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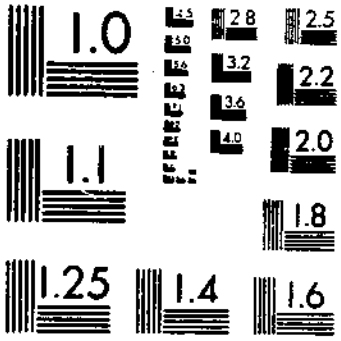


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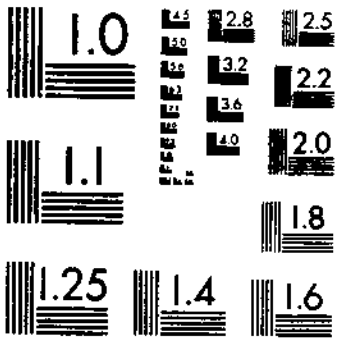


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# VINE KILLING in Relation to Maturity of Red River Valley POTATOES

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UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service
in cooperation with
Agricultural Research Service

## PREFACE

This report contains results of a cooperative study conducted through the 1950's by the Agricultural Research Service and the Agricultural Marketing Service, U.S. Department of Agriculture. The information has earlier been made available in somewhat fragmentary form within the Department of Agriculture, but has not been given general distribution. General publication has been delayed because of unavoidable factors. Although this work was done some time ago, the results are still valid. The equipment and techniques have not changed, and the research results are of current usefulness. This report is a part of a broad program of continuing research aimed at improving efficiency and holding down costs in the marketing of farm products.

T. M. Whiteman (now retired), W. R. Wright, J. M. Lutz, and J. C. Hansen (now with Colorado State University) Agr. Mktg. Serv., and A. J. Dubuque, Agr. Res. Serv., assisted in the study; the Red River Valley Potato Growers Association furnished the potatoes and performed the ordinary cultural operations on the experimental plots; the North Dakota Agr. Exp. Sta. loaned a special potato planter; the Dow Chemical Co., the Pennsylvania Salt Mfg. Co., the American Cyanamid Co., Sharples Cheimcals, Inc., The Naugatuck Chemical Division of the U.S. Rubber Co., Agsco, E. I. DuPont de Nemours & Co., Inc., the B. F. Goodrich Chemical Co., the Monsanto Chemical Co., the Atlas Powder Co., and Standard Agricultural Chemicals, Inc., supplied the chemicals used; the Woolery Machine Co., furnished the Potato Vine Burner; the Silbaugh Mfg. Co., furnished the Humboldt Stalk Cutter; the Myhra Equipment Co., furnished the Brady Stalk Pulverizer; the John Bean Division of Food Machinery & Chemical Corp. furnished the Rotobeater; F. Irons, Agr. Res. Serv., loaned the special self-propelled precision duster and made feed-rate calibrations of the dusts used; and E. J. Koch, Agr. Res. Serv., gave advice on the statistical analysis of the results.

W. L. Smith, Jr., Agr. Mktg. Serv., initiated the work; his unpublished data formed the basis for the studies reported here.

The use of trade names is for identification only and does not imply endorsement by the Department of Agriculture of the machine or product mentioned or disapproval of other machines or products.

Washington, D.C. July 1964

## CONTENTS


| | Page |
|---|---|
| Summary | 3 |
| Background of the study | 4 |
| Effect of treatments applied at different dates on yield, maturity, and internal discoloration | 5 |
| Procedure | 5 |
| Results and discussion | 8 |
| Effect of greensprouting and time of vine killing on yields, maturity, and internal discoloration | 28 |
| Procedure | 28 |
| Results and discussion | 28 |
| Effect of several different vine-killing methods on efficiency of kill | 38 |
| Procedure | 38 |
| Results and discussion: Rate of kill | 38 |
| Comparison of windrowing and re-covering, and rotobeating as methods of maturing potatoes | 45 |
| Procedure | 45 |
| Results and discussions | 45 |
| Literature cited | 47 |

# Vine Killing in Relation to Maturity of Red River Valley Potatoes

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## SUMMARY

The effectiveness of several potato vine-killing agents and the best interval between vine killing and harvesting in hastening maturity of potatoes was determined. The study also determined that the early development of the potato could be advanced by presprouting the seed so that early vine killing would not result in marked yield reduction. Triumph, Pontiac, and Red Pontiac potatoes grown in the Red River Valley of Minnesota-North Dakota were used in this study, which was carried on for four seasons.

Killing agents that resulted in an efficient kill of the potato vines reduced the amount of skinning, and in most instances, the amount of bruising during harvesting and storing of the crop. In general, treatments that killed the vines most rapidly gave the greatest decrease in susceptibility to injury, but the relationship in most cases was not close, and probably would be of little value for prediction. With actively growing vines early in the season, 3 or more weeks were required between vine killing and harvest for satisfactory results. Later in the season, as the plants approached senescence, less time was required.

Satisfactory kills of potato vines were obtained with Dow General, Penite 6, *pentachlorophenol*,[1] *Aero Cyanate*, *Endothal*, and *Dow Defoliant* applied at the recommended poundage in water at the rate of 15 gallons per acre. These low-gallonage sprays offer distinct advantages, because of the small amounts of water required, and equipment for weed control in small grains can be used.

Generally, the longer the vines were killed before harvest, the less susceptible the tubers were to skinning and bruising. However, killing the vines before about the first week in September frequently reduced yields, with the earlier kills causing the greatest reduction. After the first week in September, killing the vines had little measurable effect on yield.

Presprouting the seed resulted in faster plant emergence, but by the middle of August there was little

[1] Chemicals in italic have not been registered as potato vine killers, and may not be used as such on potatoes for food, feed, or seed, except as indicated on the inside cover.

visible difference between plots planted with presprouted seed and the control plots. Greensprouting (presprouting potatoes in the light) resulted in increased yields and reduced skinning of potatoes in 2 of 3 years. Sprouting in the dark resulted in increased yields 1 year.

For the most part vascular (xylem) discoloration was neither extensive, consistent, nor severe. The date on which the vines were killed as well as the stage of development of the plant are factors influencing the amount of discoloration. It could not be determined just when the potatoes were most susceptible to this disorder nor which vine killer could result in the greatest amount of discoloration.

In general, treatments that resulted in the most skinning also showed the greatest weight loss in storage. Although the correlation between weight loss and percent of skinning was highly significant statistically, the relationship was not close enough to be used for prediction.

The various vine-killing treatments had no discernible effect on the dormant period.

In most instances, killing the vines prematurely reduced specific gravity slightly. The longer the interval between vine-killing and harvest the greater the reduction in specific gravity. In 1 year there was no relationship between specific gravity and rate of kill; in 2 other years there was a statistically significant correlation between specific gravity and rate of kill, with the faster kills giving the greatest reduction in specific gravity. The relationship was not close enough, however, to be of value for prediction. Early harvesting resulted in slightly lower specific gravity than midseason harvest. Only when the vines were killed more than 4 weeks before harvest was the specific gravity reduced enough to result in important textural changes.

## BACKGROUND OF THE STUDY

Recent use of more effective insecticides and fungicides has resulted in keeping potato vines alive until frost. Although the lengthened growing period contributes to maximum yields, circumstances sometimes arise in which growers find it necessary to kill the vines. A satisfactory method of artificially maturing the crop is particularly important in seasons when killing frosts are late, to permit harvesting without excessive skinning and bruising, or cold-weather damage.

If late blight is present on the vines, the spores may be washed off into the soil, or be transferred from the blighted vines to clean tubers by contact at harvest, and cause extensive tuber rot. Under such conditions killing the vines would reduce the incidence of late blight tuber rot. In addition, the destruction of vines and weeds greatly facilitates the actual harvesting operation, especially mechanical harvesting. Other reasons for killing vines are to: Advance the date of harvest; to take advantage of good markets and weather; control tuber size; and reduce the late-season spread of certain virus diseases. Although killing the vines prematurely may reduce total yields, this loss may be of small consequence compared with losses if some of the crop is frozen in the ground or is unmarketable because of decay, oversized tubers, bruising, or if the general appearance of the tubers is materially affected by skinning.

Much work has been done with materials and methods for the de-

struction of potato vines. Up to the time the work described in this report was started, however, little information was available on the effect of vine killing on skinning and bruising of the tubers.

Dietz (*2*),[2] working with Triumph potatoes in Idaho, reported that microscopic examination of the tubers harvested at frequent intervals following vine killing indicates that normal ripening changes take place in the skin and that the potatoes can be harvested 10 days after vine killing without danger of damage due to immaturity. Samuel (*9*), working in Great Britain, also considered 10 days or more between killing date and harvest date to be necessary for satisfactory "setting of the skins." Kraus (*7*) observed that although some reduction in skinning was evident 7 days after application of a dinitro vine killer, only after about 14 days was the reduction enough under Idaho conditions to be of importance commercially. Otis (*8*), working with vine-killing chemicals in Oregon, stated that harvest should be delayed 1 week after a rapid kill, when a set skin is desired, and 10 days to 2 weeks if the vine kill is slow.

The present study was undertaken to:

- Obtain knowledge on the effect of the interval between vine destruction and harvest on susceptibility of the tubers to skinning and bruising;
- Compare some of the killing agents now used with others which appear to have promise, and to determine the efficiency with which they accomplish the desired results; and
- Determine if the early development of the potato could be speeded up by presprouting the seed so that vine killing could be done early in the fall without too great a yield reduction.

This report is a more detailed account of information presented earlier (*3, 4, 5, 6*).

## EFFECT OF TREATMENTS APPLIED AT DIFFERENT DATES ON YIELD, MATURITY, AND INTERNAL DISCOLORATION

### Procedure

#### First Season's Experiment

A factorial experiment, consisting of 10 killing agents, 2 different killing dates, and 4 replications, was conducted near Grand Forks, N. Dak., with the Triumph variety, planted June 10 on Bearden clay loam. Plot size was 2 rows, each 25 feet long and 38 inches apart. Two hundred pounds per acre of 4–24–12 fertilizer (a normal application rate in this area) was applied at planting time in bands in the row slightly below and to each side of the seed piece. All spray and dust applications of vine killers were made with hand equipment. The concentration and the rate of application used are in table 1. Rotobeating was done with a rubber-flail Bean Rotobeater, and vine burning was done with a modified Woolery Potato Vine Burner. Root pruning was accomplished by inserting spading forks under the plants on both sides of the row to be treated, and then pushing down on the handles so as to raise the plants slightly. Vine pulling was done by hand.

The plots, with the exception of one control plot, were harvested on September 26, 3 and 2 weeks, respectively, after the first and second

[2] Italicized numbers in parentheses refer to Literature Cited, page 47.

TABLE 1.—*Influence of various vine-killing treatments applied on two different dates on rate of kill of Triumph potatoes, first season of tests*

| Treatment [1] | Concentration used | Quantity per acre | Percent of foliage dead 1 and 7 days after application on— | | | |
|---|---|---|---|---|---|---|
| | | | Sept. 5 | | Sept. 14 | |
| | | | 1 day later | 7 days later | 1 day later | 7 days later |
| | | | *Pct.* | *Pct.* | *Pct.* | *Pct.* |
| *Aero Cyanamid dust* | 57-percent *calcium cyanamide.* | 60 lb | 15 | 20 | 15 | 99 |
| Sinox Dust B | 8-percent dinitro-ortho-sec.-butylphenol. | 25 lb | 15 | 15 | 15 | 95 |
| Regular burn | | | 99 | 99 | 99 | 99 |
| Light burn | | | 30 | 85 | 50 | 90 |
| Rotobeat | | | 100 | 100 | 99 | 100 |
| Vines pulled | | | 100 | 100 | 100 | 100 |
| Roots pruned | | | 50 | 90 | 20 | 70 |
| Dow General | 2 pt. of 55-percent dinitro-ortho-sec.-butylphenol +2 gal. diesel oil +2 lb. aluminum sulfate per 100 gal. water. | 100 gal | 70 | 85 | 80 | 99 |
| Penite 6 | 1½ gal. of 70.4-percent sodium meta arsenite per 100 gal. water. | 100 gal | 50 | 85 | 80 | 99 |
| *Ammonium sulfate* | 200 lb. per 100 gal. water. | 100 gal | 15 | 30 | 15 | 95 |
| Control 1 | | | | | | |
| Control 2 | | | | | | |

[1] Control 1 harvested same day as treatment applied; control 2 harvested same day as treated plots, Sept. 26. Chemicals in italic have not been registered as potato vine killers, and may not be used as such on potatoes for food, feed, or seed, except as indicated on the inside cover.

treatments. A single-row digger was used, and the potatoes were picked into rubber-covered wire baskets, dumped into burlap bags, and transported to the warehouse, where they were immediately weighed. They were then run over a conventional dry grader, and transferred in burlap bags to commercial potato storage, in which the temperature was gradually lowered to 38° to 40° F. and maintained at that temperature. The samples were removed from storage January 3 to 11 and were weighed. Skinning, bruising, and decay were determined in a 25-pound random sample. To use a single figure to represent the amount and severity of bruising present in a given lot, each classification was given an arbitrary value according to the total weight loss resulting from the removal of the bruised area:

| Classification of damage | Weight loss resulting from removal of bruise | Assigned value |
|---|---|---|
| Slight | More than 2 and up to 5 percent | 0.1 |
| Moderate | More than 5 and up to 10 percent | .5 |
| Severe | More than 10 percent | 1.0 |

The percentage of tubers in each classification was multiplied by the assigned value. These were added to give a single figure, termed the bruising index, which represents the estimated loss of market value. The larger the figure the greater the amount and severity of bruising. A 25-tuber subsample was used to determine the amount of stem-end discoloration. Another 15-tuber subsample was also taken at this time for specific gravity calculated from figures obtained by weighing the potatoes in air and in water. This same sample was then stored at 58° to 60° F. until February 7, to see if treatments affected dormancy.

## Second and Third Seasons' Experiments

In the second and third test seasons, a 3-way split-plot design, consisting of two harvesting dates for the whole plots, three different killing dates for the subplots, four different vine-killing treatments for the subplots, and five replications, was conducted near the same location on similar soils with the Red Pontiac variety planted May 23 in the second season and May 19 in the third season. Plot size was four rows, each 34 feet long and 38 inches apart. Two hundred thirty-five pounds per acre of 4–24–12 fertilizer was applied at planting time by the same method as was used in the first season's tests. Rotobeating was accomplished with a Humboldt Stalk Cutter. *Aero Cyanamid dust* (57-percent *calcium cyanamide*) was applied at the rate of 60 pounds per acre with a special self-propelled precision duster (fig. 1), which pro-

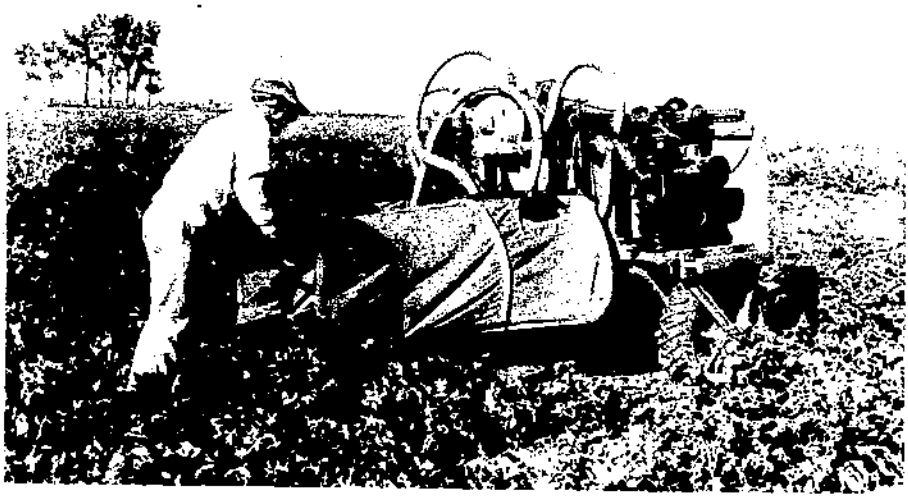

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FIGURE 1.—Special self-propelled precision duster for applying some potato vine-killing dusts.

vided a much more uniform application than the hand duster. In the third season's tests, whenever dew was absent, water at the rate of 125 gallons per acre was sprayed on the plots immediately before dusting, because earlier work showed that the dust was ineffective in the absence of dew. Dow General (55-percent dinitro-ortho-sec.-butylphenol) was applied with a hand sprayer at the rate of 2 pints of the chemical plus 2 gallons of diesel oil and 2 pounds of aluminum sulfate in 125 gallons of water per acre. For convenience in harvesting, the check plots and those treated with chemicals were rotobeat the day before harvest. Records were obtained from samples from only the two center rows to preclude any border effect of adjacent plots. The plots were harvested September 15 and October 1 in the second season, and September 16 and 30 in the third season. The potatoes were dug, handled, and stored in the same way as in the first season's experiments except that weight loss during the first few months of storage was not determined, and separate samples were stored at 58° to 60° F. only in the third season, to detect any effect of the treatments on dormancy. The samples were removed from 38° to 40° storage and examined from December 24 to 28 in the second season, and March 25 to April 3 in the third season's tests.

## Results and Discussion

### First Season's Experiment

RATE OF KILL.—An estimate of the percentage of dead foliage was made 1 and 7 days after the treatments were applied (table 1). Complete destruction of the vines was achieved by rotobeating and vine pulling. Of the other treatments, the regular burn gave the most rapid and efficient kill, with about 99 percent of the foliage dead 1 day after treatment. Dow General was the next most effective, followed by Penite 6 and the light burn, in that order. Root pruning was effective as a vine killer when applied at the first date but relatively ineffective at the second date. This can be explained by the fact that when root pruning was performed on September 5, the soil was relatively dry, temperatures were in the 80's, and a brisk wind caused the plants to wilt within 30 minutes after treatment. When root pruning was done on September 14, the soil contained abundant moisture, and temperatures were in the 60's. *Ammonium sulfate* gave a poor vine kill at the first date and a satisfactory, although relatively slow, kill at the second date. The reason for this is not clear but, apparently, vines are more difficult to kill chemically when they are actively growing than when they are approaching senescence. The dust treatments did not kill the vines at the earlier date because of the absence of dew on the plants (a common occurrence in this area), in which case these dusts are ineffective.

YIELD.—No significant[3] differences in total yields were found among treatments, even though some were ineffective as vine killers (table 2). This was probably due to the large amount of variation that occurred among plots. The difference between dates of application was highly significant, however, with the later application yielding an average of 20 hundred-

[3] Unless otherwise stated, the term "significant" is used to indicate statistical significance.

TABLE 2.—*Influence of various vine-killing treatments applied on two different dates on total yield of Triumph potatoes, first season of tests*

| Treatment [1] | Total yield per acre | | |
|---|---|---|---|
| | Date of application [2] | | Average [3] |
| | Sept. 5 | Sept. 14 | |
| | *Cwt.* | *Cwt.* | *Cwt.* |
| *Aero Cyanamid dust* | 161 | 176 | 168 |
| Sinox Dust B | 182 | 198 | 190 |
| Regular burn | 172 | 185 | 178 |
| Light burn | 150 | 184 | 167 |
| Rotobeat | 151 | 197 | 174 |
| Vines pulled | 158 | 189 | 174 |
| Roots pruned | 190 | 180 | 185 |
| Dow General | 161 | 194 | 178 |
| Penite 6 | 176 | 185 | 180 |
| *Ammonium sulfate* | 167 | 206 | 186 |
| Control 1 | 158 | 168 | 163 |
| Control 2 | 189 | 189 | 189 |
| Average [4] | 168 | 188 | ---------- |

[1] Control 1 harvested same day as treatment applied; control 2 harvested same day as treated plots, Sept. 26. Chemicals in italic have not been registered as potato vine killers, and may not be used as such on potatoes for food, feed, or seed, except as indicated on the inside cover.
[2] No significant difference between killing agents.
[3] Killing agents x killing dates not significant.
[4] Difference between killing dates significant at odds of 99:1.

weight per acre more than the earlier application. The interaction between killing agents and killing dates was not significant.

SKINNING.—An estimate of the skin removed from the tubers in each plot was made at the time the samples were removed from storage (table 3). Although there were significant differences among the averages for the vine killers for both dates, there was a highly significant interaction between vine killers and killing dates, so it is more informative to consider the amount of skinning for each date of application separately. The killing agents had no apparent effect when applied on September 14, 2 weeks before harvest, whereas they had an appreciable effect when applied on September 5, 3 weeks before harvest. With the earlier date of application, pulling the vines resulted in significantly less skinning than any of the other treatments, except rotobeating and root pruning. Rotobeating and root pruning resulted in significantly less skinning than *Aero Cyanamid*, Sinox Dust B, *ammonium sulfate*, and the untreated plot harvested the same day as the treated plots, but not significantly different from regular burning, light burning, Dow General, or Penite 6. As expected, the untreated plot, harvested at the time the first treatments were applied, showed significantly more skinning than any of the other plots, indicating that the tubers were less subject to skinning as the plants approach senescence. The amount



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TABLE 3.—*Influence of various vine-killing treatments applied on two different dates on susceptibility of Triumph potatoes to skinning, first season of tests*

| Treatment [1] | Skinning | | |
|---|---|---|---|
| | Date of application [2] | | Average [3] |
| | Sept. 5 | Sept. 14 | |
| | *Percent* | *Percent* | *Percent* |
| *Aero Cyanamid dust* | 19 | 21 | 20 |
| Sinox Dust B | 19 | 21 | 20 |
| Regular burn | 14 | 20 | 17 |
| Light burn | 14 | 21 | 18 |
| Rotobeat | 9 | 22 | 16 |
| Vines pulled | 3 | 20 | 12 |
| Roots pruned | 9 | 21 | 15 |
| Dow General | 15 | 20 | 18 |
| Penite 6 | 12 | 20 | 16 |
| *Ammonium sulfate* | 19 | 19 | 19 |
| Control 1 | 56 | 12 | 34 |
| Control 2 | 20 | 20 | 20 |
| Average [4] | 17 | 20 | |

[1] Control 1 harvested same day as treatment applied; control 2 harvested same day as treated plots, Sept. 26. Chemicals in italic have not been registered as potato vine killers, and may not be used as such on potatoes for food, feed, or seed, except as indicated on the inside cover.

[2] L.S.D. (least significant difference) between killing agents for each date at 0.05 level=8; at 0.01 level=11.

[3] L.S.D. between killing agents at 0.05 level=6; at 0.01 level=8.

[4] Difference between killing dates significant at odds of 19:1.

of skinning that occurred on the tubers from several of the treatments is shown in figure 2.

From the decrease in skinning found for the longer interval between vine killing and harvest, it might also be expected that the most rapid kill would result in the least skinning. In general this was found to be true, but the relationship was not close. It would probably be of little value for prediction purposes.

Skinning is a much more important appearance factor in red than in white-skinned potatoes because of the greater contrast between the white-skinned and red unskinned areas of red potatoes.

BRUISING.—Considering the average effect of the various vine killers for both dates (table 4), bruising was significantly reduced by all the vine-killing treatments, except the two dusts. Among the vine killers that did have an effect, vine pulling reduced bruising most, although it was not significantly different from regular burning, rotobeating, or Penite 6. Although there was no significant difference in bruising between killing dates, there was a highly significant interaction between killing dates and killing agents, indicating a differential response to the treatments at different dates. When the treatments were applied on September 5, 3 weeks before harvest, all treatments except *ammonium sulfate* and the two dusts resulted in significantly less bruising than

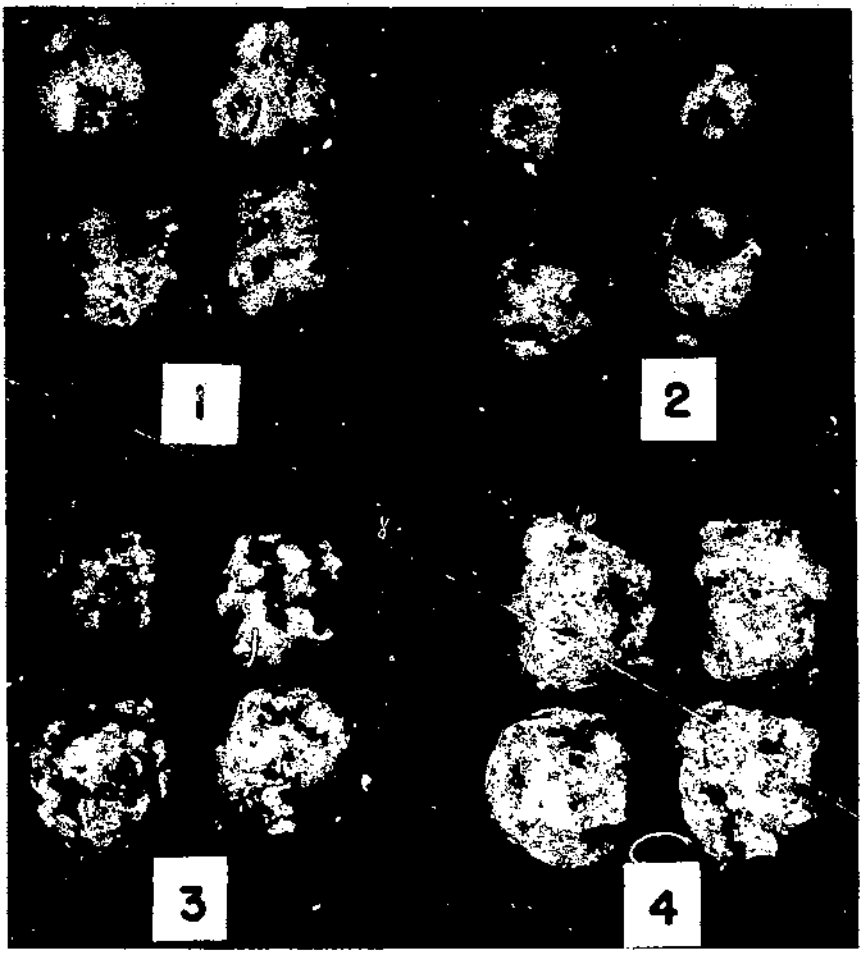


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FIGURE 2.—Typical tubers from vine-killing experiments show amount of skinning: (1) rotobeat September 5; (2) vines pulled September 5; (3) rotobeat September 14; (4) untreated. All treatments were harvested September 26.

the control harvested at the same time. When the treatments were applied on September 14, 2 weeks before harvest, all treatments except Sinox Dust B resulted in significantly less bruising than the control. In general, those treatments that killed the vines most rapidly resulted in the lowest bruising index. Again, however, the relationship is not close nor does there seem to be any close relationship between susceptibility to skinning and susceptibility to bruising. The correlation coefficient between percentage of skinning and log bruising index was found to be only 0.413. While this value is statistically significant, it accounts for only about 17 percent of the variability and therefore falls far short of the value required for prediction.

TABLE 4.—*Influence of various vine-killing treatments applied on two different dates on susceptibility of Triumph potatoes to bruising, first season of tests*

| Treatment [1] | Bruising index [2] | | |
|---|---|---|---|
| | Date of application [3] | | Average [4] |
| | Sept. 5 | Sept. 14 | |
| *Aero Cyanamid dust* | 27.3 | 10.7 | 19.0 |
| Sinox Dust B | 22.1 | 12.9 | 17.5 |
| Regular burn | 3.5 | 10.6 | 7.0 |
| Light burn | 6.0 | 9.4 | 7.7 |
| Rotobeat | 4.0 | 8.0 | 6.0 |
| Vines pulled | 1.7 | 6.0 | 3.8 |
| Roots pruned | 5.3 | 11.7 | 8.5 |
| Dow General | 6.9 | 10.8 | 8.8 |
| Penite 6 | 4.3 | 5.4 | 4.8 |
| *Ammonium sulfate* | 12.1 | 9.8 | 11.0 |
| Control 1 | 15.1 | 24.8 | 20.0 |
| Control 2 | 17.3 | 17.3 | 17.3 |
| Average [5] | 10.5 | 11.4 | ---------- |

[1] Control 1 harvested same day as treatment applied; control 2 harvested same day as treated plots, Sept. 26. Chemicals in italic have not been registered as potato vine killers, and may not be used as such on potatoes for food, feed, or seed, except as indicated on the inside cover.
[2] Explained in text, page 7.
[3] L.S.D. between killing agents for each date at 0.05 level=5.6; at 0.01 level=7.4.
[4] L.S.D. between killing agents at 0.05 level=3.9; at 0.01 level=5.2.
[5] Difference between killing dates not significant.

VASCULAR DISCOLORATION.—The data on vascular (xylem) discoloration were inconclusive since little discoloration occurred in any of the lots, except for the vines pulled on September 14, in which a considerable amount was observed (table 5). The cause of this effect is unexplained at present and should be regarded with caution until further evidence has accumulated.

WEIGHT LOSS AND SPROUTING.—Weight loss at 38° to 40° F. from September 17 to January 6, is shown in table 6. Although there were significant differences between the averages for the treatments for both dates, there was a significant interaction between vine killers and killing dates so the weight loss for each date of application is considered separately. None of the vine killers had any apparent effect on weight loss when applied on September 14; they did have a significant effect when applied on September 5. In general, with the earlier date of application, those lots that showed the greatest amount of skinning also showed the greatest weight loss during the storage period. A correlation coefficient of 0.542 was obtained, which was highly significant. However, this accounts for only about 29 percent of the variability and therefore could not be used for prediction.

SPECIFIC GRAVITY.—Although the mean specific gravity of the lots

TABLE 5.—*Influence of various vine-killing treatments applied on two different dates on amount of vascular discoloration in Triumph potatoes, first season of tests*

| Treatment [1] | Vascular discoloration | | |
|---|---|---|---|
| | Date of application [2] | | Average [3] |
| | Sept. 5 | Sept. 14 | |
| | *Percent* | *Percent* | *Percent* |
| *Aero Cyanamid dust* | 16 | 11 | 14 |
| Sinox Dust B | 6 | 12 | 9 |
| Regular burn | 22 | 16 | 19 |
| Light burn | 18 | 6 | 12 |
| Rotobeat | 11 | 4 | 8 |
| Vines pulled | 26 | 43 | 34 |
| Roots pruned | 14 | 13 | 14 |
| Dow General | 30 | 9 | 20 |
| Penite 6 | 31 | 4 | 18 |
| *Ammonium sulfate* | 29 | 9 | 19 |
| Control 1 | 3 | 7 | 5 |
| Control 2 | 8 | 8 | 8 |
| Average [4] | 18 | 12 | ---------- |

[1] Control 1 harvested same day as treatment applied; control 2 harvested same day as treated plots, Sept. 26. Chemicals in italic have not been registered as potato vine killers, and may not be used as such on potatoes for food, feed, or seed, except as indicated on the inside cover.
[2] Killing agents x killing dates not significant.
[3] L.S.D. between killing agents at 0.05 level=15.
[4] Difference between killing dates not significant.

treated September 14 was significantly higher than that for September 5, the difference was not great (table 7). No relation could be found between specific gravity and rate of kill. The specific gravity of the control plot harvested September 14 was considerably higher than that of the control plot harvested September 26. This may have been due to the increased moisture content of the soil, and a possible increase in the water content of the tubers at the later date.

DORMANT PERIOD.—The various vine-killing treatments, when applied at either date, had no discernible effect on the dormant period of Triumph potatoes stored at 38° to 40° F., from September 27 to January 11, and then at 58° to 60° until Feburary 7, when all lots had broken dormancy.

### Second and Third Seasons' Experiments

As stated earlier, these two experiments were initially designed as 3-way split plots. However, in the second season, rain prevented the application of one set of treatments in the sub-subplots, and killing frosts, another. In the third season, a killing frost occurred before one set of treatments in the sub-subplots could be applied. This presented a problem in statistical analysis which was partially solved by making a separate analysis of

TABLE 6.—*Influence of various vine-killing treatments applied on two different dates on weight loss of Triumph potatoes stored at 38° to 40° F. from September 27 to January 6, first season of tests*

| Treatment [1] | Weight loss in storage from original tuber weight | | |
|---|---|---|---|
| | Date of application [2] | | Average [3] |
| | Sept. 5 | Sept. 14 | |
| | *Percent* | *Percent* | *Percent* |
| *Aero Cyanmid dust* | 4.06 | 5.04 | 4.55 |
| Sinox Dust B | 4.20 | 4.40 | 4.30 |
| Regular burn | 3.67 | 4.12 | 3.89 |
| Light burn | 3.64 | 5.19 | 4.41 |
| Rotobeat | 4.05 | 4.52 | 4.29 |
| Vines pulled | 3.09 | 4.22 | 3.65 |
| Roots pruned | 4.06 | 4.15 | 4.10 |
| Dow General | 3.52 | 4.19 | 3.85 |
| Penite 6 | 4.58 | 4.46 | 4.52 |
| *Ammonium sulfate* | 4.62 | 4.67 | 4.64 |
| Control 1 | 7.61 | 5.54 | 6.58 |
| Control 2 | 4.77 | 4.77 | 4.77 |
| Average [4] | 4.32 | 4.60 | ---------- |

[1] Control 1 harvested same day as treatment applied; control 2 harvested same day as treated plots, Sept. 26. Chemicals in italic have not been registered as potato vine killers, and may not be used as such on potatoes for food, feed, or seed, except as indicated on the inside cover.
[2] L.S.D. between killing agents for each date at 0.05 level=1.18.
[3] L.S.D. between killing agents at 0.05 level=0.84; at 0.01 level=1.11.
[4] Difference between killing dates not significant.

variance of each of the main plots and another for both main plots using the data from those subplots that were common to both main plots.

RATE OF KILL.—An estimate of the percentage of dead foliage 1 and 7 days after the treatments were applied in the second season is shown in table 8. Considering the average response to the vine-killing treatments for the early harvested plots, rotobeating gave the most rapid and complete kill, followed closely by Dow General spray. However, there was a highly significant interaction between time of application and vine killers. *Aero Cyanamid dust* gave a relatively slow, though finally satisfactory, kill when applied 1 week before harvest, whereas it was ineffective when applied 3 weeks before harvest. In water, calcium cyanamide (active ingredient of *Aero Cyanamid dust*) is hydrolyzed to hydrogen cyanamide, which is responsible for the toxic effects on the foliage (p. 274, *1*), and calcium hydroxide. To be effective, the chemical must remain moist on the leaf for 2 to 4 hours. When *Aero Cyanamid dust* was applied 1 week before harvest dew was present on the foliage; when applied 3 weeks before harvest, dew was absent. Moreover, in the second case sufficient rain (0.79 inch) fell during the next 2 days to wash off the chemical be-

TABLE 7.—*Influence of various vine-killing treatments applied on two different dates on specific gravity of Triumph potatoes, first season of tests*

| Treatment [1] | Specific gravity | | |
|---|---|---|---|
| | Date of application [2] | | Average [3] |
| | Sept. 5 | Sept. 14 | |
| *Aero Cyanamid dust* | 1.0782 | 1.0794 | 1.0788 |
| Sinox Dust B | 1.0752 | 1.0794 | 1.0773 |
| Regular burn | 1.0746 | 1.0764 | 1.0755 |
| Light burn | 1.0781 | 1.0834 | 1.0807 |
| Rotobeat | 1.0764 | 1.0774 | 1.0769 |
| Vines pulled | 1.0770 | 1.0806 | 1.0788 |
| Roots pruned | 1.0770 | 1.0802 | 1.0786 |
| Dow General | 1.0776 | 1.0790 | 1.0783 |
| Penite 6 | 1.0787 | 1.0780 | 1.0784 |
| *Ammonium sulfate* | 1.0792 | 1.0804 | 1.0798 |
| Control 1 | 1.0779 | 1.0834 | 1.0806 |
| Control 2 | 1.0763 | 1.0763 | 1.0763 |
| Average [4] | 1.0772 | 1.0795 | |

[1] Control 1 harvested same day as treatment applied; control 2 harvested same day as treated plots, Sept. 26. Chemicals in italic have not been registered as potato vine killers, and may not be used as such on potatoes for food, feed, or seed, except as indicated on the inside cover.
[2] Killing agents x killing dates not significant.
[3] L.S.D. between killing agents at 0.05 level=0.0031.
[4] Difference between killing dates significant at odds of 99:1.

fore it had a chance to act. Dow General was unaffected by the rain because of its faster action; its toxic effect was clearly evident only 4 hours after application.

In general, similar results were obtained when the treatments were applied 2 and 3 weeks before the midseason harvest, except that *Aero Cyanamid dust* gave erratic results among replications; it gave a good kill in some replications and a poor kill in others. This was probably a result of differences among replications in the length of time the foliage remained moist; although there was a trace of dew on the plants at the time of application, it evaporated rapidly, particularly on plots with less dense foliage, as the temperature increased and the relative humidity decreased during the morning. As was found in the first season, vines were easier to kill as they approached senescence, as shown by the percentage of dead foliage 1 day after treatment, when the treatments were applied 2 weeks before harvest, compared with 3 weeks.

Comparing the average effect of the vine killers for both harvests, when treatments were applied 3 weeks before harvest, a faster kill was obtained when treatments were applied later in the season. This effect was largely a result of a failure of *Aero Cyanamid dust* to kill vines for the early harvest, while being fairly effective for the late harvest for reasons explained above.

An estimate of the percentage of

TABLE 8.—*Influence of several vine-killing treatments applied at different times before harvest on rate of kill of Red Pontiac potato vines, second season of tests*

| Application time | Amount of foliage dead | | | | |
|---|---|---|---|---|---|
| | Control | Rotobeat | After application of— | | Average |
| | | | *Aero Cyanamid dust* (60 lb. per acre) | Dow General spray (see text, p. 8) | |
| Early harvest: | | | | | |
| 1 week: | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| 1 day later [1] | 11 | 99 | 20 | 85 | [2] 54 |
| 7 days later [3] | 22 | 99 | 84 | 92 | [4] 74 |
| 3 weeks: | | | | | |
| 1 day later [1] | 3 | 99 | 6 | 87 | [2] 49 |
| 7 days later [3] | 5 | 99 | 7 | 91 | [4] 50 |
| Average: | | | | | |
| 1 day [5] | 7 | 99 | 13 | 86 | ---------- |
| 7 days [6] | 14 | 99 | 46 | 92 | ---------- |
| Midseason harvest: | | | | | |
| 2 weeks: | | | | | |
| 1 day later [7] | 22 | 99 | 24 | 94 | [8] 60 |
| 7 days later [9] | 46 | 99 | 71 | 96 | [10] 78 |
| 3 weeks: | | | | | |
| 1 day later [7] | 9 | 99 | 18 | 87 | [8] 53 |
| 7 days later [9] | 20 | 99 | 81 | 96 | [10] 74 |
| Average: | | | | | |
| 1 day [11] | 16 | 99 | 21 | 90 | ---------- |
| 7 days [12] | 33 | 99 | 76 | 96 | ---------- |
| Average, both harvests, 3 weeks before harvest: | | | | | |
| 1 day [11] | 6 | 99 | 12 | 87 | ---------- |
| 7 days [6] | 12 | 99 | 44 | 94 | ---------- |

[1] L.S.D. between 2 treatments at 1 time of application at 0.05 level=5; at 0.01 level=6.
[2] Significantly different at 0.01 level.
[3] L.S.D. between 2 treatments at 1 time of application at 0.05 level=2; at 0.01 level=3.
[4] Significantly different at 0.01 level.
[5] L.S.D. between treatments at 0.05 level=3; at 0.01 level=5.
[6] L.S.D. between treatments at 0.05 level=2; at 0.01 level=3.
[7] L.S.D. between 2 treatments at 1 time of application at 0.05 level=4; at 0.01 level=6.
[8] Significantly different at 0.01 level.
[9] L.S.D. between 2 treatments at 1 time of application at 0.05 level=12; at 0.01 level=16.
[10] Not significantly different.
[11] L.S.D. between treatments at 0.05 level=3; at 0.01 level=4.
[12] L.S.D. between treatments at 0.05 level=9; at 0.01 level=12.

TABLE 9.—*Influence of several vine-killing treatments applied at different times before harvest on rate of kill of Red Pontiac potatoes, third season of tests*

| Application time | Amount of foliage dead | | | | |
|---|---|---|---|---|---|
| | Control | Rotobeat | After application of— | | Average |
| | | | *Aero Cyanamid dust* (60 lb. per acre) | Dow General spray (see text, p. 8) | |
| Early harvest: | | | | | |
| 1 week: | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| 1 day later [1] | 21 | 99 | 29 | 90 | [2] 60 |
| 7 days later [3] | 30 | 100 | 94 | 95 | [2] 80 |
| 2 weeks: | | | | | |
| 1 day later [1] | 9 | 99 | 14 | 90 | [2] 53 |
| 7 days later [3] | 14 | 99 | 58 | 94 | [2] 66 |
| 3 weeks: | | | | | |
| 1 day later [1] | 10 | 99 | 73 | 90 | [2] 68 |
| 7 days later [3] | 10 | 99 | 80 | 94 | [2] 71 |
| Average: | | | | | |
| 1 day [4] | 13 | 99 | 39 | 90 | ---------- |
| 7 days [5] | 18 | 99 | 77 | 94 | ---------- |
| Midseason harvest: | | | | | |
| 2 weeks: | | | | | |
| 1 day later | 34 | 99 | 41 | 80 | 64 |
| 7 days later | ---------- | ---------- | ---------- | ---------- | ---------- |
| 3 weeks: | | | | | |
| 1 day later | 18 | 99 | 30 | 91 | 60 |
| 7 days later | 26 | 99 | 97 | 97 | 80 |
| Average: | | | | | |
| 1 day | 26 | 99 | 36 | 86 | ---------- |
| 7 days | ---------- | ---------- | ---------- | ---------- | ---------- |
| Average, both harvests, 2 and 3 weeks before harvest: | | | | | |
| 1 day [6] | 18 | 99 | 40 | 88 | ---------- |
| 7 days | ---------- | ---------- | ---------- | ---------- | ---------- |

[1] L.S.D. between 2 treatments at 1 time of application at 0.05 level=2; at 0.01 level=3.
[2] L.S.D. between these averages at 0.05 level=3; at 0.01 level=4.
[3] L.S.D. between 2 treatments at 1 time of application at 0.05 level=6; at 0.01 level=8.
[4] L.S.D. between treatments at 0.05 level=1; at 0.01 level=2.
[5] L.S.D. between treatments at 0.05 level=4; at 0.01 level=5.
[6] L.S.D. between treatments at 0.05 level=25; at 0.01 level=33.

dead foliage 1 and 7 days after the treatments were applied in the third season is shown in table 9. Considering the average effect of the treatments for the early harvest, the response was similar to that obtained in the second season except that *Aero Cyanamid dust* resulted in a more complete kill in the second season than in the third season. *Aero Cyanamid dust* gave a slow but excellent final kill when applied 1



719-019 O—64——3

week before harvest, a poor kill when applied 2 weeks before harvest, and a good kill when applied 3 weeks before harvest. The poor kill, when the dust was applied 2 weeks before harvest, was attributed to the foliage not remaining moist for the required period following application. This happened because of low humidity, and consequent rapid drying of the foliage even though 125 gallons of water per acre was sprayed on the vines just before dusting. The probable cause of the poorer final kill for the dust, when applied 3 weeks before harvest, compared with 2 weeks, is that 0.17 inch of rain fell about 2 hours after application, which would be sufficient to wash the chemical off the foliage before it produced the maximum toxic effect.

The data on rate of kill when the treatments were applied 2 and 3 weeks before the midseason harvest could not be analyzed statistically, because a killing frost occurred before the final reading was to be made. From the data shown, under optimum conditions, such as occurred 3 weeks before the midseason harvest, *Aero Cyanamid dust* gives a slower, but as satisfactory a final, kill as either rotobeating or Dow General spray; but, under the conditions common to this area, it cannot be relied upon to consistently give a satisfactory kill of potato vines.

YIELD.—In the second test season, killing the vines 3 weeks before the early harvest reduced the average yield significantly, compared with killing 1 week before harvest (table 10). Although the average effect of the vine killers was significant, the effect was confined to the plots treated 3 weeks before harvest, when all vine killers reduced yields below that of the control. The differences were significant for rotobeating and Dow General spray, amounting, in both cases, to slightly over 60 cwt. per acre. These two treatments gave yields that were also significantly lower at the 0.05 level than *Aero Cyanamid dust*, because of the failure of the dust to kill the vines at this time.

Application of the vine-killing treatments 2 and 3 weeks before the midseason harvest failed to have any significant effect on yield. Under the conditions prevailing in the Red River Valley in the second test season, there was little apparent yield increase after about the first week in September. As expected, killing the vines 3 weeks before the early harvest resulted in a highly significant reduction in yield, compared with the late harvest. This reduction amounted to an average of 57 cwt. per acre.

In the third test season, killing the vines 3 weeks before the early harvest also reduced yields significantly, compared with killing 1 week before harvest. There was no significant difference in yield between the plots killed 1 and 2 weeks before harvest; the difference between 2 and 3 weeks just failed to be significant. Killing the vines by any of the three vine-killing methods reduced average yields significantly but there was no significant difference among them.

For the midseason harvest, killing the vines 3 weeks before harvest by any of the vine-killing treatments reduced yields significantly. Rotobeating resulted in the greatest yield reduction, followed by Dow General spray and *Aero Cyanamid dust*. The difference in yield between rotobeating and either Dow General spray or *Aero Cyanamid dust* was highly significant, but there was no significant difference between the latter two treatments. Killing the vines 2 weeks before the midseason harvest had no significant effect on yields.

For both harvests, all three vine killers reduced average yields significantly below that of the control when applied 3 weeks before har-

**Table 10.**—*Influence of several vine-killing treatments, applied at different times before harvest, on total yield of Red Pontiac potatoes, second and third seasons of tests*

| Application time | Total yield | | | | |
|---|---|---|---|---|---|
| | Control | Rotobeat | After application of— *Aero Cyanamid dust* (60 lb. per acre) | After application of— Dow General spray (see text, p. 8) | Average |
| | *Cwt.* | *Cwt.* | *Cwt.* | *Cwt.* | *Cwt.* |
| Early harvest: | | | | | |
| 1 week: | | | | | |
| Second season [1] | 187 | 190 | 198 | 187 | [2] 190 |
| Third season [3] | 179 | 186 | 168 | 182 | [4] 179 |
| 2 weeks: | | | | | |
| Second season | ---------- | ---------- | ---------- | ---------- | ---------- |
| Third season [5] | 186 | 161 | 178 | 159 | [4] 171 |
| 3 weeks: | | | | | |
| Second season [1] | 202 | 141 | 180 | 138 | [2] 165 |
| Third season [5] | 173 | 130 | 131 | 132 | [4] 142 |
| Average: | | | | | |
| Second season [6] | 194 | 166 | 189 | 162 | ---------- |
| Third season [7] | 179 | 159 | 159 | 158 | ---------- |
| Midseason harvest: | | | | | |
| 2 weeks: | | | | | |
| Second season [3] | 230 | 226 | 225 | 219 | [2] 225 |
| Third season [5] | 180 | 197 | 182 | 178 | [4] 184 |
| 3 weeks: | | | | | |
| Second season [3] | 226 | 217 | 225 | 220 | [2] 222 |
| Third season [5] | 203 | 152 | 181 | 177 | [4] 178 |
| Average [8]: | | | | | |
| Second season | 228 | 221 | 225 | 220 | ---------- |
| Third season | 192 | 174 | 182 | 178 | ---------- |
| Average of both harvests [9]: | | | | | |
| Second season [6] | 214 | 179 | 202 | 179 | ---------- |
| Third season [10] | 186 | 160 | 168 | 161 | ---------- |

[1] L.S.D. between 2 treatments at 1 time of application at 0.05 level=29.
[2] Significantly different at 0.01 level.
[3] Not significantly different.
[4] L.S.D. between these averages at 0.05 level=30.
[5] L.S.D. between 2 treatments at 1 time of application at 0.05 level=19.
[6] L.S.D. between treatments at 0.05 level=20; at 0.01 level=28.
[7] L.S.D. between treatments at 0.05 level=14; at 0.01 level=19.
[8] Average for second season for both harvests applies only to treatments applied 3 weeks before harvest; for third season to treatments applied 2 and 3 weeks before harvest.
[9] L.S.D. between treatments at 0.05 level=17; at 0.01 level=23.
[10] L.S.D. between treatments at 0.05 level=14; at 0.01 level=18.

vest, but had little effect when applied 2 weeks before harvest. Although the average yield for all treatments for the early harvest was 26 cwt. per acre lower than that for the midseason treatments, this difference just failed to be significant at the 0.05 level.

SKINNING.—Killing the vines 3 weeks before the early harvest in the second test season reduced the average amount of skinning to about one-half that from plots killed 1 week before harvest (table 11). Although the average effect of the vine killers was highly significant, the effect was confined almost entirely to the plots killed 3 weeks before harvest. At this time, rotobeating and Dow General spray brought about a pronounced reduction in the amount of skinning while *Aero Cyanamid dust* had only a slight, although statistically significant, effect. In contrast, only rotobeating reduced skinning significantly, when the treatments were applied 1 week before harvest and this by an amount that would hardly be important commercially.

Killing the vines 3 weeks before the midseason harvest reduced the average amount of skinning below that from plots killed 2 weeks before harvest. Although the difference proved significant, it was not large. All three vine killers reduced skinning significantly, compared with the control, the difference being highly significant for Dow General spray and rotobeating, which also gave significantly less skinning than *Aero Cyanamid dust*. There was no interaction between the vine killers and times of application.

When the data for the treatments applied 3 weeks before both harvests were combined, only about one-third as much skinning occurred when the plots were harvested in midseason as when harvested early, and the difference proved highly significant. From the values shown for the controls, it is obvious that the normal process of maturing had reduced susceptibility of the potatoes to skinning. In general, those treatments that killed the vines most efficiently resulted in the greatest reduction in skinning. The relationship was not close, as shown by a correlation coefficient of −0.472. Although this value was statistically significant, it accounts for only about 22 percent of the variability. The correlation coefficient between percentage of skinning and amount of dead foliage 7 days after vine-killer application 3 weeks before the early harvest was −0.808. This correlation coefficient was not only highly significant, but accounted for about 65 percent of the variability, and thus is high enough to be used for prediction purposes. Moreover, the two correlation coefficients proved to be significantly different; the correlation between efficiency of kill and susceptibility to skinning tends to be higher when applied 3 weeks before the early harvest than at other times.

Similar results were obtained in the third test season, except that information was obtained on the effect of vine killers applied 2 weeks before the early harvest as well as 1 and 3 weeks. Although killing the vines even 1 week before harvest had some effect in reducing skinning, the effect became progressively more pronounced as the time between application and harvest was increased. It was not until this period was extended to 3 weeks that good control of skinning was attained. The data for the midseason harvest in the third test season also showed greater differences between the control and the vine-killing treatments indicating that the normal process of maturing did not proceed as rapidly in the third test season as in the preceding season.

TABLE 11.—*Influence of several vine-killing treatments applied at different times before harvest on susceptibility of Red Pontiac potatoes to skinning, second and third seasons of tests*

| Application time | Amount of skinning | | | | |
|---|---|---|---|---|---|
| | Control | Rotobeat | After application of— | | Average |
| | | | *Aero Cyanamid dust* (60 lb. per acre) | Dow General spray (see text, p. 8) | |
| Early harvest: | | | | | |
| 1 week: | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| Second season [1] | 35 | 28 | 30 | 30 | [2] 31 |
| Third season [3] | 38 | 30 | 31 | 31 | [4] 32 |
| 2 weeks: | | | | | |
| Second season | ---------- | ---------- | ---------- | ---------- | ---------- |
| Third season [3] | 32 | 17 | 22 | 18 | [4] 22 |
| 3 weeks: | | | | | |
| Second season [1] | 36 | 4 | 27 | 5 | [5] 18 |
| Third season [3] | 30 | 9 | 8 | 7 | [4] 14 |
| Average: | | | | | |
| Second season [5] | 36 | 16 | 28 | 18 | ---------- |
| Third season [6] | 33 | 19 | 20 | 19 | ---------- |
| Midseason harvest: | | | | | |
| 2 weeks: | | | | | |
| Second season | 9 | 7 | 9 | 7 | [7] 8 |
| Third season [8] | 18 | 11 | 13 | 9 | [7] 13 |
| 3 weeks: | | | | | |
| Second season | 8 | 5 | 5 | 3 | [7] 5 |
| Third season [8] | 17 | 5 | 5 | 6 | [7] 8 |
| Average: | | | | | |
| Second season [9] | 8 | 6 | 7 | 5 | ---------- |
| Third season [9] | 18 | 8 | 9 | 8 | ---------- |
| Average of both harvests [10]: | | | | | |
| Second season [9] | 22 | 4 | 16 | 4 | ---------- |
| Third season [6] | 24 | 10 | 12 | 10 | ---------- |

[1] L.S.D. between 2 treatments at 1 time of application at 0.05 level=5; at 0.01 level=7.
[2] Significantly different at 0.01 level.
[3] L.S.D. between 2 treatments at 1 time of application at 0.05 level=4; at 0.01 level=6.
[4] L.S.D. between these averages at 0.05 level=3; at 0.01 level=5.
[5] L.S.D. between treatments at 0.05 level=4; at 0.01 level=5.
[6] L.S.D. between treatments at 0.05 level=2; at 0.01 level=3.
[7] Significantly different at 0.05 level.
[8] L.S.D. between 2 treatments at 1 time of application at 0.05 level=2; at 0.01 level=3.
[9] L.S.D. between treatments at 0.01 level=2.
[10] Average for the second season for both harvests applies only to treatments applied 3 weeks before harvest; for the third season, to treatments applied 2 and 3 weeks before harvest.

Bruising.—For the early harvest in the second season of tests, the average effect of all three vine killers was to reduce susceptibility to bruising, as measured by the bruising index, to a little more than half that which occurred in the control plots (table 12). Although there was a trend toward less bruising in the plots killed 3 weeks before harvest as compared with 1 week, the difference was not significant.

For the midseason harvest, the vine-killing treatments had no discernible effect on the extent of bruising. However, killing the vines 3 weeks before harvest resulted in significantly less bruising than killing at 2 weeks. Significantly less bruising occurred at the second harvest than at the first.

In general, those treatments that killed the vines most efficiently resulted in the greatest reduction in bruising. The relationship was not close; the correlation coefficient of only −0.261, while significant at the 0.05 level, falls far short of that required for prediction purposes.

In contrast to the results obtained in the second test season, the vine-killing treatments had no perceptible effect on bruising in the third season. Moreover, significantly less bruising occurred at the first harvest than at the second. This latter effect was probably brought about by lower tuber temperature when the potatoes were handled, at the second harvest.

Vascular Discoloration.—Rotobeating the vines 3 weeks before the early harvest in the second test season caused significantly more vascular discoloration than any other treatment, but had no effect when applied 1 week before harvest. At the midseason harvest, the control tubers had more discoloration than those rotobeat or sprayed with Dow General (table 13).

In the third season, on the other hand, Dow General averaged significantly more discoloration at the early harvest than the control or *Aero Cyanamid dust*. However, most discoloration occurred when the vine killers were applied 3 weeks before harvest; Dow General caused significantly more discoloration than any other treatment. Although rotobeating caused more discoloration than the control, and tended to cause more than *Aero Cyanamid dust*, the difference just failed to be significant at the 0.05 level. Considering the average for both harvests, vine killing with Dow General spray caused the most discoloration, followed closely by rotobeating. *Aero Cyanamid dust* gave about the same amount of discoloration as the control. Practically all discoloration occurred at the early harvest; there was no significant difference in the amount of discoloration in potatoes from the midseason harvest.

Weight Loss and Sprouting.—Weight losses due to sprout removal and other weight losses of Red Pontiac potatoes stored at an average temperature of 59° F. from September 18 until February 16, in the third test season are shown in table 14. Killing the vines by each of the three methods resulted in a highly significant reduction in total weight loss during the period, compared to the control, but there were no significant differences among the three vine killers used. Similar results were obtained for weight losses due to sprout removal and other causes, except that *Aero Cyanamid dust*-treated tubers had significantly less weight loss from sprout removal than did rotobeat tubers. In the case of other types of weight loss, the earlier the vines were killed the less the weight loss. These results were probably caused by two factors. First, there was a trend toward a slightly longer dormant period in the treated lots,

TABLE 12.—*Influence of several vine-killing treatments applied at different times before harvest on susceptibility of Red Pontiac potatoes to bruising, second and third seasons of tests*

| Application time | Bruising index [1] | | | | |
|---|---|---|---|---|---|
| | Control | Rotobeat | After application of— *Aero Cyanamid dust* (60 lb. per acre) | After application of— Dow General spray (see text, p. 8) | Average |
| Early harvest: | | | | | |
| 1 week: | | | | | |
| Second season | 3.1 | 1.8 | 1.7 | 2.3 | [3] 2.2 |
| Third season [2] | .4 | .3 | .4 | .9 | [3] .5 |
| 2 weeks: | | | | | |
| Second season | ---------- | ---------- | ---------- | ---------- | ---------- |
| Third season [2] | .2 | .2 | .4 | .2 | [3] .2 |
| 3 weeks: | | | | | |
| Second season | 3.7 | 1.4 | 1.5 | .3 | [3] 1.7 |
| Third season [2] | .6 | .1 | .3 | .6 | [3] .4 |
| Average: | | | | | |
| Second season [3] | 3.4 | 1.6 | 1.6 | 1.3 | ---------- |
| Third season [2] | .4 | .2 | .4 | .6 | ---------- |
| Midseason harvest: | | | | | |
| 2 weeks: | | | | | |
| Second season [2] | 1.9 | 1.9 | 1.3 | .7 | [4] 1.4 |
| Third season [2] | 2.7 | 1.2 | 1.2 | 1.8 | [3] 1.7 |
| 3 weeks: | | | | | |
| Second season [2] | .4 | .8 | .7 | .3 | [4] .6 |
| Third season [2] | 2.3 | 1.7 | .6 | 1.2 | [3] 1.4 |
| Average: | | | | | |
| Second season [2] | 1.2 | 1.3 | 1.0 | .5 | ---------- |
| Third season [3] | 2.5 | 1.4 | .9 | 1.5 | ---------- |
| Average of both harvests: [5] | | | | | |
| Second season [2] | 2.1 | 1.1 | 1.1 | .3 | ---------- |
| Third season [2] | 1.4 | .8 | .6 | .8 | ---------- |

[1] Explained in text, p. 7.
[2] Not significantly different.
[3] L.S.D. between treatments at 0.05 level=1.4.
[4] Significantly different at 0.05 level.
[5] Average for the second season for both harvests applies only to treatments applied 3 weeks before harvest; for the third season, to treatments applied 2 and 3 weeks before harvest.
[6] L.S.D. between treatments at 0.05 level=1.1.

TABLE 13.—*Influence of several vine-killing treatments applied at different times before harvest on amount of vascular discoloration in Red Pontiac potatoes, second and third seasons of tests*

| Application time | Amount of vascular discoloration | | | | |
|---|---|---|---|---|---|
| | Control | Rotobeat | After application of— | | Average |
| | | | *Aero Cyanamid dust* (60 lb. per acre) | Dow General spray (see text, p. 8) | |
| Early harvest: | | | | | |
| 1 week: | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| Second season | 5 | 8 | 6 | 8 | 7 |
| Third season [1] | 6 | 7 | 11 | 10 | 8 |
| 2 weeks: | | | | | |
| Second season | ---------- | ---------- | ---------- | ---------- | ---------- |
| Third season [1] | 10 | 12 | 3 | 10 | 9 |
| 3 weeks: | | | | | |
| Second season [2] | 4 | 10 | 4 | 2 | 5 |
| Third season [1] | 5 | 16 | 6 | 30 | 14 |
| Average: | | | | | |
| Second season | 4 | 9 | 5 | 5 | ---------- |
| Third season [3] | 7 | 12 | 7 | 17 | ---------- |
| Midseason harvest: | | | | | |
| 2 weeks: | | | | | |
| Second season | 7 | 18 | 29 | 14 | 17 |
| Third season | 2 | 6 | 10 | 7 | 6 |
| 3 weeks: | | | | | |
| Second season [1] | 12 | 5 | 8 | 6 | 8 |
| Third season | 9 | 9 | 8 | 12 | 10 |
| Average: | | | | | |
| Second season | 10 | 12 | 18 | 10 | ---------- |
| Third season | 6 | 8 | 9 | 10 | ---------- |
| Average of both harvests: [4] | | | | | |
| Second season | 8 | 8 | 6 | 4 | ---------- |
| Third season [5] | 6 | 11 | 7 | 15 | ---------- |

[1] L.S.D. between 2 treatments at 1 time of application at 0.05 level=11.
[2] L.S.D. between 2 treatments at 1 time of application at 0.05 level=6.
[3] L.S.D. between treatments at 0.05 level=7.
[4] Average for the second season for both harvests applies only to treatments applied 3 weeks before harvest; for the third season, to treatments applied 2 and 3 weeks before harvest.
[5] L.S.D. between treatments at 0.05 level=5; at 0.01 level=7.

although the differences failed to be significant. Second, there was less skinning in the treated lots than in the control; skinning is known to be a factor in causing weight loss. The correlation coefficient between percentage of skinning and total weight loss was +0.398. Although this proved to be highly significant, it accounts for only about 16 percent of the variability, and therefore would not be useful for prediction.

TABLE 14.—*Influence of several vine-killing treatments applied three different times before harvest on weight losses due to sprout removal and other weight losses of Red Pontiac potatoes harvested September 16 and stored at an average temperature of 59° F. from September until February 16, in the third season of tests*

| Application time | Weight loss (percent of original tuber weight) | | | | |
|---|---|---|---|---|---|
| | Control | Rotobeat | After application of— | | Average |
| | | | *Aero Cyanamid dust* (60 lb. per acre) | Dow General spray (see text, p. 8) | |
| Harvest: | | | | | |
| 1 week: | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| Sprouts | 2.70 | 2.61 | 1.68 | 2.27 | 2.32 |
| Other | 10.63 | 9.79 | 9.82 | 9.65 | [1] 9.97 |
| Total | 13.33 | 12.40 | 11.50 | 11.92 | 12.29 |
| 2 weeks: | | | | | |
| Sprouts | 2.71 | 2.38 | 2.34 | 1.79 | 2.30 |
| Other | 9.84 | 8.76 | 8.99 | 8.52 | [1] 9.03 |
| Total | 12.55 | 11.14 | 11.33 | 10.31 | 11.33 |
| 3 weeks: | | | | | |
| Sprouts | 2.74 | 2.87 | 2.33 | 2.58 | 2.63 |
| Other | 10.15 | 8.74 | 7.89 | 8.31 | [1] 8.77 |
| Total | 12.89 | 11.61 | 10.22 | 10.89 | 11.40 |
| Average: | | | | | |
| Sprouts [2] | 2.72 | 2.62 | 2.12 | 2.21 | |
| Other [3] | 10.21 | 9.10 | 8.90 | 8.83 | |
| Total [4] | 12.92 | 11.72 | 11.02 | 11.04 | |

[1] L.S.D. between these averages at 0.05 level=0.58; at 0.01 level=0.84.
[2] L.S.D. between treatments at 0.05 level=0.43.
[3] L.S.D. between treatments at 0.05 level=0.58; at 0.01 level=0.78.
[4] L.S.D. between treatments at 0.05 level=0.81; at 0.01 level=1.09.

SPECIFIC GRAVITY.—In the second test season, killing the vines 3 weeks before the early harvest reduced specific gravity slightly, but highly significantly, compared to killing at 1 week (table 15). On the average, killing the vines by any of the three vine killers reduced the specific gravity below that of the control. Rotobeating had the greatest reduction, followed by Dow General, and then *Aero Cyanamid dust*. The differences among treatments were all significant or very nearly significant. A differential response of the vine killers to time of application was noted. Specifically, each of the three vine killers reduced specific gravity below that of the control by about the same amount when applied 1 week before harvest. All three were significantly different from each other when applied 3 weeks before harvest; the more rapid killers gave the greatest reduction.

TABLE 15.—*Influence of several vine-killing treatments applied at different times before harvest on specific gravity of Red Pontiac potatoes, second and third seasons of tests*

| Application time | Specific gravity | | | | |
|---|---|---|---|---|---|
| | Control | Rotobeat | After application of— *Aero Cyanamid dust* (60 lb. per acre) | After application of— Dow General spray (see text, p. 8) | Average |
| **Early harvest:** | | | | | |
| 1 week: | | | | | |
| Second season [1] | 1.0836 | 1.0740 | 1.0751 | 1.0750 | [2] 1.0769 |
| Third season [3] | 1.0754 | 1.0715 | 1.0714 | 1.0730 | [4] 1.0728 |
| 2 weeks: | | | | | |
| Second season | ---------- | ---------- | ---------- | ---------- | ---------- |
| Third season [5] | 1.0744 | 1.0668 | 1.0714 | 1.0677 | [6] 1.0701 |
| 3 weeks: | | | | | |
| Second season [1] | 1.0797 | 1.0650 | 1.0771 | 1.0687 | [2] 1.0726 |
| Third season [5] | 1.0779 | 1.0643 | 1.0674 | 1.0664 | [4] 1.0690 |
| Average: | | | | | |
| Second season [5] | 1.0816 | 1.0695 | 1.0761 | 1.0718 | ---------- |
| Third season [6] | 1.0759 | 1.0675 | 1.0701 | 1.0690 | ---------- |
| **Midseason harvest:** | | | | | |
| Second season [7] | 1.0804 | 1.0781 | 1.0800 | 1.0804 | [8] 1.0797 |
| Third season [9] | 1.0745 | 1.0723 | 1.0718 | 1.0749 | [10] 1.0734 |
| 3 weeks: | | | | | |
| Second season [7] | 1.0820 | 1.0716 | 1.0754 | 1.0735 | [8] 1.0756 |
| Third season [9] | 1.0746 | 1.0681 | 1.0711 | 1.0717 | [10] 1.0714 |
| Average: | | | | | |
| Second season [11] | 1.0812 | 1.0748 | 1.0777 | 1.0770 | ---------- |
| Third season [12] | 1.0746 | 1.0702 | 1.0714 | 1.0733 | ---------- |
| **Average of both harvests:** [13] | | | | | |
| Second season [14] | 1.0808 | 1.0683 | 1.0762 | 1.0711 | ---------- |
| Third season [15] | 1.0754 | 1.0679 | 1.0704 | 1.0702 | ---------- |

[1] L.S.D. between 2 treatments at 1 time of application at 0.05 level=0.0034; at 0.01 level=0.0046.
[2] Significantly different at 0.01 level.
[3] L.S.D. between 2 treatments at 1 time of application at 0.05 level=0.0032; at 0.01 level=0.0043.
[4] L.S.D. between these averages at 0.05 level=0.0030.
[5] L.S.D. between treatments at 0.05 level=0.0024; at 0.01 level=0.0032.
[6] L.S.D. between treatments at 0.05 level=0.0019; at 0.01 level=0.0025.
[7] L.S.D. between 2 treatments at 1 time of application at 0.05 level=0.0037; at 0.01 level=0.0051.
[8] Significantly different at 0.05 level.
[9] L.S.D. between 2 treatments at 1 time of application at 0.05 level=0.0025.
[10] Significantly different at 0.05 level.
[11] L.S.D. between treatments at 0.05 level=0.0026; at 0.01 level=0.0036.
[12] L.S.D. between treatments at 0.05 level=0.0025; at 0.01 level=0.0033.
[13] Average for the second season for both harvests applies only to treatments applied 3 weeks before harvest; for the third season, to treatments applied 2 and 3 weeks before harvest.
[14] L.S.D. between treatments at 0.05 level=0.0021; at 0.01 level=0.0028.
[15] L.S.D. between treatments at 0.05 level=0.0017; at 0.01 level=0.0023.

For the midseason harvest in the second test season, killing the vines 3 weeks before harvest reduced specific gravity slightly, but significantly below those killed 2 weeks before harvest. Although the average effect of the vine killers was significant, the effect was almost entirely confined to the plots killed 3 weeks before harvest; at this time all three vine killers reduced specific gravity highly significantly below that of the control. Rotobeating reduced specific gravity below that of *Aero Cyanamid dust*, but was not significantly different from Dow General. Specific gravity increased slightly as harvest was delayed. The difference, however, just failed to be significant.

Similar results were obtained for the early harvest in the third season, except that data were obtained on vine killing 2 weeks before harvest. Specific gravity was slightly lower the earlier the vines were killed. The average difference between killing at 1 and 3 weeks before harvest for all treatments was significant, but differences between 1 and 2 and 2 and 3 weeks were not significant. These results were largely a result of the masking effect of the control, which was variable between time of application even though not treated, and *Aero Cyanamid dust*, which gave a poor kill when applied 2 weeks before harvest. The interaction between vine killers and time of application showed that, with the exception of Dow General applied 1 week before harvest, those treatments which resulted in a satisfactory kill of the vines reduced specific gravity significantly below that of the control.

Specific gravity of the early harvested lots was slightly, but significantly, lower than those harvested at midseason. Killing the vines 3 weeks before harvest also reduced specific gravity slightly, but significantly, below those killed 2 weeks before harvest. All three vine killers reduced specific gravity below that of the control. Rotobeating resulted in significantly lower specific gravity than *Aero Cyanamid dust* and Dow General spray, but there was no significant difference between the latter two treatments.

There was a highly significant interaction between dates of harvest and vine killers, and a significant interaction between times of application and vine killers. Considering the first interaction, all four treatments were significantly different from each other at the early harvest; at the midseason harvest Dow General was not significantly different from the control. In the case of the second interaction, all three vine killers reduced specific gravity below that of the control when they were applied 2 weeks before harvest; there was no significant difference among the three vine killers. When the vine killers were applied 3 weeks before harvest, not only did they reduce specific gravity significantly below that of the control, but rotobeating resulted in lower specific gravity than *Aero Cyanamid dust* or Dow General.

In both years, changes in specific gravity were related to rate of kill; the more rapid and complete killing agents gave the greatest reduction in specific gravity. The relationship between these two variates was not close, as shown by correlation coefficients of $-0.505$ for the second season and $-0.601$ for the third season. Although both of these coefficients proved significant at the 0.01 level, they represent only about 25 and 36 percent, respectively, of the variation in the two variables that was concomitant or simultaneous, and therefore could not be used for prediction purposes.

## EFFECT OF GREENSPROUTING AND TIME OF VINE KILLING ON YIELDS, MATURITY, AND INTERNAL DISCOLORATION

### Procedure

This experiment was a 3 x 4 factorial consisting of three preplanting treatments, four different killing dates, and six replications. The preplanting treatments consisted of (1) the control kept in a relatively unsprouted condition at 40° F. until planted, (2) greensprouted (presprouted in the light) in diffuse light at room temperature for 2 to 3 weeks, and (3) sprouted in the dark at room temperature for 2 to 3 weeks. The potatoes were grown during 3 years near the same location on soils of the Fargo-Bearden series, that are typical of the better soils of the Red River Valley of Minnesota-North Dakota. The Triumph variety was used in the first season, the Pontiac variety in the second season, the Red Pontiac variety in the third season. Plot size was 2 rows, 25 feet long and 38 inches apart, in the first season. The length of the plots was increased to 40 feet in the second and third seasons. Two-hundred to two-hundred-fifty pounds of 4–24–12 fertilizer was applied at planting time, in bands in the row, slightly below and to each side of the seed piece. Stand counts were made at appropriate intervals after planting, to detect any effect of the preplanting treatments on rate of emergence. Cultural operations were typical of good commercial practice for the area. The vines in all treatments, including the control, were killed by rotobeating 1 day, and 2, 4, and 6 weeks before harvest. The potatoes were dug, handled, and stored as described earlier in this report. Planting and harvest dates were:

| Season | Planted | Harvested |
|---|---|---|
| First | June 10 | Oct. 12 |
| Second | May 21 | Oct. 5 |
| Third | May 13 | Oct. 2 |

### Results and Discussion

Rate of Emergence.—In all three seasons the plants from greensprouted seed came up first, followed closely by those from seed sprouted in the dark, and the controls last (figure 3). The probable reason for the slower emergence of the potatoes sprouted in the dark, compared with those greensprouted, is that some of the sprouts on the former were undoubtedly broken off during cutting, handling, and planting (the sprouts on the tubers sprouted in the dark were much longer and less sturdy than those on the greensprouted tubers). Considerable variation in plant size was observed 8 weeks after planting in the plots planted with seed sprouted in the dark, compared with those greensprouted. Subsequent plant growth, as measured by increase in

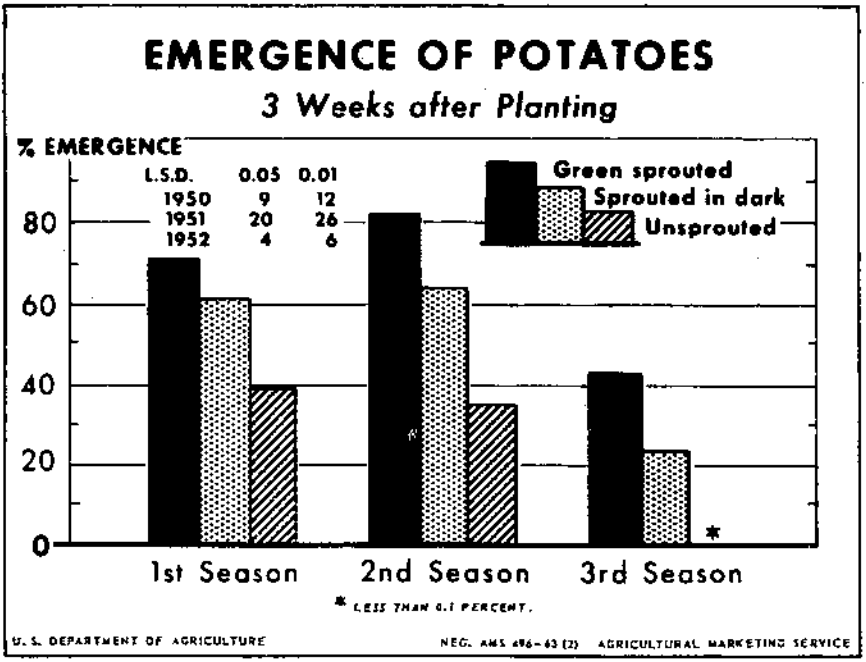


FIGURE 3

plant height (figure 4), and attainment of the blossom stage was in order of emergence but the difference between treatments gradually decreased; by the second week in August there was little visible difference between the treatments. The slower come-up in the second season was due to the earlier planting date and resultant lower soil temperatures during the first week after planting.

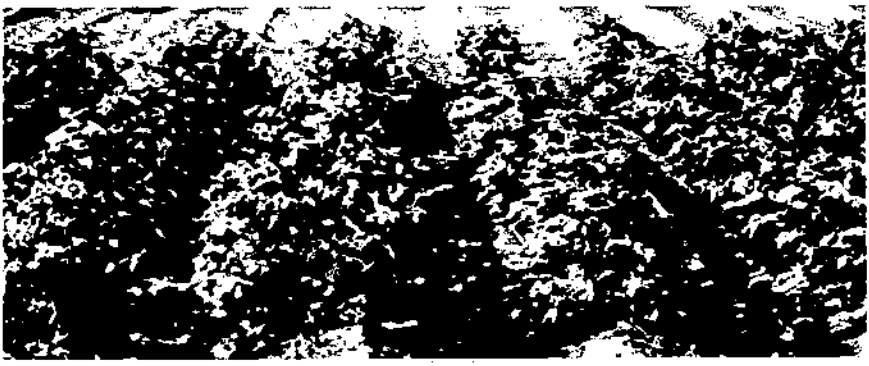

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FIGURE 4.—Size of plants from greensprouted (left) and control (right) seed potatoes July 9, third season of tests.

YIELD.—In the first season, with the Triumph variety, the yield from seed sprouted in the dark was significantly higher than the other two treatments (table 16). There was no perceptible difference between the other two treatments. In the second season, with the Pontiac variety, greensprouting resulted in highly significantly higher yields than sprouting in the dark or the control. There was no significant difference between the latter two treatments. Somewhat similar results were obtained in the third season, except that the difference between the greensprouted lots and the control just failed to be significant. Killing the vines 6 weeks before harvest reduced yields significantly in 3 years by as much as 75 cwt. There was a trend toward reduced yields when the vines were killed 4 weeks before harvest, although the difference was significant only with the Triumph variety in the first season. In 3 years there was no interaction between preplanting treatments and time of vine killing. These data indicate that there is little change in yield after the first week in September but there can be substantial increases in yield during the latter part of August.

SIZE OF TUBERS.—The average size of the tubers, calculated from counts of the number of tubers in a 25-pound sample, is shown in table 17. The preplanting treatments had no effect on tuber size in the first or second seasons but in the third, sprouting in the dark resulted in a slight but significant increase in tuber size, compared with greensprouting. The cause of this effect remains obscure. In 3 years, killing vines as much as 4 weeks before harvest failed to significantly affect the average size of the tubers, but killing 6 weeks before harvest reduced the average weight of the tubers by more than 1.5 ounces.

SKINNING.—In the first season, with the Triumph variety, the preplanting treatments had no effect on susceptibility to skinning (table 18). In both the second and third seasons, with Pontiacs, skinning was very low but greensprouted tubers had significantly less skinning than the control and, in the second season, less than tubers sprouted in the dark. A partial explanation of these results is that the growing season (the number of days between emergence and killing frost) was about 10 days shorter in the first season than in the second and third seasons. The plants which emerged earliest in the first season did not have sufficient time to reach natural maturity. This is further supported by the fact that the small amount of skinning which occurred in the second and third seasons indicates that the normal maturing process was well along before the plots were harvested.

The longer the interval between vine killing of Triumph potato vines and harvest, the greater the reduction in skinning. Killing the vines 6 weeks before harvest brought about a highly significant decrease, compared with 4 weeks. The difference between 4 and 2 weeks was slight but significant; the difference between 2 weeks and 1 day just failed to be significant.

Similar results were obtained in the second and third seasons with Pontiacs, except that the difference between 6 and 4 weeks was not significant. There was no interaction between the preplanting treatments and time of vine killing.

BRUISING.—The preplanting treatments had no significant effect on susceptibility to bruising in any of the first 3 years. In the first season, killing the Triumph variety vines 2 weeks before harvest had no effect on susceptibility to bruising (table 19), but killing 4 and 6 weeks before harvest reduced susceptibility to bruising progressively. Bruising

TABLE 16.—*Effect of preplanting treatments and date of vine killing on total yield of potatoes, first, second, and third seasons of tests*

| Treatment | Total yield per acre | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Time vines killed before harvest | | | | | | | | | | | | Average | | |
| | 1 day | | | 2 weeks | | | 4 weeks | | | 6 weeks | | | | | |
| | First season | Second season | Third season | First season | Second season | Third season | First season | Second season | Third season | First season | Second season | Third season | First [1] season | Second [2] season | Third [3] season |
| | *Cwt.* | *Cwt.* | *Cwt.* | *Cwt.* | *Cwt.* | *Cwt.* | *Cwt.* | *Cwt.* | *Cwt.* | *Cwt.* | *Cwt.* | *Cwt.* | *Cwt.* | *Cwt.* | *Cwt.* |
| Control | 222 | 207 | 134 | 197 | 194 | 132 | 220 | 207 | 130 | 155 | 127 | 99 | 198 | 184 | 124 |
| Greensprouted | 202 | 235 | 129 | 227 | 228 | 145 | 200 | 218 | 132 | 155 | 164 | 112 | 196 | 211 | 130 |
| Sprouted in dark | 230 | 199 | 120 | 248 | 213 | 130 | 208 | 193 | 127 | 167 | 127 | 94 | 213 | 183 | 118 |
| Average | [4] 218 | [5] 214 | [6] 128 | [4] 224 | [5] 212 | [6] 136 | [4] 209 | [5] 206 | [6] 130 | [4] 159 | [5] 139 | [6] 102 | ------- | ------- | ------- |

[1] L.S.D. between treatments at 0.05 level=13.
[2] L.S.D. between treatments at 0.05 level=13; at 0.01 level =18.
[3] L.S.D. between treatments at 0.05 level=7; at 0.01 level=10.
[4] L.S.D. between averages at 0.05 level=15; at 0.01 level=20.
[5] L.S.D. between averages at 0.05 level=16; at 0.01 level=21.
[6] L.S.D. between averages at 0.05 level=9; at 0.01 level=11.

TABLE 17.—*Effect of preplanting treatments and date of vine killing on size of potato tubers, first, second, and third seasons of tests*

| Treatment | Average weight of tubers | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Time vines killed before harvest | | | | | | | | | | | | Average | | |
| | 1 day | | | 2 weeks | | | 4 weeks | | | 6 weeks | | | | | |
| | First season | Second season | Third season | First season | Second season | Third season | First season | Second season | Third season | First season | Second season | Third season | First [1] season | Second [2] season | Third [1] season |
| | *Ounces* | *Ounces* | *Ounces* | *Ounces* | *Ounces* | *Ounces* | *Ounces* | *Ounces* | *Ounces* | *Ounces* | *Ounces* | *Ounces* | *Ounces* | *Ounces* | *Ounces* |
| Control | 7.1 | 6.3 | 9.2 | 6.9 | 6.1 | 8.6 | 7.3 | 6.7 | 8.6 | 4.9 | 4.9 | 7.1 | 6.6 | 6.0 | 8.4 |
| Greensprouted | 7.3 | 6.3 | 8.2 | 6.7 | 6.0 | 9.2 | 6.9 | 6.2 | 9.0 | 5.6 | 4.6 | 7.2 | 6.6 | 5.8 | 8.4 |
| Sprouted in dark | 7.0 | 7.1 | 9.1 | 7.4 | 6.7 | 8.7 | 6.6 | 6.6 | 8.4 | 5.6 | 4.9 | 7.1 | 6.6 | 6.3 | 8.3 |
| Average | [3] 7.1 | [4] 6.6 | [5] 8.8 | [3] 7.0 | [4] 6.3 | [5] 8.8 | [3] 6.9 | [4] 6.5 | [5] 8.7 | [3] 5.4 | [4] 4.8 | [5] 7.1 | ------- | ------- | ------- |

[1] Not significantly different.
[2] L.S.D. between treatments at 0.05 level=0.4; at 0.01 level =0.5.
[3] L.S.D. between averages at 0.05 level=0.4; at 0.01 level=0.6.
[4] L.S.D. between averages at 0.05 level=0.4; at 0.01 level=0.6.
[5] L.S.D. between averages at 0.05 level=0.7; at 0.01 level=0.9.

TABLE 18.—*Effect of preplanting treatments and date of vine killing on skinning of potato tubers, first, second, and third seasons of tests*

| Treatment | Percent skinning | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Time killed before harvest | | | | | | | | | | | | Average | | |
| | 1 day | | | 2 weeks | | | 4 weeks | | | 6 weeks | | | | | |
| | First season | Second season | Third season | First season | Second season | Third season | First season | Second season | Third season | First season | Second season | Third season | First [1] season | Second [2] season | Third [3] season |
| | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| Control | 25 | 8 | 4 | 21 | 9 | 7 | 17 | 2 | 3 | 5 | 1 | 1 | 17 | 5 | 4 |
| Greensprouted | 28 | 4 | 4 | 22 | 3 | 4 | 17 | 1 | 2 | 4 | 1 | 1 | 18 | 2 | 3 |
| Sprouted in dark | 20 | 7 | 4 | 21 | 8 | 2 | 18 | 2 | 1 | 4 | 1 | 1 | 16 | 4 | 2 |
| Average | [4] 24 | [5] 6 | [6] 4 | [4] 21 | [5] 7 | [6] 4 | [4] 17 | [5] 2 | [6] 2 | [4] 4 | [5] 1 | [6] 1 | ------- | ------- | ------- |

[1] Not significantly different.
[2] L.S.D. between treatments at 0.05 level=2.
[3] L.S.D. between treatments at 0.05 level=1; at 0.01 level=2.
[4] L.S.D. between averages at 0.05 level=4; at 0.01 level=5.
[5] L.S.D. between averages at 0.05 level=2; at 0.01 level=3.
[6] L.S.D. between averages at 0.05 level=1; at 0.01 level=2.

TABLE 19.—*Effect of preplanting treatments and date of vine killing on bruising of Triumph potatoes, first season of tests*

| Treatment | Bruising index | | | | |
|---|---|---|---|---|---|
| | Time killed before harvest | | | | Average [1] |
| | 1 day | 2 weeks | 4 weeks | 6 weeks | |
| Control | 8.2 | 11.6 | 3.0 | 1.2 | 6.0 |
| Greensprouted | 9.5 | 7.3 | 5.1 | 2.0 | 6.0 |
| Sprouted in dark | 10.1 | 9.2 | 4.9 | 1.8 | 6.5 |
| Average [2] | 9.3 | 9.4 | 4.3 | 1.7 | |

[1] Not significantly different.
[2] L.S.D. between treatments at 0.05 level=1.9; 0.01 level=2.6.

at 6 weeks was less than one-half that of 4 weeks, as measured by the bruising index described on page 7. In the second and third seasons there was a trend toward less bruising the longer the Pontiac vines were killed before harvest, but the differences between treatments in both years just failed to be significant at the 5 percent level.

There was no interaction between the preplanting treatments and the time the vines were killed before harvest in any of the first 3 years.

The difference in the results in the first, compared to the second and third seasons, is due in part to the fact that in the latter 2 years the potatoes had already matured naturally to a considerable extent before harvest, which masked the treatment effect.

DECAY.—In any evaluation of bruising susceptibility, decay must be considered, because any break in the periderm allows the entrance of decay-producing organisms. The only year in which decay was significant was in the first season, with the Triumph variety (table 20). In that year, killing the vines 1 day before harvest significantly increased the incidence of decay (almost exclusively fusarium decay following bruising) over that from plots killed 2, 4, and 6 weeks before harvest. As was the case with bruising, the preplanting treatments had no effect on decay nor was there any interaction between these treatments and time of vine killing. In the second season, with the Pontiac variety, there was a trend towards less decay in the plots killed 4 and 6 weeks before harvest than in those killed 2 weeks and 1 day before harvest but the difference was not significant. In the third season there was practically no decay.

VASCULAR DISCOLORATION.—In the first season, with the Triumph variety, there was not sufficient vascular (xylem) discoloration to permit an evaluation of any treatment effect. Considering the average effect, killing the vines 4 weeks before the second season's harvest resulted in highly significantly less internal discoloration than any other time (table 21). When the vines were killed 2 weeks before harvest, significantly less discoloration occurred in lots that received preplanting treatments than the control. When killed 1 day before harvest, the control contained sig-

TABLE 20.—*Effect of preplanting treatments and date of vine killing on decay of Triumph potatoes, first season of tests*

| Treatment | Percentage of decay | | | | |
|---|---|---|---|---|---|
| | Time killed before harvest | | | | Average [1] |
| | 1 day | 2 weeks | 4 weeks | 6 weeks | |
| | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| Control | 5.2 | 2.5 | 2.3 | 0.7 | 2.7 |
| Greensprouted | 5.4 | 3.7 | 2.4 | .4 | 3.0 |
| Sprouted in dark | 4.2 | 1.7 | 2.3 | 1.8 | 2.5 |
| Average [2] | 4.9 | 2.6 | 2.3 | 1.0 | |

[1] Not significantly different.
[2] L.S.D. between treatments at 0.05 level=2.0; at 0.01 level=2.6.

nificantly less discoloration than those sprouted in the dark.

In the third season, killing the vines 6 weeks before harvest significantly increased the amount of discoloration over those killed at any other time. The preplanting treatments had no significant effect on discoloration nor was there any interaction between this factor and the time of vine killing.

These data indicate that the date on which the vines are killed, as well as the stage of development of the plant, are factors influencing the amount of discoloration. The data do not reveal just when they are most susceptible.

SPECIFIC GRAVITY.—In general, killing the vines more than 2 weeks before harvest tended to reduce specific gravity progressively in the first 3 years. The greatest change took place between 6 and 4 weeks (table 22). In the first season, with the Triumph variety, and in the third season, with the Red Pontiac variety, the differences between 6 and 4 weeks and 4 and 2 weeks were highly significant. Although the results in the second season, with the Pontiac variety, were somewhat similar, the differences between 6 weeks and each of the other killing dates were the only ones that proved to be significant.

There was no main effect of the preplanting treatments in the first 3 years but there was a significant interaction between preplanting treatment and time of vine killing in the first season. Specifically, when the vines were killed 6 weeks before harvest, both greensprouting and sprouting in the dark resulted in significantly higher specific gravity than the control. The same trend was evident when the vines were killed at 4 weeks and 2 weeks, but the differences in most cases were small and failed to be significant. In contrast, when the vines were killed 1 day before harvest, both the control and sprouting in the dark resulted in a higher specific gravity than greensprouting and the difference proved highly significant. Apparently, the greensprouted lots reached their maximum specific gravity about 2 weeks before harvest and then decreased. This phenomenon is known to occur under certain conditions. The specific gravity of the lots sprouted in the dark and the control continued to increase until harvested.

TABLE 21.—*Effect of preplanting treatments and date of vine killing on vascular discoloration of potatoes, second and third seasons of tests*

| Treatment | Amount of vascular discoloration | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Time killed before harvest | | | | | | | | Average | |
| | 1 day | | 2 weeks | | 4 weeks | | 6 weeks | | | |
| | Second [1] season | Third season | Second [1] season | Third season | Second [1] season | Third season | Second [1] season | Third season | Second [2] season | Third [2] season |
| | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| Control | 11 | 12 | 26 | 13 | 11 | 9 | 18 | 21 | 16 | 14 |
| Greensprouted | 15 | 12 | 14 | 11 | 5 | 14 | 17 | 18 | 13 | 14 |
| Sprouted in dark | 19 | 7 | 17 | 7 | 9 | 18 | 23 | 24 | 17 | 14 |
| Average | [3] 15 | [4] 10 | [3] 19 | [4] 10 | [3] 8 | [4] 14 | [3] 19 | [4] 21 | -------- | -------- |

[1] L.S.D. between treatments at 0.05 level=8.
[2] Not significantly different.
[3] L.S.D. between averages at 0.05 level=4; at 0.01 level=6.
[4] L.S.D. between averages at 0.05 level=5; at 0.01 level=6.

TABLE 22.—*Effect of preplanting treatments and date of vine killing on specific gravity of potatoes, first, second, and third seasons of tests*

| Treatment | Specific gravity | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Time killed before harvest | | | | | | | | | | | | Average | | |
| | 1 day | | | 2 weeks | | | 4 weeks | | | 6 weeks | | | | | |
| | First [1] season | Second season | Third season | First [1] season | Second season | Third season | First [1] season | Second season | Third season | First [1] season | Second season | Third season | First [2] season | Second [2] season | Third [2] season |
| Control | 1.0818 | 1.0788 | 1.0792 | 1.0789 | 1.0799 | 1.0778 | 1.0764 | 1.0778 | 1.0753 | 1.0662 | 1.0666 | 1.0659 | 1.0758 | 1.0758 | 1.0749 |
| Greensprouted | 1.0772 | 1.0790 | 1.0806 | 1.0807 | 1.0814 | 1.0779 | 1.0775 | 1.0810 | 1.0751 | 1.0689 | 1.0718 | 1.0694 | 1.0781 | 1.0753 | 1.0748 |
| Sprouted in dark | 1.0814 | 1.0781 | 1.0774 | 1.0790 | 1.0785 | 1.0792 | 1.0782 | 1.0777 | 1.0767 | 1.0701 | 1.0677 | 1.0678 | 1.0772 | 1.0755 | 1.0768 |
| Average | [3] 1.0801 | [4] 1.0786 | [3] 1.0791 | [3] 1.0795 | [4] 1.0799 | [3] 1.0783 | [3] 1.0774 | [4] 1.0788 | [3] 1.0757 | [3] 1.0684 | [4] 1.0688 | [3] 1.0677 | | | |

[1] L.S.D. between treatments at 0.05 level=0.0027; at 0.01 level=0.0036.
[2] Not significantly different.
[3] L.S.D. between averages at 0.05 level=0.0016; at 0.01 level=0.0021.
[4] L.S.D. between averages at 0.05 level=0.0030; at 0.01 level=0.0041.
[5] L.S.D. between averages at 0.05 level=0.0015; at 0.01 level=0.0020.

# EFFECT OF SEVERAL DIFFERENT VINE-KILLING METHODS ON EFFICIENCY OF KILL

## Procedure

This experiment was of the randomized block design, consisting of between 14 and 37 different killing agents applied to the Red Pontiac variety, grown on soils of the Fargo-Bearden series. Since the experiment was of a preliminary nature, the treatments were unreplicated in the second season, but in the third season, three replications were used. Plot size was two rows, 34 feet long and 38 inches apart, in the second season and in one of the experiments in the third season. In the other experiment in the third season, a single row was used. In all three experiments, untreated guard rows were left between plots to preclude any border effect on adjacent plots. The potatoes were planted on May 23 in the second season, and May 19 in the third season. Fertilization and cultural operations performed on the plots were the same as those described for the previous experiment. All spray treatments were made with a hand sprayer; dust treatments were applied with the special self-propelled precision duster described earlier. Rotobeating was accomplished with a Humboldt Stalk Cutter. The treatments were applied on both September 7 and 18 in the second season, and on September 8 in the first, and September 15, in the second experiment in the third season. Data were not obtained on yield, skinning, bruising, and internal discoloration in these experiments, because it was felt that sufficient data on these variates had already been obtained from other experiments.

## Results and Discussion:

### Rate of Kill

Where possible an estimate of the percentage of dead foliage was made 1 and 7 days after the treatments were applied. In the second season, very nearly complete destruction of the vines (table 23) was achieved by: Pulling or cutting the vines; and rotobeating; spraying the vines with 1.5 gallons of Penite 6, plus 6 pounds of *pentachlorophenol* in 6 gallons of diesel oil, applied in 125 gallons of water per acre (high-gallonage rate). Of the other treatments applied at the high-gallonage rate Dow General at 2 pints per acre, Penite 6 at 1.5 gallons, *pentachlorophenol* at 6 pounds, and *Aero Cyanate* at 24 pounds killed the vines nearly as rapidly. *Ammonium sulfate* at 200 pounds and *Aero Cyanate* at 12 pounds also gave a satisfactory kill at the high-gallonage rate.

Satisfactory kills were also obtained with Penite 6, Dow General, and *Aero Cyanate*, applied in as little as 15 gallons of water per acre (low-gallonage rate). These treatments were only slightly less effective than the high-gallonage rates. With such low-gallonage applications, the use of equipment that would provide complete coverage of the vines with finely divided droplets appeared to be essential to obtain a good kill. Low gallonage offers the advantages of using the small amounts of water and equipment used for weed control in small grains. Reducing the amount of Dow General by one-half had little noticeable effect on the rate of kill; there was a slightly slower kill with *Aero Cyanate* and Penite 6 at the lower rate of application. The addition of a wetting agent with

TABLE 23.—*Effect of several different vine-killing treatments on rate of kill of Red Pontiac potatoes, second season of tests*

| Treatment [1] | Concentration used | Quantity per acre | Percent dead foliage 1 and 7 days after application on— | | |
|---|---|---|---|---|---|
| | | | Sept. 7 | | Sept. 18 |
| | | | 1 day | 7 days | 1 day |
| | | | *Pct.* | *Pct.* | *Pct.* |
| *Aero Cyanate* | 12 lb. of 91 percent *potassium cyanate* + NNO [2] per 125 gal. water. | 125 gal. | 80 | 90 | 90 |
| Do | 24 lb. + NNO [2] per 125 gal. water. | 125 gal. | 90 | 95 | 95 |
| Do | 12 lb. + NNO [2] per 15 gal. water. | 15 gal. | 80 | 85 | 40 |
| Do | 24 lb. + NNO [2] per 15 gal. water. | 15 gal. | 90 | 90 | 75 |
| *Aero Cyanamid* | 57 percent *calcium cyanamide.* | 60 lb. | 20 | 90 | 70 |
| *Aero Sodium Cyanamid.* | 27 percent *monosodium cyanamide.* | 35 lb. | 20 | 80 | 30 |
| Do | do | 50 lb. | 20 | 80 | 30 |
| Do | do | 75 lb. | 30 | 85 | 30 |
| *Ammonium sulfate* | 200 lb. per 125 gal. water. | 125 gal. | 85 | 90 | 80 |
| *Copper sulfate + sodium chloride.* | 10 lb. each per 125 gal. water. | 125 gal. | 20 | 40 | 30 |
| *Dow Delfoliant* | 6 lb. of 85-percent *sodium monochloroacetate* + 0.1 gal. kerosene + emulsifier [3] per 15 gal. water. | 15 gal. | ------ | ------ | 30 |
| Do | 8 lb. of 85-percent *sodium monochloroacetate* + 0.1 gal. kerosene and emulsifier [3] per 15 gal. water. | 15 gal. | ------ | ------ | 30 |
| Do | 6 lb. of 85-percent *sodium monochloroacetate* + NNO [2] per 15 gal. water. | 15 gal. | ------ | ------ | 30 |
| Do | 8 lb. of 85-percent *monochloroacetate* + NNO [2] per 15 gal. water. | 15 gal. | ------ | ------ | 30 |
| Dow General | 2 pt. of 55-percent dinitro-otho-sec.-butylphenol + 2 gal. diesel oil + 2 lb. aluminum sulfate per 125 gal. water. | 125 gal. | 95 | 95 | 99 |
| Do | 2 pt. of 55-percent dinitro-ortho-sec.-butylphenol + 2 gal. diesel oil + 2 lb. aluminum sulfate per 15 gal. water. | 15 gal. | 85 | 85 | 90 |

See footnotes at end of table.

TABLE 23.—*Effect of several different vine-killing treatments on rate of kill of Red Pontiac potatoes, second season of tests*—Continued

| Treatment [1] | Concentration used | Quantity per acre | Percent dead foliage 1 and 7 days after application on— | | |
|---|---|---|---|---|---|
| | | | Sept. 7 | | Sept. 18 |
| | | | 1 day | 7 days | 1 day |
| | | | *Pct.* | *Pct.* | *Pct.* |
| Dow General | 1 pt. of 55-percent dinitro-ortho-sec.-butylphenol + 1 gal. diesel oil + 1 lb. aluminum sulfate + NNO [2] per 15 gal. water. | 15 gal. | 85 | 85 | 85 |
| Do | 1 pt. of 55-percent dinitro-ortho-sec.-butylphenol + 1 gal. diesel oil + 1 lb. aluminum sulfate per 15 gal. water. | 15 gal. | 85 | 90 | 85 |
| *Goodrite n.i.x* | 15 lb. of 91-percent *sodium isopropyl xanthate* per 125 gal. water. | 125 gal. | 30 | 75 | 35 |
| Do | 20 lb. of 91-percent *sodium isopropyl xanthate* per 125 gal. water. | 125 gal. | 40 | 80 | 40 |
| *MCP* [4] | 1 lb.[3] per 40 gal. water | 40 gal. | 10 | 25 | 20 |
| *N-1 naphthal phthalmic acid.* | 2.4 lb. per 125 gal. water | 125 gal. | 10 | 20 | 25 |
| Do | 4.8 lb. per 125 gal. water | 125 gal. | 10 | 20 | 30 |
| Do | 9.6 lb. per 125 gal. water | 125 gal. | 15 | 25 | 25 |
| Penite 6 | 1.5 gal. of 70.4-percent sodium meta arsenite per 125 gal. water. | 125 gal. | 90 | 99 | 99 |
| Do | 1.5 gal. of 70.4-percent sodium meta arsenite per 15 gal. water. | 15 gal. | 90 | 95 | 85 |
| Do | 3 qt. of 70.4-percent sodium meta arsenite + NNO [2] per 15 gal. water. | 15 gal. | 85 | 90 | 80 |
| Do | 3 qt. of 70.4-percent sodium meta arsenite per 15 gal. water. | 15 gal. | 85 | 95 | 85 |
| Penite 6 + *pentachlorophenol.* | 1.5 gal. of 70.4-percent sodium meta arsenite + 6 lb. *pentachlorophenol* + 6 gal. diesel oil + emulsifier [5] per 125 gal. water. | 125 gal. | 99 | 100 | 99 |
| *Pentachlorophenol* | 6 lb. + 6 gal. diesel oil + emulsifier [5] per 125 gal. water. | 125 gal. | 90 | 95 | 95 |
| Sinox Dust B | 8-percent dinitro-ortho-sec.-butylphenol. | 25 lbs. | 20 | 30 | 25 |
| *2,4-D* [7] | 1 lb.[3] per 40 gal. water | 40 gal. | 10 | 25 | 20 |

See footnotes at end of table.

TABLE 23.—*Effect of several different vine-killing treatments on rate of kill of Red Pontiac potatoes, second season of tests*—Continued

| Treatment [1] | Concentration used | Quantity per acre | Percent dead foliage 1 and 7 days after application on— | | |
|---|---|---|---|---|---|
| | | | Sept. 7 | | Sept. 18 |
| | | | 1 day | 7 days | 1 day |
| | | | *Pct.* | *Pct.* | *Pct.* |
| Roots pruned | | | 10 | 25 | 35 |
| Rotobeat | | | 99 | 99 | 99 |
| Rotobeat light | | | 90 | 90 | 75 |
| Vines cut | | | 99 | 100 | 100 |
| Vines pulled | | | 100 | 100 | 100 |
| Control [8] | | | 10 | 20 | 25 |

[1] Chemicals in italic have not been registered as potato vine killers, and may not be used as such on potatoes for food, feed, or seed, except as indicated on the inside cover.
[2] An Atlas wetting agent added at the rate of 1:2,400.
[3] 4-percent Titron x–155 and 3-percent Titron B–1956.
[4] *Sodium 2-methyl 4-chlorophenoxacetate.*
[5] Acid equivalent.
[6] 2-percent Monsanto Emulsifier R.
[7] *Sodium 2,4-dichlorophenoxacetate.*
[8] Rotobeat 1 day before harvest.

Dow General or Penite 6 had little perceptible effect on rate of kill.

*Aero Cyanamid dust* at 60 pounds and *Aero Sodium Cyanate dust* at 75 pounds resulted in slow, but finally satisfactory, kills.

Inadequate kills were obtained with *copper sulfate plus sodium chloride, Goodrite n.i.x., 2,4-D, MCP, N–1 naphthal phthalamic acid* sprays, Sinox Dust B, and root pruning. The data on *Dow Defoliant* were too limited in this test to permit its evaluation as a vine killer.

In most instances, the rate of kill appeared to be faster when applied on September 18 than on September 7. However, because a killing frost arrived before the estimate of amount of dead foliage 7 days after application was to be made, a more complete evaluation was not possible.

In the third season, some of the materials that gave unsatisfactory kills the year before were dropped and some new materials added. Primary emphasis was placed on spray materials that could be applied at the low-gallonage rate, because such methods could be more readily adapted by growers, using, of course only the chemicals that are registered for this purpose.

When applied September 8, vine pulling and vine cutting resulted in almost complete defoliation, followed closely by Dow General at 2 pints, and Penite 6 at both 0.8 and 1.5 gallons at either high or low gallonage (table 24). Slower, but finally satisfactory, kills were obtained with *Dow H916* at both 0.5 and 1 gallon, *Endothal 4060* at 1 or 2 gallons, *Aero Cyanate* at 24 pounds, and *Dow Defoliant* at 8 pounds, applied at low gallonage.

TABLE 24.—*Effect of several different vine-killing treatments on rate of kill of Red Pontiac potatoes, third season of tests*

| Treatment [1] | Concentration used | Quantity per acre | Percent dead foliage 1 and 7 days after application on Sept. 8 | |
|---|---|---|---|---|
| | | | 1 day [2] | 7 days [2] |
| | | *Gal.* | *Pct.* | *Pct.* |
| *Aero Cyanate* | 12 lb. of 91-percent *potassium cyanate* + NNO [4] per 15 gal. water. | 15 | 37 | 80 |
| Do | 24 lb. of 91-percent *potassium cyanate* + NNO [4] per 15 gal. water. | 15 | 72 | 85 |
| *CMU* [5] | 2 lb. per 15 gal. water | 15 | 17 | 28 |
| Do | 4 lb. per 15 gal. water | 15 | 17 | 45 |
| *Dow Defoliant* | 6 lb. of 85-percent *sodium monochloroacetate* + NNO [4] per 15 gal. water. | 15 | 33 | 68 |
| Do | 8 lb. of 85-percent *sodium monochloroacetate* + NNO [4] per 15 gal. water. | 15 | 38 | 85 |
| Dow General | 2 pt. of 55-percent dinitro-ortho-sec.-butylphenol + 2 gal. diesel oil + 2 lb. aluminum sulfate per 125 gal. water. | 125 | 88 | 96 |
| Do | 1 pt. of 55-percent dinitro-ortho-sec.-butylphenol + 1 gal. diesel oil + 1 lb. aluminum sulfate per 15 gal. water. | 15 | 72 | 78 |
| Do | 2 pt. of 55-percent dinitro-ortho-sec.-butylphenol + 2 gal. diesel oil + 2 lb. aluminum sulfate per 15 gal. water. | 15 | 90 | 97 |
| *Dow H 916* | 0.5 gal. of 40-percent *pentachlorophenol* + emulsifier [6] per 15 gal. water. | 15 | 58 | 90 |
| Do | 1 gal. of 40-percent *pentachorophenol* + emulsifier [6] per 15 gal. water. | 15 | 70 | 95 |
| *Endothal 4069* | 1 gal. of 67-percent *disodium salt of 3,6-endoxy hexahydrophthalic acid* + wetting agent [7] per 15 gal. water. | 15 | 53 | 90 |
| Do | 2 gal. of 67-percent *disodium salt of 3,6-endoxy hexahydrophthalic acid* + wetting agent [7] per 15 gal. water. | 15 | 60 | 90 |
| Penite 6 | 1.5 gal. of 70.4-percent sodium meta arsenite per 125 gal. water. | 125 | 80 | 98 |
| Do | 0.8 gal. of 70.4-percent sodium meta arsenite per 15 gal. water. | 15 | 75 | 96 |

See footnotes at end of table.

TABLE 24.—*Effect of several different vine-killing treatments on rate of kill of Red Pontiac potatoes, third season of tests*—Continued

| Treatment [1] | Concentration used | Quantity per acre | Percent dead foliage 1 and 7 days after application on Sept. 8 | |
|---|---|---|---|---|
| | | | 1 day [2] | 7 days [3] |
| | | *Gal.* | *Pct.* | *Pct.* |
| Penite 6 | 1.5 gal. of 70.4-percent sodium meta arsenite per 15 gal. water. | 15 | 73 | 98 |
| Roots pruned | | | 23 | 35 |
| Vines cut | | | 99 | 100 |
| Vines pulled | | | 100 | 100 |
| Control [8] | | | 17 | 25 |

[1] Chemicals in italic have not been registered as potato vine killers, and may not be used as such on potatoes for food, feed, or seed, except as indicated on the inside cover.
[2] L.S.D. between treatments at 0.05 level=14; at 0.01 level=19.
[3] L.S.D. between treatments at 0.05 level=18; at 0.01 level=23.
[4] An Atlas wetting agent added at the rate of 1:2,400.
[5] Wettable powder of *3-(p-chlorophenyl)-1, 1-dimethylurea.*
[6] 2-percent Monsanto Emulsifier R.
[7] 0.5-percent Sharples Nonic 218.
[8] Rotobeat 1 day before harvest.

Inadequate kills were obtained by root pruning, *CMU*, *Dow Defoliant* at 1 pint, and *Aero Cyanate* at 12 pounds.

When applied September 15, somewhat similar results were obtained, except that Dow General at 1 pint and *Aero Cyanate* at 12 pounds gave satisfactory kills. As noted in previous experiments, plants were easier to kill as they approached senescence (table 25). In addition, *Ammate*, used for the first time in this experiment, gave an inadequate kill at both the 10- and 20-pound rates.

TABLE 25.—*Effect of several different vine-killing treatments on rate of kill of Red Pontiac potatoes, third season of tests*

| Treatment [1] | Concentration used | Quantity per acre | Percent dead foliage 1 and 7 days after application on Sept. 15 | |
|---|---|---|---|---|
| | | | 1 day [2] | 7 days [2] |
| | | *Gal.* | *Pct.* | *Pct.* |
| *Aero Cyanate* | 12 lb. of 91-percent *potassium cyanate* + NNO[4] per 15 gal. water. | 15 | 33 | 93 |
| *Ammate* | 10 lb. of 95-percent *ammonium sulfamate* + wetter-sticker[5] per 15 gal. water. | 15 | 37 | 58 |
| Do | 20 lb. of 95-percent *ammonium sulfamate* + wetter-sticker[5] per 15 gal. water. | 15 | 37 | 62 |
| *Dow Defoliant* | 6 lb. of 85-percent sodium monochloroacetate + NNO[4] per 15 gal. water. | 15 | 33 | 78 |
| Do | 8 lb. of 85-percent *sodium monochloroacetate* + NNO[4] per 15 gal. water. | 15 | 35 | 87 |
| Dow General | 1 pt. of 55-percent dinitro-ortho-sec.-butylphenol + 1 gal. diesel oil + 1 lb. aluminum sulfate per 125 gal. water. | 125 | 87 | 97 |
| Do | 1 pt. of 55-percent dinitro-ortho-sec.-butylphenol + 1 gal. diesel oil + 1 lb. aluminum sulfate per 15 gal. water. | 15 | 85 | 98 |
| *Dow H916* | 1 gal. of 40-percent *pentachlorophenol* + emulsifier[6] per 15 gal. water. | 15 | 73 | 97 |
| *Endothal 4069* | 1 gal. of 67-percent *di-sodium salt of 3,6-endoxy hexahydrophthalic acid* + wetting agent[7] per 15 gal. water. | 15 | 38 | 96 |
| Penite 6 | 0.8 gal. of 70.4-percent sodium meta arsenite per 125 gal. water. | 125 | 38 | 99 |
| Do | 0.8 gal. of 70.4-percent sodium meta arsenite per 15 gal. water. | 15 | 37 | 98 |
| Vines cut | | | 99 | 100 |
| Vines pulled | | | 100 | 100 |
| Control [8] | | | 28 | 43 |

[1] Chemicals in italic have not been registered as potato vine killers, and may not be used as such on potatoes for food, feed, or seed, except as indicated on the inside cover.
[2] L.S.D. between treatments at 0.05 level=6; at 0.01 level=8.
[3] L.S.D. between treatments at 0.05 level=16; at 0.01 level=21.
[4] An Atlas wetting agent added at the rate of 1:2,225.
[5] DuPont Spreader-sticker added at the rate of 1:2,225.
[6] 2-percent Monsanto Emulsifier R.
[7] 0.5-percent Sharples Nonic 218.
[8] Rotobeat 1 day before harvest.

# COMPARISON OF WINDROWING AND RE-COVERING, AND ROTOBEATING AS METHODS OF MATURING POTATOES

## Procedure

Because of the nature of the treatments it was more practical to use a systematic design consisting of windrowing and re-covering Red Pontiac potatoes 1, 7, and 14 days before harvest compared with rotobeating at the same intervals. Windrowing consisted of digging two rows of potatoes with a specially equipped digger and redepositing them on the ground in a single band about 18 inches wide. They were re-covered with soil in a separate operation with an integral-mounted cultivator fitted with 18-inch diameter disks. The potatoes were planted on May 26, in this fourth season, and harvested September 23. No fertilizer was applied to the Fargo-Bearden soil on which the potatoes were grown. Plot size was 4 rows 34 feet long and 38 inches apart. The treatments were replicated 7 times. Culture, harvesting, and storage were the same as in previous experiments.

## Results and Discussion

Data were not obtained on yield because the systematic design might lead to erroneous conclusions. The treatments had no significant effect on amount or extent of bruising, decay, or internal discoloration.

SKINNING.—Windrowing and re-covering Red Pontiac potatoes 14 days before harvest resulted in significantly more skinning than did rotobeating, in part, because some skinning took place in the windrowing and re-covering (table 26). Although both windrowing and re-covering, and rotobeating 7 days before harvest significantly reduced the amount of skinning that took place below that for the treatments applied 1 day before harvest, they were not significantly different from each other. Observations indicated that less than 1-percent skinning took place during the last 2 windrowing and re-covering treatments, because the potatoes had started to mature naturally.

TABLE 26.—*Effect of windrowing and re-covering and rotobeating on susceptibility of Red Pontiac potatoes to skinning, fourth season of tests*

| Treatment and time applied | Skinning [1] |
|---|---|
| | *Percent* |
| Windrow and re-cover: | |
| 1 day before harvest | 35 |
| 7 days before harvest | 18 |
| 14 days before harvest | 26 |
| Rotobeat: | |
| 1 day before harvest | 30 |
| 7 days before harvest | 21 |
| 14 days before harvest | 15 |

[1] L.S.D. between treatments at 0.05 level=9; at 0.01 level=13.

WEIGHT LOSS.—During storage at about 40° F. for several months, the potatoes from the plots rotobeat 1 day before harvest lost significantly more weight than any of the other treatments (table 27). The cause of this effect was probably twofold. First, the potatoes from this treatment were appreciably skinned when placed in storage. Secondly, although windrowing and re-covering both 1 day and 14 days before harvest also resulted in considerable skinning, the amount of weight loss was not measured between the time the potatoes were windrowed and re-covered and the time these same potatoes were harvested.

TABLE 27.—*Effect of windrowing and re-covering and rotobeating on weight loss of Red Pontiac potatoes stored at about 40° F. and 80 percent relative humidity from September 24 to March 5*

| Treatment and time applied | Weight loss [1] |
|---|---|
| Windrow and re-cover: | *Percent* |
| 1 day before harvest | 6.94 |
| 7 days before harvest | 6.29 |
| 14 days before harvest | 7.04 |
| Rotobeat: | |
| 1 day before harvest | 8.05 |
| 7 days before harvest | 6.94 |
| 14 days before harvest | 6.60 |

[1] L.S.D. between treatments at 0.05 level=0.96.

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