/3 lb.			

1 Bordeaux ½:1:100 used in all sprays.
2 1:1 DDT-pyrophyllite mixture used in all sprays.
3 40 percent nicotine.

It is evident from the data in table 3 that it is impossible to secure adequate control of a heavy infestation with the standard lead arsenate or nicotine bentonite programs alone under the weather conditions of 1944 which were highly favorable to the codling moth. If satisfactory control is to be obtained with these programs, supplementary measures, such as scraping and banding, are essential.

The lead arsenate program used on the No. 1 plots of all varieties was the standard recommendation for heavy infestations in Indiana and Illinois. The tank-mix nicotine bentonite programs (Turley plot 3, Ben Davis plot 7, and Rome Beauty plot 6) are the most effective that have been developed at Vincennes for use in the Middle West. On plots given this treatment in 1944 better results would have been obtained if the concentration had not been reduced in cover sprays 6 to 8. It should be understood, however, that the primary purpose of these tests was to establish the relative effectiveness of the different treatments. This can best be done under a heavy infestation where the better treatments will not all give nearly perfect control.

Of the three treatments the DDT-pyrophyllite mixture at 2 pounds (1 pound of DDT) per 100 gallons was the most effective in reducing the percentage of wormy fruit, and the nicotine bentonite was considerably more effective than lead arsenate. Nicotine bentonite was generally more effective than DDT in the control of stings.

Highly effective and satisfactory results were obtained with a spray utilizing 4 ounces of DDT per 100 gallons with half strength of either lead arsenate (Rome Beauty plot 3) or nicotine bentonite (Turley plot 4). At this strength DDT may not cause an excessive build-up of mite infestations. The substitution of DDT for nearly half of the nicotine bentonite offers a means of extending the supply of nicotine, which is in considerable demand at the present time.

Nearly perfect control of a heavy infestation was obtained by using DDT at 1 ½ pounds per 100 gallons in the Rome Beauty plot 13. The total number of worm entrances per tree during the season averaged 49 on this plot as compared with 2,943 on the standard lead arsenate plot.

The addition of oil and bentonite to the sixth and seventh cover sprays applied to Rome Beauty plot 11 increased the effectiveness of the 3/4 pound strength of DDT so that it equaled that of the 1-pound (plot 12) for the remainder of the season. The oil likewise improved the effectiveness of the 1 ½ pound strength (plot 13). The mineral oil was added to the formula used on two of the DDT plots of Rome Beauty in an effort to check the European red mite infestation, which began to cause noticeable injury on some trees in July. At the strengths used the reduction in the mite population was negligible. Before the application of the sixth cover spray (July 7), the average numbers of mites and unhatched eggs per leaf were 2, 8, 2, 66, 92, and 24 on plots 1, 3, 6, 11, 12, and 13, respectively.

The plots showed no bronzing of foliage with the exception of Rome Beauty plots 11, 12, 13, and 14; plot 13 on Rome Beauty was injured the least at harvest, which began late in September. This development, and the fact that the Grimes Golden plot (F, table 1) also had the lowest mite infestation, suggests that it may be possible to control mites with higher concentrations of DDT.

During the first-brood period control of worm entrances with lead arsenate was almost equal to that of the best nicotine bentonite formulas, but both insecticides were less effective than DDT. After the change to hot dry weather, however, larvicidal-efficiency tests showed that lead arsenate deposits were becoming less toxic, as has frequently been noted in similar tests during previous dry seasons. On Rome Beauty the larvicidal efficiency of the standard lead arsenate treatment declined from 66 percent after the third cover spray (June 2) to 57 percent after the fourth and 51 percent after the fifth (June 28), although the deposits of arsenic trioxide were approximately the same after each spray. Periodic counts made to determine the actual infestation developing in the plots indicated that the number of injuries on all lead arsenate plots increased more than five fold between June 20 and July 17, but only doubled on the nicotine bentonite and DDT plots.

During the early part of the season arsenical residues on Rome Beauty plot 1 were twice those of DDT on plot 13, but from July 20 to September 17 the DDT was much more resistant to weathering and accumulated heavier residues. Both DDT and nicotine bentonite treatments gave excellent codling moth control from the middle of August throughout September. On plot 13 the larvicidal efficiency was 98.8 percent on September 17, 18 days after the final spray. The results indicate that DDT residues on Rome Beauty are much more resistant to weathering late in the season than they are on Grimes Golden, apparently because of the greater amount of wax formed by Rome Beauty apples. Analyses have shown that considerable DDT becomes embedded or dissolved in this wax.

The injury from the use of lead arsenate was severe on Ben Davis and moderate on Rome Beauty. The bronzing of foliage on Rome Beauty plots 11, 12, 13, and 14 sprayed with DDT appeared to be responsible for poor coloration of the fruit.

Large-Scale Tests Comparing DDT Nicotine Bentonite

With the cooperation of the W. C. Reed and Son Orchard Company it became possible to set up a large-scale test of DDT. The areas selected for the experiments were located in one of the most heavily infested sections of a 265-acre orchard. In 1943, under a lead arsenate program of 10 cover sprays, Winesaps at one end of the orchard block were only 31 percent clean and averaged nearly 1 worm per apple.

The grower's regular orchard crew applied the sprays from a stationary plant. The 8-acre (12 by 18 trees) DDT area contained several varieties, and was surrounded on three sides by similar varieties sprayed with the standard tank-mix nicotine bentonite (Mississippi) oil program, the same as applied to the remainder of this orchard. In small-scale tests such as those summarized in table 3, nicotine is at a disadvantage when compared with lead arsenate because of moth movement between plots. However, the nicotine bentonite proved to be two to three times as effective as the standard lead arsenate. It should be added that the ability of the worms in this orchard to enter fruit sprayed with lead arsenate is greater than that of the population in an average orchard.

The 1:1 DDT-prophyllite mixture was applied in 10 cover sprays between May 16 and August 29, the first 5 with the DDT at 1 pound per 100 gallons of the last 5 at 3/4 pound. Mineral oil (0.75 percent) and bordeaux (3/4:1/2:-100) supplemented the DDT used in the sixth cover spray on Golden Delicious, Jonathan, and some of the Rome Beauty trees. Eleven cover sprays were applied to the nicotine bentonite area between May 17 and August 23.

The four men comprising the spray crew differed considerably in the thoroughness of their spraying and in the amount of material applied. For example, in the DDT area the Jonathan trees sprayed by one man averaged 24 percent of wormy apples, whereas others nearby, sprayed by another man, averaged only 8 percent. The amount of spray material used in both DDT and nicotine bentonite areas averaged about 20 percent less than in the small-plot tests on trees of comparable size. This lighter spraying, along with the light crop on Starking and Golden Delicious, the

tendency of most of the varieties in 1944 to set fruit in clusters, and the heavy carry-over of hibernating worms resulted in a heavy infestation.

The average yield of apples per tree approximated 1,200 for Starking, 1,400 for Golden Delicious, 3,100 for Jonathan, 4,200 for Rome Beauty, and 7,300 for Grimes Golden.

The infestation data, representing picks and drops from a total of 70 trees, are summarized in table 4.

Table 4. Varietal differences in infestation following a large-scale commercial test of DDT and tank-mix nicotine bentonite. 1944.

Variety	Date of final picking	DDT Worms per 100 apples on Jne 20 Number	DDT Season totals Clean apples Percent	DDT Season totals Wormy apples Percent	Nicotine Bentonite Worms per 100 apples on-Jne 20 Number	Nicotine Bentonite Season totals Clean apples Percent	Nicotine Bentonite Season totals Wormy apples Percent
Starking	Sept. 9	3	64	24	10	28	67
Grimes Gold'n	Sept.14	2	61	19	4	61	31
Golden Delic.	Sept. 16	—	61	16	—	61	31
Jonathan	Sept. 16	2	72	16	5	40	48
Rome Beauty	Oct. 19	3	76	12	9	37	58
Average		2.5	67	17	7	45	47

The least difference between treatments in the percentage of wormy fruit was on the Grimes Golden, probably because, as shown in the laboratory-field tests, DDT did not satisfactorily resist weathering on this variety, whereas nicotine bentonite generally resists weathering as well on one variety as on another. The greatest difference was on Rome Beauty, a variety on which DDT performed extremely well late in the season in the small-plot tests, probably because of the heavy wax in which it became embedded. It is difficult to protect the Starking variety with nicotine bentonite, partly because of its open calyx. DDT and nicotine bentonite deposits on the foliage, where most eggs are laid, are much more toxic to larvae than are those of lead arsenate, but nicotine deposits on fruit permit more movement of larvae than does DDT, hence, fruit sprayed with nicotine has a higher proportion of calyx entrances than fruit sprayed with either DDT or lead arsenate.

Although from one-third to one-half as much fruit was wormy in the DDT area as in the nicotine area, more of it was stung. The stings on fruit sprayed with DDT are very small, however, and in most cases would be overlooked. Apparently the larvae die just after they cut through the skin and before they can do any further damage to the fruit such as often occurs where lead arsenate is used.

The first-brood infestation, indicated by the number of worms per 100 apples on June 20, was unusually severe. Comparisons of the first-brood and all-season infestations

for the past 10 years in southern Indiana show that when the first-brood worm entrances average as much as 1 per 100 apples a full second- and third-brood spray program will be needed if the weather is normal. It will be seen in table 4 that roughly 7 percent of the entire crop became wormy for each successful first-brood worm entrance per 100 apples, despite the application of 5 or 6 cover sprays after June 21. Most of the first-brood worms were found in the tops of large trees or on the inside of the clusters, where there was little or no spray material.

On an average 227 spring-brood moths per trap (52 uniformly spaced at 1 per 13 trees) were taken in each area, an indication that the population was uniformly heavy at the beginning of the experiments. The nicotine sprays caused an immediate decline in moth abundance, whereas the DDT sprays showed no effect until 2 or 3 days after they were applied. Previous work had indicated that DDT is slow in its action against codling moth adults when used under orchard conditions. During the second half of the season, traps in the DDT area averaged 313 moths each and those in the nicotine area 540 moths. The total number of moths trapped was 36,500.

Although the European red mite became noticeably abundant on some trees in the DDT area early in July, and the common red spider appeared later that month, the small lady beetle moved in and partially checked the mites. Apparently the DDT deposits were light enough to permit the survival of mite predators and thus avoid a serious outbreak. The mite population was sufficiently heavy, however, to be a constant menace. It averaged 19 mites and 102 eggs per leaf on Golden Delicious in one part of the block on July 20. After 0.75 percent of summer oil was added to the DDT spray and the spray was applied to the same area, 18 mites and 77 eggs were found on July 25. Some bronzing occurred on Golden Delicious, scattered Starking, and most Rome Beauty trees, but very little on Grimes Golden or Jonathan. The same delayed maturity of the Rome Beauty apples was noted here as in the small-plot tests. Mites were very scarce in the nicotine area.

Effect of DDT On Other Apple Pests

All DDT treatments resulted in almost complete destruction of apple leafhoppers, whereas the insects were abundant on trees sprayed with lead arsenate. The same was true of the woolly apple aphid. It has been reported, however, that in the Northwest the use of DDT was followed by a great increase in abundance of these aphids.

In the spring of 1944 the other three species of aphids common on apple were absent on the plots in which DDT

had been most effective against the codling moth in 1943, whereas the percentage of aphid-infested buds on adjacent plots sprayed with other materials was as high as 91 percent. It was first thought that DDT residues on leaves and twigs were sufficiently great to kill the fall migrants on their return to the apple trees, or to kill their young before they could deposit their eggs [4], but it now appears that the early defoliation caused by the heavy mite infestations and dry weather was partly responsible.

The tarnished plant bug and both the striped and the spotted cucumber beetles were frequently found dead on collecting tables placed in the DD plots. The spotted cucumber beetle sometimes injures apples. Observations indicated that little if any control of crawlers of the San Jose scale can be attributed to DDT.

Present Status and Availablity of DDT

The tests with DDT at the Vincennes laboratory, although perhaps the most extensive against the codling moth of any conducted in this country, are not yet conclusive, because both the 1943 and 1944 codling moth seasons were unusually dry. Tests must be made in seasons with normal or excessive rainfall, and large-scale tests should be set up under as wide a variety of conditions as possible, before the general adoption of DDT by the apple industry is desirable.

More experiments with DDT is also necessary to determine (1) the best methods of processing, (2) the supplements needed, (3) its effectiveness in combination with standard fungicide programs, (4) a means of improving its adhesiveness early in the season on all varieties and late in the season on varieties with very little wax, (5) a means of controlling mite outbreaks, (6) methods of residue removal if DDT is found toxic to human beings (in limited tests the residues have been found extremely difficult to remove), (7) the effect on spray men and others handling the material, (8) the possibility of an accumulative effect on the trees should DDT build up in the soil, and (9), possibly most important of all, whether its continued use as an insecticide will bring about the development of resistant strains of the codling moth, which would be able to exist in the presence of heavier deposits of DDT than are now required for control.

DDT is allocated by the War Production Board. Its production is limited because of expanded military programs calling for chlorine and benzene, raw materials required in

4 Steiner, L. F. Residual effect of DDT sprays on early spring apple aphids. Jour. Econ. Ent. 37: 5[illegible]0-561. 1944.

its manufacture. Limited amounts are available for experimental purposes, but there are no indications that a supply will be available for general use in 1945.

The present carry-over of codling moth larvae is unusually large and, with only a small supply of nicotine available for current use, every possible effort should be made to reduce the hibernating population to a minimum by using recommended supplemental practices such as scraping, pruning, and orchard and packing-house sanitation.

Summary

The new insecticide DDT has been extensively tested against the codling moth at Vincennes, Ind., during the seasons of 1943 and 1944. In a large-scale test DDT sprays at 1 pound per 100 gallons were more effective than the standard nicotine bentonite program (1 pint of nicotine sulfate (40 percent nicotine) per 100 gallons), and in small-plot field tests DDT at the same strength gave much better control than the standard lead arsenate program (4 and 3 pounds per 100 gallons).

DDT is a very effective supplement or fortifying agent when added in small quantities to lead arsenate or nicotine

bentonite, and can be used in split schedules ahead of or following sprays of lead arsenate or nicotine bentonite. It can be used effectively with summer oils and with bordeaux mixture.

Owing to variations in the physical properties of different lots of DDT received for testing, the results have varied considerably. Much remains to be done to develop formulations most suitable for codling moth sprays.

At a certain dosages in the range required for codling moth control DDT is very toxic to important predators of the European red mite and the common red spider. Under favorable weather conditions in DDT-sprayed plots the mite population have built up to extremely destructive levels in record-breaking time.

DDT is very effective against apple leafhoppers and has shown promise in the control of several species of apple aphids.

Much more experimental work must be done before general adoption of DDT by growers is desirable. There are no indications that a supply will be available for general use in 1945.

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Brinton, James H.	Hanover, R. 3
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Brossman, Morse	Ephrata, R. 2
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Brubaker, Daniel A.	Ephrata, R. 2
Bruschki, August	Pittsburgh, R. D. 6 (10)
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Burkholder, Sam	Shippensburg, R. 2
Burkholder, Wilbur	Shippensburg, R. 2
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Diehl, J. M.	Duncansville, R. D.
Diehl, M. A.	St. Thomas
Diffenderfer, C. N.	St. Thomas, R. 1
Diffenderfer, R. G.	St. Thomas
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Dona, Henry	Allentown
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Duke, D. R.	Perkasie, R. 3
Duld, John	Arendtsville
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Ebling, Aaron	Reading, R. 2
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Eddinger, A. G.	Dallas, R. 3
Edgerton, J. Russell	Westtown
Eichner, Mike	Wexford, R. 1
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Everhart, W. J.	York, R. 3
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Fogelsanger, W. H.	Shippensburg
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Garrahan, R. H.	Kingston
Garretson, Donald	Aspers, R. D.
Garretson, Harry	Aspers
Garretson, Lloyd W.	Arendtsville
Garretson, Lloyd	Biglerville
Garretson, R. B.	Bendersville
Garrettson, Robt.	Floradale
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Gillan, C. F.	St. Thomas
Gillan, G. G.	St. Thomas
Gillan, R. J.	St. Thomas

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Goodling, G. A.	Loganville
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Hafer, Harry D.	Fayetteville, R. 1
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Haldeman, E. W.	Doylestown, R. 1
Haldeman, Hayes	Biglerville
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Hartman, Clair	Franklin, R. D.
Hartman, Clem	Cashtown
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Hess, Ray B.	Waynesboro, R. 1
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Hess, T. E.	Wapwallopen, R. D.
Heston, Herman	Newtown
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Higgins, W. A.	Dallas, R. D.
Hildebrandt, John A.	Dallas, R. 2
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Hill, Wm. D.	North East
Hinnershitz, C. Walter	1255 Buttonwood St., Reading
Hoch, D. R.	Chambersburg
Hoch, Paul	Wapwallopen, R. 1
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Hoffman, Eugene	Butler, Star Route
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Hosler, Ralph	Berwick, R. D.
Hostetter, Henry U.	Washington Boro
Hottenstein, Ira	Lehighton, R. 3
Houck, Clyde	Clymer, R. D.
Hover, Howard	New Wilmington
Hovis, D. M.	Chambersburg, R. 5
Houk, Mrs. Dallas	New Castle, R. 1
Houk, J. M.	New Castle, R. 6
Howard, P. H.	Dover, R. 1
Howatt, Mrs. Maude	Coopersburg, R. 2
Huber, Edwin B.	Chambersburg
Huber, Herman	Narrowsburg, N. Y., R. 1
Huey, S. R.	New Castle, R. 3
Huff, John	Franklin, R. 2
Huff, M. F.	Oil City, R. 1

Name	Address
Huff, Warren C.	Ithaca, N. Y., R. 2
Hughes, J. N.	Mercer
Hunt, N. M.	New Castle, R. 4
Hunt, L. J.	New Castle, R. 4
Hutton, Russell B.	Waynesboro, R. 1
Hykes, Edward	York, R. 4
Ide, Wilfred	Sweet Valley, R. 1
Imswiler, John S.	West Union St., West Chester
Ingham, M. M.	New Castle, R. 5
Jackson, C. E. Co.	Chambersburg
Jaman, John	Bethlehem, R. 1
James, J. E.	Hagerstown, Md.
Jersey Package Co., Inc.	Bridgeton, N. J.
Johnson, David	New Hope
Johnson, Rolland A.	Hereford
Johnson, Rudolph	McKnightstown
Johnston, Mrs. F. C.	Dallas
Johnston, John & Sons	New Wilmington
Johnston, R. S.	New Wilmington, R. 1
Jones, J. H.	Paradise, R. 1
Jordan Orchards,	N. Jerome St., Allentown
Kane, Melvin	Orrtanna
Kauffman, C. B.	Bird-in-Hand
Kauffman, C. E.	Manchester, R. I.
Kauffman, J. B.	York, R. 7
Kauffman, Melvin L.	Bird-in-Hand
Kauffman, Milton H.	Hamburg, Star Route
Kebler, John	North East, R. 1
Keim, Milton W.	Boyertown, R. 2
Keller, Ambrose	Freeland, Md.
Keller, L. H.	Bendersville
Keller, Paul	Fogelsville
Keller, Paul J.	Chambersburg, R. 2
Kelso, James E.	Enon Valley
Kendig, Dr. J. S.	Salunga
Kerchner, Harvey T.	Lenhartsville
Kessler, Geo. W.	Tyrone
Ketner, Jacob B.	Wernersville
Kidd, Alvin D.	Hillsdale
Kisner, Emery	Berwick, R. 1
Kister, U. G.	Etters
Kitchen, E. M.	Pacific Coast Borax Co., 51 Madison Ave. New York
Kleppinger, B. M.	Coopersburg, R. 2
Kline, H. F.	Kintersville
Klug, Herbert J.	Aspinwall
Knappenberger, Thos.	Zionsville
Knaub, Harvey	Hellam, R. 1
Knelly, Willis	Sugarloaf, R. D.
Knouse, M. E.	Arendtsville
Koehler, Paulus E.	Monaca
Koch, Marlin	McKeansburg
Kohler, Chas.	542 W. King St., York
Komar, John	New Bedford
Kovacs, Rudolph	Orefield
Kratz, T. Percy	Doylestown
Kraus, John	Barnsville

Name	Address
Kreider, Ben. R.	Manheim, R. 1
Kuhn, Floyd	Cashtown
Kunkle, B. F.	Tamaqua, R. 1
Kunkle, George	Orwigsburg
Lancaster Co., Institution District	Lancaster
Landis c/o Aaron H. Palmer	Lancaster, R. 6
Lapp, John F.	Ronks, R. 1
Laskowski, B. J.	Trucksville, R. D.
Latshaw, John G.	Marion
Laudenslager, Martin	Orefield, R. 1
Lawrence, Lester	Lake Ariel, R. 2
LeBoutillier, Chas.	Wayne
Lengel, Paul	Pine Grove
Leonard, F. E.	Carlisle, R. 1
Lepole, Mrs. Carrie E.	Akron
Lesher, Adam	Chambersburg, R. 1
Lethiewitz, Frank	Lake Ariel, R. 1
Lett, E. R.	General Chem. Co. Philadelphia
Lewis, Nelson H.	Pittston, R. 1
Lewis Norman	Pittston, R. 1
Lieberknecht, M. L.	Mt. Wolf
Lightner, Irvin	York, R. 5
Linde, J. Eric	Orefield, R. 1
Linde, T. G.	Bethlehem, R. 4
Lingerman, Ralph	New Castle, R. 5
Linville, Arthur S.	Media, R. 2
Livingood, Mrs. Stella	Robesonia
Long, D. Edward	Fayetteville
Long, John C.	342 E. Liberty St., Lancaster
Long, Wm.	South Hampton
Loop, A. I.	North East
Lorane Orchards	Lorane
Lord, John	Wyoming, R. 1
Lott, John	Gettysburg
Lott, Robt.	Aspers
Lott, Wm. M.	Gardners
Lucabaugh, J. W.	Hanover, R. 6
Lucabaugh, Stewart	Hanover, R. 6
Lute, Harvey	Barnesboro, R. 2
McCleary, T. W.	Chambersburg, R. 4
McClelland, J. B.	Canonsburg
McClure, F. L.	New Castle, R. 5
McCormick, C. M.	Slippery Rock, R. 3
McCormick, James	Harrisburg
McCready, H. E.	Phoebe Flower Shop, Allentown
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
McHenry, Clarence	Indiana
McIlvaine, J. S.	Fayettsville
McKee, J. M.	Dairy Corp. Sale Co. Century Bldg., Pittsburgh
McKeehan, James	Honesdale
McKibben, J. W.	Kenwood, Chambersburg
McNitt Fruit Farm	Milroy
McPherson Bros.	Bridgeton

Name	Address
Mackel, Edward	St. Thomas, R. 1
Mackey, Earl	Orefield
MacNeal, Wm. H.	Parkesburg
Maddon, Leroy	Lake Ariel, R. 2
Madeira, Ambrose	West Leesport, R. 1
Mains, Guy L.	Kennett Square
Marcks, Miss Verna	Emaus
Marsteller, Wm.	Stewartstown
Martin, C. S.	Chambersburg, R. 4
Marvel Package Co.	Laurel, Del.
Mason, Jack G.	Reading, R. 2
Mattern, Chas.	Hollidaysburg, R. D.
Mattern, Jos. C.	Hollidaysburg
Mattern, Richard H.	Hollidaysburg
Matthews, W. H.	Box 313, Salem, Ohio
Mauger, Ralph	Boyertown, R. 2
Maurer, Jay	Hegins
Mayer, Guy S.	Willow St., R. 1
Mecartney, J. L.	State College
Mechling Farms	Moorestown, N. J.
Meehan, S. Mendelson	Newtown Square
Meister, Kenneth A.	Chambersburg, R. 6
Melcher, Bennett	Bally
Mellor, Wm. W.	Wayne
Mengel, John R.	West Leesport
Merring, Guy	Cortez
Meyer, Allen	Annville
Meyer, Morris A., Jr.	Lebanon, R. 3
Mickels, Joe	Wexford, R. 1
Mickley, Myron	Quincy
Mickley, Roy A.	Orrtanna
Miller, Abraham H.	Lancaster, R. 1
Miller, Art L.	We-Know Produce, Chambersburg
Miller, Blaine	Indiana, R. 4
Miller, C. E.	820 Mulb'ry Ave.Hagerstown,Md
Miller, Christ	Marion
Miller, Frank	Lake Ariel
Miller, Frank N.	Waynesboro, R. 4
Miller, Harper	Quincy
Miller, Harvey	Loganville
Miller, Jacob R.	Elizabeth, R. 3
Miller, James	Aspers
Miller, John S.	Somerset
Miller, John W.	Ephrata, R. 1
Miller, R. W.	100 S. High St. Mechanicsburg
Millhouse, John	Shippensburg, R. 2
Mimm, Howard	McKeansburg
Mimm, Jonathan	McKeansburg
Mineo, Thos.	Pittston, R. 1
Mitchell, E. B.	Beaufort Farms, Harrisburg
Mitchell, Robt.	Shavertown, Box 245
Mock, P. H.	Cherry Tree, R. D.
Mohler, A. M.	233 S. Lincoln St., Lebanon
Mohr, Frank J.	Fogelsville
Mohrman, Richard	Narrowsburg, N. Y.
Moluf, A. J.	301 Grape St., Vineland, N. J.
Moon, Henry T.	Haddonfield, N. J.
Moon, Wm.	Macungie, R. D.
Mooney, C. E.	Chambersburg, R. 1

Name	Address
Etter, Frank L.	Chambersburg, R. 2
Evans, I. Rowland	Longwood Farms, Kennett Sq.
Evans, W. H.	Plainsville
Everhart, W. J.	York, R. 3
Ewing, Wm. B.	West Grove
Fagan, F. N.	State College
Fassett, Lloyd	Meshoppen
Feaster, W. C.	949 Forest Dr. Hagerstown, Md.
Fetterman, J. Gordon	Media
Fetters, Donald	Gardners
Fidler Alfred	Aspers, R. D.
Fink, Clifford	Ferndale
Fischer Fred	Franklin, R. D.
Fisher, Fred M.	Wernersville
Fitzgerald, H.	Oconomowoc, Wis.
Fletcher, S. W.	State College
Flora, Wm.	Wrightsville, R. D.
Fogelsanger, R. B.	Chambersburg, R. 5
Fogelsanger, W. H.	Shippensburg
Foreman, Bitner	St. Thomas, R. 1
Forrester, W. R.	Mercer
Forry, S. E.	Ephrata, R. 1
Fox, A. Grant	Normandale, Ontario
Fox, Frank	Hollidaysburg, R. 2
Frantz, Ira	Dallas, R. D.
Frantz, S. P.	Trucksville, R. D.
Frecon, Robt.	Chambersburg, R. 3
Freed, A. J.	Racine
Reed, W. A.	Racine
Frey, H. E.	Red Lion, R. 2
Fry, John L.	C. K. Whitner & Co. Reading
Funk, Elwood	Lititz, R. 3
Funk, Sheldon	Boyertown
Gackenbach, C. A.	Orefield, R. 1
Gallinger, M.	Guernsey
Galt, Sara E.	Terre Hill
Gamber, N. Edward	Jonestown, R. 1
Gardenhour, G. W.	Smithsburg, Md.
Garman, Samuel A.	Ephrata, R. 2
Garrahan, R. H.	Kingston
Garretson, Donald	Aspers, R. D.
Garretson, Harry	Aspers
Garretson, Lloyd W.	Arendtsville
Garretson, Lloyd	Biglerville
Garretson, R. B.	Bendersville
Garrettson, Robt.	Floradale
Gay, Arthur	Dallas, R. 1
Gehr, Harvey J.	Waynesboro
Geiger, Clinton	Neffs
Geigley, A. W.	Fairfield
Gelwix, Dr. J. M.	Chambersburg
German, Wilmer	Slatington, R. D.
Gerrity, John	Dallas, R. 3
Geyer, John O.	Soudertown, R. 2
Gibson, Harold	Blairsville, R. D.
Giesman, Roy	Springtown, R. 2
Gillan, C. F.	St. Thomas
Gillan, G. G.	St. Thomas
Gillan, R. J.	St. Thomas

Name	Address
Gipe, Raymond	Chambersburg, R. 5
Glick, David W.	Lancaster, R. 5
Goepfrich, Emil	Elizabethtown
Gold, Robt. W.	Hawley
Good, Harvey	Lancaster, R. 8
Goodling, G. A.	Loganville
Gomer, Ira E.	Chambersburg, R. 6
Goshorn, Frank	Quincy
Goshorn, Taylor L.	Quincy, Box 47
Grand View Orchards	Pittston, R. 1
Greiner, Nathan N.	243 Col. Ave., Elizabethtown
Griest, Frederick E.	Floradale
Griest, Frederick, Jr.	Biglerville
Grimshaw, Harry	Girard
Gross, H. S.	York, R. 5
Grove, W. E.	York Springs
Grove, W. E.	Chambersburg
Guist, Aristis	Hellam, R. D.
Guise, H. L.	Gardners
Guyton, T. L.	Harrisburg
Haas, Wm. F.	Coplay, R. 1
Haase, Alfred H.	Narrowsburg, N. Y.
Haase, Herman	Narrowsburg, R. 1, N. Y.
Hacker, A. L.	Allentown
Hafer, Fred D.	Quincy, Box 69
Hafer, Harry D.	Fayetteville, R. 1
Hafer, John A.	Chambersburg, R. 5
Hafer, Roy	Fayetteville, R. 1
Hagel, Paul	Sheridan, R. 1
Hager, D. R.	Orrtanna, R. 1
Haine, Jhon	New Castle, R. 3
Haines, Robt. B.	Hereford, Box 56
Haldeman, E. W.	Doylestown, R. 1
Haldeman, Hayes	Biglerville
Hall, George	Murryville
Hall, Mrs. John	Orrtanna
Hall, L. C.	North Girard
Hartman, Clair	Franklin, R. D.
Hartman, Clem	Cashtown
Hartman, J. Blair	Biglerville
Hartman, L. E.	Cly
Hartranft, Harry	Zionsville
Hartzok, J. W.	Marion, R. 6
Harvey, Clyde	Northbrook
Harvey, H. R.	Foxburg
Haudenshield, Chas.	111 Noblestown Rd., Crafton
Haudenshield, Crist	Canonsburg, R. 1
Haugh, Frank P.	803 Marshall (14) Pittsburgh
Hausman, George B.	Coopersburg, R. 2
Hantz, Franklin	904 W. 9th St., Hazelton
Haverstick, Paul E.	1254 Lititz Pike, Lancaster
Hayfield Farms	Trucksville, R. 1
Hayman, Guy L.	Northbrook
Hayman, Harold	Stillwater, R. D.
Hayworth, James	Mayview
Hazlett, W. C.	Chambersburg
Heacock, O. J.	Biglerville
Heaps, Marshall	Cardiff, Md.
Heckenluber, Roy	Biglerville
Heeb, C. C.	Chambersburg

Name	Address
Heffelfinger, Henry S.	Myerstown, R. 3
Hege, H. P.	Chambersburg, R. 1
Heim, Russell	McKeansburg
Henry, Heinz	Narrowsburg, N. Y.
Heisey, Henry	Mercersburg
Heisey, L. W.	Lancaster, R. 1
Heisey, S. A.	Greencastle, R. 4
Heller, Hoyt	Dallas, R. 3
Hempstead, Walter	Honesdale
Henderson, Lowrie	Stoneboro
Henry, A. C.	Chambersburg, R. 1
Henry, Owen	Chambersburg, R. 1
Herb, Ray H.	Orwigsburg
Herman, Asher	Wescosville
Herr, C. H.	Lancaster, R. 6
Herr, Robt. C.	Lancaster, R. 2
Hershey, H. F.	Hamburg, R. 3
Hess, Elam S.	Mount Joy, R. 2
Hess, F. M.	Waynesboro
Hess, Ira S.	Florin
Hess, Dr. J. C.	1222 W. Erie Ave., Philadelphia
Hess, Paul G.	Waynesboro, R. 2
Hess, Ralph C.	Waynesboro, R. 2
Hess, Ray B.	Waynesboro, R. 1
Hess, Stine P.	Greencastle, R. 1
Hess, T. E.	Wapwallopen, R. D.
Heston, Herman	Newtown
Hibert, Wm.	Indiana, R. D.
Hicht, Ralph	Punxsutawney, R. D.
Higgins, W. A.	Dallas, R. D.
Hildebrandt, John A.	Dallas, R. 2
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
Hoch, Paul	Wapwallopen, R. 1
Hockenberry, John	Shippensburg, R. D.
Hoffman, Eugene	Butler, Star Route
Holod Lumber Co.	Olyphant
Hood, T. C.	Saltsburg, R. 1
Hoopes, Wilmer W.	West Chester
Horner, Winfield G.	Gettysburg, R. D.
Horst, Elmer R.	Lebanon, R. 4
Horst, J. Morris	Lebanon, R. 3
Hosler, Ralph	Berwick, R. D.
Hostetter, Henry U.	Washington Boro
Hottenstein, Ira	Lehighton, R. 3
Houck, Clyde	Clymer, R. D.
Hover, Howard	New Wilmington
Hovis, D. M.	Chambersburg, R. 5
Houk, Mrs. Dallas	New Castle, R. 1
Houk, J. M.	New Castle, R. 6
Howard, P. H.	Dover, R. 1
Howatt, Mrs. Maude	Coopersburg, R. 2
Huber, Edwin B.	Chambersburg
Huber, Herman	Narrowsburg, N. Y., R. 1
Huey, S. R.	New Castle, R. 3
Huff, John	Franklin, R. 2
Huff, M. F.	Oil City, R. 1

Name	Address
Huff, Warren C.	Ithaca, N. Y., R. 2
Hughes, J. N.	Mercer
Hunt, N. M.	New Castle, R. 4
Hunt, L. J.	New Castle, R. 4
Hutton, Russell B.	Waynesboro, R. 1
Hykes, Edward	York, R. 4
Ide, Wilfred	Sweet Valley, R. 1
Imswiler, John S.	West Union St., West Chester
Ingham, M. M.	New Castle, R. 5
Jackson, C. E. Co.	Chambersburg
Jaman, John	Bethlehem, R. 1
James, J. E.	Hagerstown, Md.
Jersey Package Co., Inc.	Bridgeton, N. J.
Johnson, David	New Hope
Johnson, Rolland A.	Hereford
Johnson, Rudolph	McKnightstown
Johnston, Mrs. F. C.	Dallas
Johnston, John & Sons	New Wilmington
Johnston, R. S.	New Wilmington, R. 1
Jones, J. H.	Paradise, R. 1
Jordan Orchards,	N. Jerome St., Allentown
Kane, Melvin	Orrtanna
Kauffman, C. B.	Bird-in-Hand
Kauffman, C. E.	Manchester, R. I.
Kauffman, J. B.	York, R. 7
Kauffman, Melvin L.	Bird-in-Hand
Kauffman, Milton H.	Hamburg, Star Route
Kebler, John	North East, R. 1
Keim, Milton W.	Boyertown, R. 2
Keller, Ambrose	Freeland, Md.
Keller, L. H.	Bendersville
Keller, Paul	Fogelsville
Keller, Paul J.	Chambersburg, R. 2
Kelso, James E.	Enon Valley
Kendig, Dr. J. S.	Salunga
Kerchner, Harvey T.	Lenhartsville
Kessler, Geo. W.	Tyrone
Ketner, Jacob B.	Wernersville
Kidd, Alvin D.	Hillsdale
Kisner, Emery	Berwick, R. 1
Kister, U. G.	Etters
Kitchen, E. M.	Pacific Coast Borax Co., 51 Madison Ave. New York
Kleppinger, B. M.	Coopersburg, R. 2
Kline, H. F.	Kintersville
Klug, Herbert J.	Aspinwall
Knappenberger, Thos.	Zionsville
Knaub, Harvey	Hellam, R. 1
Knelly, Willis	Sugarloaf, R. D.
Knouse, M. E.	Arendtsville
Koehler, Paulus E.	Monaca
Koch, Marlin	McKeansburg
Kohler, Chas.	542 W. King St., York
Komar, John	New Bedford
Kovacs, Rudolph	Orefield
Kratz, T. Percy	Doylestown
Kraus, John	Barnsville

Name	Address
Kreider, Ben. R.	Manheim, R. 1
Kuhn, Floyd	Cashtown
Kunkle, B. F.	Tamaqua, R. 1
Kunkle, George	Orwigsburg
Lancaster Co., Institution District	Lancaster
Landis c/o Aaron H. Palmer	Lancaster, R. 6
Lapp, John F.	Ronks, R. 1
Laskowski, B. J.	Trucksville, R. D.
Latshaw, John G.	Marion
Laudenslager, Martin	Orefield, R. 1
Lawrence, Lester	Lake Ariel, R. 2
LeBoutillier, Chas.	Wayne
Lengel, Paul	Pine Grove
Leonard, F. E.	Carlisle, R. 1
Lepole, Mrs. Carrie E.	Akron
Lesher, Adam	Chambersburg, R. 1
Lethiewitz, Frank	Lake Ariel, R. 1
Lett, E. R.	General Chem. Co. Philadelphia
Lewis, Nelson H.	Pittston, R. 1
Lewis Norman	Pittston, R. 1
Lieberknecht, M. L.	Mt. Wolf
Lightner, Irvin	York, R. 5
Linde, J. Eric	Orefield, R. 1
Linde, T. G.	Bethlehem, R. 4
Lingerman, Ralph	New Castle, R. 5
Linville, Arthur S.	Media, R. 2
Livingood, Mrs. Stella	Robesonia
Long, D. Edward	Fayetteville
Long, John C.	342 E. Liberty St., Lancaster
Long, Wm.	South Hampton
Loop, A. I.	North East
Lorane Orchards	Lorane
Lord, John	Wyoming, R. 1
Lott, John	Gettysburg
Lott, Robt.	Aspers
Lott, Wm. M.	Gardners
Lucabaugh, J. W.	Hanover, R. 6
Lucabaugh, Stewart	Hanover, R. 6
Lute, Harvey	Barnesboro, R. 2
McCleary, T. W.	Chambersburg, R. 4
McClelland, J. B.	Canonsburg
McClure, F. L.	New Castle, R. 5
McCormick, C. M.	Slippery Rock, R. 3
McCormick, James	Harrisburg
McCready, H. E.	Phoebe Flower Shop, Allentown
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
McHenry, Clarence	Indiana
McIlvaine, J. S.	Fayettsville
McKee, J. M.	Dairy Corp. Sale Co. Century Bldg., Pittsburgh
McKeehan, James	Honesdale
McKibben, J. W.	Kenwood, Chambersburg
McNitt Fruit Farm	Milroy
McPherson Bros.	Bridgeton

Name	Address
Mackel, Edward	St. Thomas, R. 1
Mackey, Earl	Orefield
MacNeal, Wm. H.	Parkesburg
Maddon, Leroy	Lake Ariel, R. 2
Madeira, Ambrose	West Leesport, R. 1
Mains, Guy L.	Kennett Square
Marcks, Miss Verna	Emaus
Marsteller, Wm.	Stewartstown
Martin, C. S.	Chambersburg, R. 4
Marvel Package Co.	Laurel, Del.
Mason, Jack G.	Reading, R. 2
Mattern, Chas.	Hollidaysburg, R. D.
Mattern, Jos. C.	Hollidaysburg
Mattern, Richard H.	Hollidaysburg
Matthews, W. H.	Box 313, Salem, Ohio
Mauger, Ralph	Boyertown, R. 2
Maurer, Jay	Hegins
Mayer, Guy S.	Willow St., R. 1
Mecartney, J. L.	State College
Mechling Farms	Moorestown, N. J.
Meehan, S. Mendelson	Newtown Square
Meister, Kenneth A.	Chambersburg, R. 6
Melcher, Bennett	Bally
Mellor, Wm. W.	Wayne
Mengel, John R.	West Leesport
Merring, Guy	Cortez
Meyer, Allen	Annville
Meyer, Morris A., Jr.	Lebanon, R. 3
Mickels, Joe	Wexford, R. 1
Mickley, Myron	Quincy
Mickley, Roy A.	Orrtanna
Miller, Abraham H.	Lancaster, R. 1
Miller, Art L.	We-Know Produce, Chambersburg
Miller, Blaine	Indiana, R. 4
Miller, C. E.	820 Mulb'ry Ave.Hagerstown,Md
Miller, Christ	Marion
Miller, Frank	Lake Ariel
Miller, Frank N.	Waynesboro, R. 4
Miller, Harper	Quincy
Miller, Harvey	Loganville
Miller, Jacob R.	Elizabeth, R. 3
Miller, James	Aspers
Miller, John S.	Somerset
Miller, John W.	Ephrata, R. 1
Miller, R. W.	100 S. High St. Mechanicsburg
Millhouse, John	Shippensburg, R. 2
Mimm, Howard	McKeansburg
Mimm, Jonathan	McKeansburg
Mineo, Thos.	Pittston, R. 1
Mitchell, E. B.	Beaufort Farms, Harrisburg
Mitchell, Robt.	Shavertown, Box 245
Mock, P. H.	Cherry Tree, R. D.
Mohler, A. M.	233 S. Lincoln St., Lebanon
Mohr, Frank J.	Fogelsville
Mohrman, Richard	Narrowsburg, N. Y.
Moluf, A. J.	301 Grape St., Vineland, N. J.
Moon, Henry T.	Haddonfield, N. J.
Moon, Wm.	Macungie, R. D.
Mooney, C. E.	Chambersburg, R. 1

Name	Address
Moore, M. A.	Lititz
Morse, Carl	New Wilmington, R. 1
Mowery, Harold	Mechanicsburg, R. D.
Murphy, Daniel	New Castle, R. 2
Murphy, P. J.	White Haven, R. D.
Murray, Geo. R.	298 Phila. Av., Chambersburg
Murrin, W. L.	Butler, Box 733
Myers, A. Jackson	6120 Reedland St., Philadelphia
Myers, Everett	Homer City, R. 2
Nagy, James	Sharpesville
Nesbitt, C. M.	Interlaken, N. J.
Neuman, O., Jr.	Miller Chem. & Fertilizer Corp. 1000 S. Caroline St. Baltimore, Md.
Neuroth, Jos.	602 N. 6th St., Allentown
Newcomer, L. E.	130 E. Locust St., Fleetwood
Newell, C. B.	Roxbury
Newcoman, H. W.	New Castle, R. 4
Nitchman, C. H.	Aspers, R. 1
Nolt, Harrison S.	Columbia, R. 1
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Pratt, B. G.	160 Moore St., Hackensack,N.J.

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Raffensberger, Elmer	Biglerville
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Rahauser, Jos.	Greencastle
Rankin, Chas. C.	401 S. Walnut St., West Chester
Ray, Fred C.	Penn Run, R. D.
Readinger, Austen B.	Fleetwood, R. 1
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Reed, Guy S.	Summit Station
Reichard, D. L.	Waynesboro, Box 374
Reinhard, Milton B.	303 N. 9th St. Allentown
Reist, A. E.	Palmyra
Reist, J. Clarence	Paragon Nut & Fruit Farm Landisville
Reist, Mrs. Margaret B.	1166 Avonroad Schnectady, N. Y.
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Rick, Chas. M.	431 Windsor, St., Reading
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Runk, J. A.	Huntingdon
Runkle, M. V.	Felton
Ruth, Charles	422 Ridge St., Emaus
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Shaffer, J. I.	B. J. Pratt Co., 160 Moore St. Hackensack, N. J.
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Shenot, Earl	Wexford
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Sheppard, L. P.	229 W. Cottage Place, York
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Simmons, Dan	Frank St., Box 720, Pittsburgh, (10)
Simmons, Earl	Frank St., Box 700, Pittsburgh, (10)
Simmons, S. L.	Frank St., Box 55 Pittsburgh, (10)
Singer, E. G.	Chambersburg, R. 5
Slade, Jos	2735 Greenleaf St., Allentown
Slade, Martin A.	Biglerville
Slaybaugh, Glen	Gettysburg, R. 5
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Smedley, Samuel L.	Newtown Square
Smedley, S. L., Jr.	Newtown Square
Smith, Arthur G.	Chambersburg, R. 2

Name	Address
Smith A. Woodward	Blairsville, Box 75
Smith, Clemon	Nescopek, R. D.
Smith, Geo. A.	Smithsburg, Md.
Smith, G. E.	Bethlehem, R. 4
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Smith, S. A.	Yoe
Smith, Thos. L.	1000 S. Caroline St., Baltimore, Md.
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Stock, Guy	Bendersville
Stockdale, H. C.	458 Pratt St., Ravenna, Ohio
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Taylor, Ralph S.	West Chester, R. D.
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Thomas, Edwin W.	King of Prussia
Thomford, C. F. B.	Kennett Square
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Thompson, Lawrence	New Wilmington
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Wagonhurst, Mrs. Anna	Bechtelsville, R. D.
Wagner, Chas. E.	McClure
Wagner, H. D.	232 Main St., Emaus
Walker, Frank C.	Chambersburg
Walker, Paul	Chambersburg
Wallace, G. W.	Blue Ridge Fruit Exchange, Waynesboro
Wallace, J. Chester	New Castle, R. 1
Walton, Robt. J.	Hummelstown
Watkins, R. G.	WilkesBarre, Box 128
Weaver, Abram	Scalp Level
Weaver, E. A.	Fayetteville
Weaver, Russell	Aspers, R. D.
Weaver, Wm. S.	Macungie
Weber, Nelson	Orefield
Weigle, H. M.	Aspers
Weimer, E. A.	245 Seneca St., Harrisburg
Weinman, R. B.	Koppers Co., Pittsburgh
Welles, Thos. D.	Furlong
Welty, Richard	Smithsburg, Md.
Wenger, Samuel	Paradise
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Whiting, Ralph D.	101 E. Union Ave., Bound Brook, N. J.
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Witherow, R. T.	Punxsutawney
Wolf, George S.	1014 N. Christian St., Lancaster
Wolfe, Chas. D.	U. B. Orphanage, Quincy
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Wood, Ensign R. J.	N. A. S. Melbourne, Florida, Box 55
Woodward, M. H. & Son	Mendenhall
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Wotring, Oscar A.	Orefield
Wunder, James	405 DuPont St., Philadelphia
Yeager, J. F.	Phoenixville
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