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# A Study of the Influence of Petroleum Mulches on Several Herbicides With Selected Vegetable Crops

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# A STUDY OF THE INFLUENCE OF PETROLEUM MULCHES ON SEVERAL HERBICIDES WITH SELECTED VEGETABLE CROPS

by

C. Linnis Mills

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF FIGURES

LIST OF FIGURES (continued)

ABSTRACT

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Vegetable Crops

by

C. Linnis Mills, Master of Science

Utah State University, 1968

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Department: Plant Science

The effects of petroleum mulches on plant response to herbicides were studied at the Farmington Field Station. The herbicides were applied to the soil preemergent and by incorporation at one-half, normal and double the recommended rates with asphalt overlay. The herbicides and crops used were: Atrazine and Ramrod on sweet corn, PEBC and Diphenamid on tomatoes and EPTC and Trifluralin on snap beans.

Germination, overall crop rating, grass and broadleafed weed control and yields were measured. Data recorded from these trials showed that herbicides are as effective under the asphalt when compared to plots with herbicide but no asphalt. Considering all herbicides and conditions, overall crop growth and weed control were not increased or decreased by the asphalt mulch. Germination and yield were not affected by the interaction of herbicides with the asphalt overlay on the three crops.

(110 pages)

# INTRODUCTION

Petroleum mulches have been used successfully in vegetable crops to increase soil temperature, maintain soil moisture, reduce surface crusting and enhance seed germination. These factors have helped to increase yields and earliness of crops. Weeds also benefit from the above mentioned factors as a result of the petroleum mulch.

Mechanical harvesting in vegetables is receiving more consideration each year. Uniformity of maturity is one of the principal requirements for mechanical harvesting, thus uniform germination is of utmost importance. When planting small seeded vegetable crops in the early spring, uniform stands are not generally obtained. Poor seed is usually not the cause of uneven stand in the crop. Poor stands can also be attributed to low soil temperature, and lack of soil moisture and crusting of the soil prior to the emergence of the seedlings.

Herbicides are commonly used in the production of vegetable crops due to the increased cost of hand labor. Herbicides may be less active in the early spring because of the low soil temperature. Excess amounts of moisture may cause leaching and more rapid loss of some herbicides, thus reducing their effectiveness or residual action.

Petroleum mulches used on small seeded crops will increase soil temperature 10 to 18°F. With increased soil temperature the crops germinate faster and herbicidal response may be increased to some degree. The mulches also help to maintain the soil moisture near the soil surface so as to be more available to the small seedlings. Under conditions causing drying of the soil surface the increased surface moisture under asphalt overlays also enhances herbicidal activity which reduces the weed competition to that crop.

Work with petroleum mulches as they may influence herbicidal activity has been conducted in other areas of the United States. It is important that the work be done under climatic conditions in Utah to be applicable to our area.

## Objectives

The main purpose of the study was to determine the effects of petroleum mulches on recommended herbicides with selected vegetable crops.

The objectives of these investigations were as follows:

1. To determine possible deleterious or beneficial effects of petroleum mulches on activity of recommended herbicides.

2. To determine the effects of petroleum mulches and herbicides on germination of tomatoes, snap beans and sweet corn.

3. To determine the effect of petroleum mulches and herbicides on earliness of maturity of tomatoes, snap beans, and sweet corn.

4. To determine the effect of petroleum mulches on herbicides applied at logarithmic rates on tomatoes, snap beans and sweet corn.

## REVIEW OF LITERATURE

Petroleum mulches are becoming more important in the vegetable industry. The effects of petroleum mulch on herbicides have been studied in other sections of the United States.

There are three methods of applying herbicides with asphalt mulches. They are, mixing the herbicide into the asphalt, incorporating the herbicides into the soil and then covering it with petroleum mulch or applying the herbicide to the soil surface and capping it with the asphalt.

Bayer (1962) used eight herbicides on selected vegetable crops. He tested their influence on weed control when mixed with or applied under the asphalt. The herbicides were as effective with and under the mulch as when applied alone. The residual life of CDEC and CDAA was extended when mixed with asphalt. EPTC herbicidal activity was enhanced when applied under or mixed with the asphalt.

Bing (1965) compared several types of mulches with selected herbicides on nursery stock. He reported that herbicides mixed in and under the asphalt responded similarly to herbicides applied alone.

According to Fletcher (1964) sugar beet yields were increased by two tons when using petroleum mulch. He attributed the increased yield to lack of soil crusting, increased soil temperature, and maintenance of moisture in the root zone of the crop. He mixed Murbetex into the mulch to control the weeds.

Hamson (1964) observed the effect of petroleum on several herbicides. He applied the herbicides at logarithmic rates and then applied the mulch. Some herbicides were enhanced by the mulch while other herbicides were less effective.

Lyons (1966) compared the effects of petroleum mulch on herbicides under furrow irrigated conditions. Their herbicides were surface applied and incorporated into the soil, before covering them with asphalt. According to Lyons the herbicides were equally effective under the asphalt as when used alone. The volatile herbicides appeared to give better weed control when covered by the mulch than when applied to the soil without the mulch.

Miller (1962) incorporated Amiben into the petroleum mulch and also applied the chemical to the soil surface and covered it with asphalt on several crops. Under greenhouse conditions germination was enhanced by the incorporation of Amiben in the asphalt.

Under field conditions cucumbers showed a marked increase in yield when the Amiben was mixed with the asphalt or when Amiben was applied to the soil and capped with the mulch.

Norton (1966) used selected chemicals such as dinitro and Alanap-3 on warm season crops. He established that under greenhouse conditions herbicide and mulch combinations reduced the residual action of the herbicides. In another study Norton (1967) reported the residual action of DNBP to be greatly reduced when applied with or under the petroleum mulch.

Phillip (1965) observed that when diuron was mixed with asphalt mulch, there was a marked reduction in the weed control on cotton.

Wiggans (1962) compared asphalt with other mulches to determine their effects on various herbicides with vegetable crops. He reported that asphalt mulch caused a marked increase in weeds when used without herbicides. When he incorporated herbicides into the mulch there was a reduction in the weed population in the crops.

Welker (1963) also tested herbicidal activity with petroleum mulch on several vegetables. The herbicides were mixed with the mulch, incorporated into and applied to the surface of the soil, and then asphalt was applied as an overlay. The mulch increased the effectiveness to some degree of all herbicides used. The best results in the study were obtained by mixing the herbicide into the mulch.

Cialone (1964) compared asphalt mulch with polyethylene sheets to test their response to selected herbicides. Over a three year period EPTC and 2,4-D amine were consistently enhanced by the petroleum mulch. He also reported that wetable powder herbicides decreased in activity when mixed with the asphalt mulch.

Ozaki (1966) reported less injury of the crops when herbicides were mixed with asphalt mulch. This was attributed to the stablizing of the herbicides at the soil surface.

Abramitis (1962) mixed 2,4-D amine, DCPA, DMPA and Pennsalt TD-62 with petroleum mulch. The herbicides with the mulch gave similar results to the herbicide alone. Herbicides formulated as emulsifiable concentrates remained in suspension with the asphalt while the wettable powder herbicides according to Abramitis must be applied to the soil and covered with asphalt for maximum effectiveness.

There is a problem in mixing herbicides in petroleum mulches because a new label is required for the mixture before the product can be sold. New recommendations for each crop would also be required. By incorporation or preemergent application of the herbicide before covering it with asphalt, the existing label clearance would apply. This has been considered in this study.

MATERIALS AND METHODS

1967 Experiments at Farmington Field Station

Experimental treatments included the following crops and herbicides:

| Crop | Variety | Herbicide |
|---|---|---|
| Tomatoes | Campbell 52-12 | PEBC<br>Diphenamid |
| Snap beans | Executive | EPTC<br>Trifluralin |
| Sweet corn | NK 199 | Atrazine<br>Ramrod |

The treatments used in the experiments were as follows:

| | | | | | |
|---|---|---|---|---|---|
| 1. | Control | | | | |
| 2. | Hard | Ashpalt | No herbicide | | |
| 3. | Soft | " | " | " | |
| 4. | No | " | 0.5[a] | " | Incorporated |
| 5. | Hard | " | " | " | " |
| 6. | Soft | " | " | " | " |
| 7. | No | " | 1.0[b] | " | " |
| 8. | Hard | " | " | " | " |
| 9. | Soft | " | " | " | " |
| 10. | No | " | 2.0[c] | " | " |
| 11. | Hard | " | " | " | " |
| 12. | Soft | " | " | " | " |
| 13. | No | " | 0.5 | " | Preemergence |
| 14. | Hard | " | " | " | " |

| | | | | |
|---|---|---|---|---|
| 15. | Soft | Asphalt | 0.5 herbicide | Preemergence |
| 16. | No | " | 1.0 " | " |
| 17. | Hard | " | " " | " |
| 18. | Soft | " | " " | " |
| 19. | No | " | 2.0 " | " |
| 20. | Hard | " | " " | " |
| 21. | Soft | " | " " | " |

a = one half recommended rate

b = normal recommended rate

c = double recommended rate

The herbicides were applied at the normal recommended rate, one half the recommended rate and double the recommended rate. The recommended rates of the herbicides were as follows: PEBC, 4 lbs/A; diphenamid, 4 lbs/A; EPTC, 3 lbs/A; trifluralin, 1 lb/A; Atrazine, 2 lbs/A; and Ramrod, 6 lbs/A. Recent information indicates the chemical name of Ramrod is propaclor. The herbicides were applied at 100 gal/A with a boom type sprayer using tee-jet nozzles for the incorporated treatments. The incorporation was accomplished with a power driven hooded rotavator with L shaped teeth at a forward speed of 1.5 M.P.H. and a depth of two and one-half inches. A two gallon Knapsack type sprayer was used to apply the preemergent herbicides at 50 gal/A.

Diphenamid and PEBC were incorporated on April 28 and EPTC, trifluralin, Atrazine and Ramrod on May 4. Due to heavy rains planting was delayed until May 15.

The tomatoes were planted on May 15 in both the incorporated plots and preemergent plots. The herbicides were applied to the preemergent plots and then all plots were covered immediately by the asphalt mulches. On May 23 the same procedure was followed for snap beans and sweet corn.

The petroleum mulches used in the experiment were furnished by the Chevron Research Corporation. Petroleum products used were hard and soft asphalt as defined by Chevron Research. The mulches were applied to the treatments at the rate of 300 gallons per acre with a compressed air sprayer.

A split plot design was used with herbicides assigned at random to the main blocks for each crop. The herbicide blocks were further divided for the asphalt treatments which were randomized. Each subplot was three feet wide by twenty five feet long.

Seeds of each crop were counted for each sub-plot based on a planting rate of 3 seeds/ft for sweet corn, 6 seeds/ft for snap beans and 12 seeds/ft for tomatoes. All planting was done with an experimental single row belt seeder on which the individual lots of seed were spread evenly with approximately 1 inch on the belt equivalent to 1 foot at planting.

On June 2 plant stand counts were taken on tomatoes and snap beans. On June 12 plant counts were taken on snap beans and sweet corn. On June 25 crop response ratings and weed control ratings were recorded. Crop response ratings were on a scale of 0 to 5 with 0 indicating complete kill of crop and 5 excellent growth of crop. Weed control ratings were on a scale of 0 to 5 with 0 indicating no weed control and 5 excellent control of weeds. On June 29 tomatoes were thinned from 6 to 9 inches to allow for proper development. It was not necessary to thin the snap beans or sweet corn. All control plots were given careful weeding according to good cultural practices.

The field was irrigated every seven days throughout the growing season. Ammonium phosphate was broadcast over the field at a rate of 200 lbs per acre. Weeding and cultivation were done as deemed necessary. The crops were dusted periodically with Sevin for insect control.

The crops were allowed to develop to maturity before harvesting and recording the yield. Crops were harvested at optimun maturity for processing. On July 31 snap beans were picked and sized to determine earliness. The corn was harvested on August 25. Weights of the corn with husks, corn without husks, cobs without kernels, and kernels were recorded. There were two picking dates for tomatoes, September 19 and October 6. The fruits were weighed, counted, and percent solids were recorded.

## 1967 Logarithmic Weed Control Trials at the Farmington Field Station

Tomatoes, snap beans and sweet corn were used with the appropriate herbicides. Each crop was divided into eight plots with four plots for each herbicide.

The treatments used in the experiment were as follows:

1. The herbicides were incorporated into the soil at logarithmic rates with no asphalt applied to the soil.

2. The herbicides were applied preemergent at logarithmic rates and then covered with hard asphalt.

3. The herbicides were applied preemergent at logarithmic rates and then covered with soft asphalt.

4. The herbicides were applied preemergent at logarithmic rates with no asphalt applied.

Highest rates for logarithmic plots for the herbicides were as follows: PEBC, diphenamid, EPTC and Ramrod, 20 lbs/A; trifluralin, 10 lbs/A; and Atrazine, 5 lbs/A. The crops were planted August 9 immediately after incorporated treatments were applied. Preemergent herbicides were applied on August 10. Asphalt treatments were applied immediately after preemergent herbicides.

On August 18 and 24 plant stand counts were taken on tomatoes, snap beans, and sweet corn.

For the first week after planting all plots were carefully irrigated to maintain adequate soil moisture for seed germination. Irrigation intervals were 7 days from emergence to termination of the experiment. On October 16 weed control ratings were recorded. Ratings were taken every twelve and one half feet on a scale of 1 - 10 with 1 indicating no weed control and 10 excellent weed control.

## RESULTS

### Sweet Corn Experiments 1967

The results of the sweet corn experiments with petroleum mulch and herbicides are shown in Table 1 through 18. The Analyses of Variance for the emergence of sweet corn (Table 1) indicates significant differences for asphalt treatments at odds of 19:1. Duncan's multiple range test for emergence of sweet corn (Table 2) indicates that hard asphalt increased emergence significantly at odds of 19:1 over the control without asphalt. Germination under soft asphalt was similar to hard asphalt but was not significantly different from the control at the 5 percent level.

Analyses of Variance for germination (Table 1), overall crop rating (Table 3), grass control (Table 4), broadleafed weed control (Table 6), yield of ears with husk (Table 9), ears without husk (Table 11), cobs (Table 14) and kernels (Table 16) showed that the interactions of asphalt x Atrazine and Ramrod were not significant. The interactions of asphalt x herbicide x rate were also not significant for the above mentioned factors.

There were significant differences between the rates of herbicides used. The F test for rates of herbicides from the Analyses of Variance for grass control (Table 4), broadleaf weed control (Table 6), yield of corn with husk (Table 9), ears without husk (Table 11), cobs (Table 14), and kernels (Table 16), all indicated significance at the one percent level. A comparison of means for annual grass control (Table 5) and broadleaf weed control (Table 7) indicated the combined effects of both chemicals were significantly better than the control at odds of 19:1.

A comparison of means for yield of sweet corn without husk (Table 12), for cobs (Table 15) and for kernels (Table 17) all showed the preemergent method of application to yield significantly higher than the incorporated method of application. The preemergent recommended rate of herbicide as measured by ears of corn with husk (Table 10) was not significantly different from the incorporated method of application.

The interactions of herbicide x rate were highly significant for broadleafed weed control (Table 6) and significant for yield of corn without husk (Table 11) and yield of kernels (Table 16). The control of broadleafed weeds (Table 8) in the treated plots were significantly better than in the plots without the herbicides.

There was a trend toward higher yields with the preemergent method of application for both Ramrod and Atrazine. Yield of corn without husk (Table 13) shows preemergent application of Atrazine at double and normal rates to be nonsignificant with incorporated Ramrod at the normal rate. All other preemergent plots gave significantly better yields than the incorporated plots. The yield of kernels (Table 18) showed the preemergent plots to yield significantly more than the incorporated plots with the exception of Atrazine at the 1 and 2 pound rates.

Table 1. Analysis of Variance for emergence of sweet corn with Ramrod and Atrazine at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 8.6785 | 0.1463 |
| Error (a) | 2 | 59.2976 | |
| Rate | 6 | 18.6309 | 0.9627 |
| Herbicide x rate | 6 | 36.4564 | 1.8837 |
| Error (b) | 12 | 19.3532 | |
| Asphalt | 2 | 52.7618 | 3.4066* |
| Herbicide x asphalt | 2 | 21.1429 | 1.3651 |
| Rate x asphalt | 12 | 37.3453 | 2.4112 |
| Rate x asphalt x herbicide | 12 | 13.5873 | 0.8772 |
| Error (c) | 28 | 15.4881 | |
| TOTAL | 83 | 22.6832 | |

*Significant at 5 percent level.

Table 2. Comparison of means for emergence of sweet corn seedlings for hard and soft asphalt.

| Mulch | Mean number emerged |
|---|---|
| Hard asphalt | 46.1786 a |
| Soft asphalt | 45.1786 ab |
| Control | 43.4643 b |

a b = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 3. Analysis of Variance for overall rating of sweet corn with Ramrod and Atrazine at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 1.7143 | 2.8799 |
| Error (a) | 2 | 0.5952 | |
| Rate | 6 | 1.5397 | 2.7132 |
| Herbicide x rate | 6 | 0.9921 | 1.7482 |
| Error (b) | 12 | 0.5675 | |
| Asphalt | 2 | 0.1429 | 0.2599 |
| Herbicide x asphalt | 2 | 1.8571 | 3.2499 |
| Rate x asphalt | 12 | 0.8373 | 1.4652 |
| Rate x asphalt x herbicide | 12 | 0.3849 | 0.6736 |
| Error (c) | 28 | 0.5714 | |
| TOTAL | 83 | 0.7177 | |

Table 4. Analysis of Variance for grass control ratings in sweet corn with Ramrod and Atrazine at 3 rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 0.0119 | 0.0769 |
| Error (a) | 2 | 0.1548 | |
| Rate | 6 | 5.8174 | 27.6611** |
| Herbicide x rate | 6 | 0.0953 | 0.4548 |
| Error (b) | 12 | 0.2103 | |
| Asphalt | 2 | 0.0476 | 0.3635 |
| Herbicide x asphalt | 2 | 0.0476 | 0.3635 |
| Rate x asphalt | 12 | 0.1865 | 1.4243 |
| Rate x asphalt x herbicide | 12 | 0.0476 | 0.3635 |
| Error (c) | 28 | 0.1310 | |
| TOTAL | 83 | 0.5420 | |

**Significant at 1 percent level.

Table 5. Comparison of means for annual grass control for the combined effects of Atrazine and Ramrod.

| Method of application of herbicide | Rate | Mean rating[+] for grass control |
|---|---|---|
| Preemergent | 2.0 | 5.00 a |
| Incorporate | 0.5 | 5.00 a |
| Preemergent | 1.0 | 4.92 a |
| Incorporate | 2.0 | 4.92 a |
| Preemergent | 0.5 | 4.83 a |
| Incorporate | 1.0 | 4.83 a |
| Control | | 3.08 b |

[+]5 = excellent control, 0 = no grass control.
a b = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 6. Analysis of Variance for broadleaf weed control ratings in sweet corn with Ramrod and Atrazine at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 15.4286 | 49.8460* |
| Error (a) | 2 | 0.3095 | |
| Rates | 6 | 4.5794 | 52.4551** |
| Herbicide x rate | 6 | 0.7064 | 8.0910** |
| Error (b) | 12 | 0.0873 | |
| Asphalt | 2 | 0.2500 | 1.6153 |
| Herbicide x asphalt | 2 | 0.0357 | 0.2307 |
| Rate x asphalt | 12 | 0.0972 | 0.6282 |
| Rate x asphalt x herbicide | 12 | 0.1052 | 0.6795 |
| Error (c) | 28 | 0.1548 | |
| TOTAL | 83 | 0.6764 | |

**Significant at 1 percent level.
*Significant at 5 percent level.

Table 7. Comparison of means for broadleaf weed control ratings for the combined effect of Atrazine and Ramrod.

| Method of application of herbicide | Rate | Mean rating+ for broadleaf control |
|---|---|---|
| Preemergent | 2.0 | 4.67 a |
| Incorporate | 2.0 | 4.58 a |
| Preemergent | 0.5 | 4.58 a |
| Preemergent | 1.0 | 4.50 ab |
| Incorporate | 1.0 | 4.25 bc |
| Incorporate | 0.5 | 4.00 c |
| Control | | 2.92 d |

+5 = excellent control, 0 = no weed control.
a b c d = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 8. Means for rating broadleaf weed control for methods of application of Atrazine and Ramrod.

| Herbicide | Rate | Method of application | Mean rating+ for broadleaf control |
|---|---|---|---|
| Atrazine | 2.0 | Preemergent | 5.00 a |
| " | 1.0 | " | 5.00 a |
| " | 2.0 | Incorporate | 5.00 a |
| " | 0.5 | " | 4.83 a |
| " | 1.0 | " | 4.83 a |
| " | 0.5 | Preemergent | 4.83 a |
| Ramrod | 0.5 | " | 4.33 b |
| " | 2.0 | " | 4.33 b |
| " | 2.0 | Incorporate | 4.17 b |
| " | 1.0 | Preemergent | 4.00 bc |
| " | 1.0 | Incorporate | 3.67 c |
| " | 0.5 | " | 3.17 d |
| Atrazine | | Control | 3.00 d |
| Ramrod | | " | 2.83 d |

+5 = excellent control, 0 = no weed control.
a b c d = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 9. Analysis of Variance for yield of sweet corn ears with husk with Ramrod and Atrazine at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 100.3629 | 62.8269* |
| Error (a) | 2 | 1.5975 | |
| Rate | 6 | 139.5368 | 50.8659** |
| Herbicide x rate | 6 | 4.5085 | 1.6435 |
| Error (b) | 12 | 2.7432 | |
| Asphalt | 2 | 6.9687 | 2.1991 |
| Herbicide x asphalt | 2 | 7.1500 | 2.2563 |
| Rate x asphalt | 12 | 1.1128 | 0.3511 |
| Rate x asphalt x herbicide | 12 | 0.8181 | 0.2581 |
| Error (c) | 28 | 3.1688 | |
| Sampling | 84 | 1.5864 | |
| TOTAL | 167 | 7.6296 | |

**Significant at 1 percent level.
*Significant at 5 percent level.

Table 10. Combined effect of herbicides (Atrazine and Ramrod) for mean in yield of sweet corn with husk.

| Method of application of herbicide | Rate | Mean yield in lbs/plot |
|---|---|---|
| Preemergent | 0.5 | 11.96 a |
| Preemergent | 2.0 | 11.03 ab |
| Control | | 10.69 bc |
| Preemergent | 1.0 | 10.68 bc |
| Incorporate | 2.0 | 7.43 c |
| Incorporate | 1.0 | 7.28 c |
| Incorporate | 0.5 | 5.64 c |

a b c d = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 11. Analysis of Variance for yield of sweet corn ears without husk with Ramrod and Atrazine at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 58.4809 | 30.4580* |
| Error (a) | 2 | 1.9201 | |
| Rate | 6 | 85.4826 | 42.3410** |
| Herbicide x rate | 12 | 6.2487 | 3.0951* |
| Error (b) | 12 | 2.0189 | |
| Asphalt | 2 | 6.3963 | 2.2762 |
| Herbicide x asphalt | 2 | 5.7423 | 2.0434 |
| Rate x asphalt | 12 | 0.8134 | 0.2894 |
| Rate x asphalt x herbicide | 12 | 0.9671 | 0.3442 |
| Error (c) | 28 | 2.8101 | |
| Sampling | 84 | 1.2974 | |
| TOTAL | 167 | 5.2105 | |

**Significant at 1 percent level.
*Significant at 5 percent level.

Table 12. A comparison of means for yield of sweet corn ears without husk for the combined effects of herbicides (Atrazine and Ramrod).

| Method of application of herbicide | Rate | Mean yield in lbs/plot |
|---|---|---|
| Preemergent | 0.5 | 9.3004 a |
| " | 1.0 | 8.6604 ab |
| Control | | 8.5142 abc |
| Preemergent | 2.0 | 8.5100 abc |
| Incorporated | 2.0 | 5.8354 d |
| " | 1.0 | 5.6154 d |
| " | 0.5 | 4.5433 e |

a b c d e = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 13. Means for yield of sweet corn without husk for methods of application of Atrazine and Ramrod.

| Herbicide | Rate | Method of application | Mean yield in lbs/plots |
|---|---|---|---|
| Ramrod | 0.5 | Preemergent | 9.66 a |
| " | 1.0 | " | 9.48 ab |
| " | 2.0 | " | 9.01 abc |
| " | | Control | 8.95 abc |
| Atrazine | 0.5 | Preemergent | 8.94 abc |
| " | | Control | 8.07 bc |
| " | 2.0 | Preemergent | 8.01 cd |
| " | 1.0 | " | 7.84 cd |
| Ramrod | 1.0 | Incorporated | 6.92 d |
| " | 2.0 | " | 6.83 e |
| Atrazine | 2.0 | " | 4.85 e |
| " | 0.5 | " | 4.82 e |
| " | 1.0 | " | 4.31 e |
| Ramrod | 0.5 | " | 4.26 e |

a b c d e = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 14. Analysis of Variance for yield of cobs of sweet corn with Ramrod and Atrazine at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 6.5333 | 26.1176** |
| Error (a) | 2 | 0.2502 | |
| Rate | 6 | 6.8140 | 30.6083** |
| Herbicide x rate | 6 | 0.4223 | 1.8967 |
| Error (b) | 12 | 0.2226 | |
| Asphalt | 2 | 0.4802 | 0.9693 |
| Herbicide x asphalt | 2 | 0.7338 | 1.4812 |
| Rate x asphalt | 12 | 0.1983 | 0.4002 |
| Rate x asphalt x herbicide | 12 | 0.2051 | 0.4139 |
| Error (c) | 28 | 0.4954 | |
| Sampling | 84 | 0.2518 | |
| TOTAL | 167 | 0.5714 | |

**Significant at 1 percent level.

Table 15. Comparison of means for yield of cobs of sweet corn for the combined effect of herbicides (Atrazine and Ramrod).

| Method of application of herbicide | Rate | Mean yield in lbs/plot |
|---|---|---|
| Preemergent | 0.5 | 4.03 a |
| " | 2.0 | 3.89 a |
| Control | | 3.85 a |
| Preemergent | 1.0 | 3.75 a |
| Incorporated | 2.0 | 3.09 b |
| " | 1.0 | 3.06 b |
| " | 0.5 | 2.65 b |

a b = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 16. Analysis of Variance for yield of kernels of sweet corn with Ramrod and Atrazine at three rates with hard and soft asphalt and a control.

| Sources of variation | Degrees of freedom | Mean squares | F |
|---|---|---|---|
| Herbicide | 1 | 32.0601 | 62.8629* |
| Error (a) | 2 | 0.5100 | |
| Rate | 6 | 47.4015 | 47.3589** |
| Herbicide x rate | 6 | 3.3376 | 3.3346* |
| Error (b) | 12 | 1.0009 | |
| Asphalt | 2 | 2.8753 | 2.3568 |
| Herbicide x asphalt | 2 | 2.5806 | 2.1153 |
| Rate x asphalt | 12 | 0.3766 | 0.3087 |
| Rate x asphalt x herbicide | 12 | 0.5964 | 0.4889 |
| Error (c) | 28 | 1.2200 | |
| Sampling | 84 | 0.5239 | |
| TOTAL | 167 | 2.6963 | |

**Significant at 1 percent level.
*Significant at 5 percent level.

Table 17. Comparison of means for yield of kernels of sweet corn for the combined effects of herbicides (Atrazine and Ramrod).

| Methods of application of herbicide | Rate | Mean yield in lbs/plot |
|---|---|---|
| Preemergent | 0.5 | 5.32 a |
| " | 1.0 | 4.88 a |
| Control | | 4.67 a |
| Preemergent | 2.0 | 4.62 a |
| Incorporate | 2.0 | 2.75 b |
| " | 1.0 | 2.57 b |
| " | 0.5 | 1.72 c |

a b c = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 18. Comparison of means for yield of kernels of sweet corn for methods of application of Atrazine and Ramrod.

| Herbicide | Rate | Method of application | Mean yield in lbs/plot |
|---|---|---|---|
| Ramrod | 0.5 | Preemergent | 5.65 a |
| " | 1.0 | " | 5.48 a |
| Atrazine | 0.5 | " | 5.00 ab |
| Ramrod | | Control | 4.99 ab |
| " | 2.0 | Preemergent | 4.95 ab |
| Atrazine | | Control | 4.34 bc |
| " | 2.0 | Preemergent | 4.29 bc |
| " | 1.0 | " | 4.28 bc |
| Ramrod | 1.0 | Incorporated | 3.84 c |
| " | 2.0 | " | 3.53 c |
| Atrazine | 2.0 | " | 1.97 d |
| " | 0.5 | " | 1.94 d |
| " | 1.0 | " | 1.66 d |
| Ramrod | 0.5 | " | 1.55 d |

a b c d = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Snap Bean Experiments 1967

The results of the sanp bean experiments with petroleum mulch and herbicides at Farmington are shown in Tables 19 through 38. Analyses of Variance for effects of petroleum mulch on snap beans were not significant for emergence (Table 19), overall crop rating (Table 21), grass (Table 24) and broadleaf weed control (Table 26), sieve sizes 1 through 6 (Tables 28, 30, 31, 32, 35, 35) and yield (Table 37) at the 5 percent level. The interaction of asphalt x herbicide also was not significantly different for any of the above mentioned factors. The interaction of asphalt x herbicide x rate was significant on number of beans for sieve size four. A comparison of means (Table 33) shows that the interaction of the herbicide x asphalt x rate had no significant effect on the number of snap beans when compared with the control.

There were significant differences between the rates of herbicides used. Analyses of Variance for emergence (Table 19), overall crop response (Table 21), grass control (Table 24), yield (Table 37) were highly significant and sieve sizes one (Table 28) and six (Table 35) were significant at odds of 19:1. The means for the emergence of snap beans (Table 20) showed the control to be significantly better than the incorporated double and normal recommended rates of herbicide, but was not significantly different from the other treatments. The overall crop rating (Table 22) indicated the preemergent application of herbicides to produce significantly better plants than the incorporated method of application.

The combined rates of EPTC and trifluralin used were superior to the check plot in the control of annual grass (Table 25). An examination of means for the number of sieve size 1 snap beans (Table 29) indicates that the herbicide treatments did not significantly reduce the number of pods as compared with the control. Beans of sieve size 6 and larger (Table 36) were similar in response to sieve size one. None of the treatments significantly increased or decreased the number of beans produced within a sieve size. The yield of snap beans (Table 38) for the preemergent plots was superior to the control and incorporated plots.

The interaction of herbicide x rate was significant at odds of 19:1. Analyses of Variance for overall crop response (Table 21), and broadleafed weed control (Table 26) indicate significance for the interaction of herbicide x rate. A comparison of means for overall crop response (Table 23) shows that the treatments did not significantly influence plant growth when compared to the control. The means for broadleafed weed control (Table 27) showed that the treatments of herbicides did not significantly influence or reduce the control of weeds when compared to the check plots in snap beans.

Table 19. Analysis of Variance for emergence of snap beans with trifluralinand EPTC at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean squares | F |
|---|---|---|---|
| Herbicide | 1 | 708.4805 | 7.7464 |
| Error (a) | 2 | 91.4355 | |
| Rate | 6 | 1745.4560 | 6.7493** |
| Herbicide x rate | 6 | 231.5521 | 0.8954 |
| Error (b) | 12 | 258.6147 | |
| Asphalt | 2 | 530.0410 | 1.2185 |
| Herbicide x asphalt | 2 | 453.5898 | 1.0427 |
| Rate x asphalt | 12 | 313.1321 | 0.7198 |
| Rate x asphalt x herbicide | 12 | 291.5959 | 0.6703 |
| Error (c) | 28 | 435.0000 | |
| Emergence dates | 1 | 79866.4400 | 485.3435** |
| Date x herbicide | 1 | 750.0937 | 4.5583* |
| Date x rate | 6 | 1564.0160 | 9.5044** |
| Date x asphalt | 2 | 442.7344 | 2.6905 |
| Date x herbicide x asphalt | 2 | 146.2656 | 0.8888 |
| Date x rate x asphalt | 12 | 234.7161 | 1.4264 |
| Date x rate x herbicide | 6 | 106.7031 | 0.6484 |
| Date x rate x herbicide x asphalt | 12 | 118.7318 | 0.7215 |
| Error (d) | 48 | 164.5565 | |
| TOTAL | 167 | 867.4983 | |

**Significant at 1 percent level.
*Significant at 5 percent level.

Table 20. Comparison of means for emergence of snap bean seedling with the combined effect of herbicides (EPTC and trifluralin).

| Methods of application of herbicide | Rate | Mean number of seedlings |
|---|---|---|
| Preemergent | 0.5 | 116.38 a |
| " | 2.0 | 113.83 a |
| Control | | 110.96 a |
| Preemergent | 1.0 | 108.63 ab |
| Incorporate | 0.5 | 105.33 ab |
| " | 1.0 | 99.83 bc |
| " | 2.0 | 91.83 c |

a b c = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 21. Analysis of Variance for overall rating of snap bean with trifluralin and EPTC at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 1.7143 | 14.3999 |
| Error (a) | 2 | 0.1191 | |
| Rate | 6 | 3.7897 | 8.3771** |
| Herbicide x rate | 6 | 1.9087 | 4.2192* |
| Error (b) | 12 | 0.4524 | |
| Asphalt | 2 | 0.4643 | 0.6393 |
| Herbicide x asphalt | 2 | 1.1071 | 1.5245 |
| Rate x asphalt | 12 | 0.5337 | 0.7625 |
| Rate x asphalt x herbicide | 12 | 0.3433 | 0.4755 |
| Error (c) | 28 | 0.7262 | |
| TOTAL | 83 | 0.9105 | |

**Significant at 1 percent level.
*Significant at 5 percent level.

Table 22. Comparison of means for overall rating of snap beans for the combined effects of herbicides (EPTC and trifluralin).

| Methods of application of herbicides | Rate | Mean rating+ for crop response |
|---|---|---|
| Preemergent | 0.5 | 4.67 a |
| " | 2.0 | 4.58 a |
| " | 1.0 | 4.50 a |
| Control | | 4.17 ab |
| Incorporate | 1.0 | 3.75 bc |
| " | 0.5 | 3.67 bc |
| " | 2.0 | 3.17 c |

+5 = excellent growth, 0 = no crop.
a b c = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 23. Comparison of means for overall rating of snap beans for methods of application of EPTC and trifluralin.

| Herbicides | Rate | Method of application | Mean rating+ for crop response |
|---|---|---|---|
| Trifluralin | 0.5 | Preemergent | 4.83 a |
| EPTC | 2.0 | " | 4.83 a |
| Trifluralin | 1.0 | " | 4.67 ab |
| EPTC | 0.5 | " | 4.50 abc |
| Trifluralin | 2.0 | " | 4.33 abc |
| EPTC | 1.0 | " | 4.33 abc |
| Trifluralin | | Control | 4.33 abc |
| EPTC | 0.5 | Incorporate | 4.17 abc |
| EPTC | 2.0 | " | 4.00 abcd |
| EPTC | | Control | 4.00 abcd |
| Trifluralin | 1.0 | Incorporate | 3.83 cd |
| EPTC | 1.0 | " | 3.67 d |
| Trifluralin | 0.5 | " | 3.17 d |
| Trifluralin | 2.0 | " | 2.33 d |

+5 = excellent growth, 0 = no growth of crop.
a b c d = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 24. Analysis of Variance for grass control ratings with trifluralin and EPTC at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 0.4286 | 17.9987 |
| Error (a) | 2 | 0.0238 | |
| Rate | 6 | 2.3849 | 6.1957** |
| Herbicide x rate | 6 | 0.1786 | 0.4639 |
| Error (b) | 12 | 0.3849 | |
| Asphalt | 2 | 0.0357 | 0.7500 |
| Herbicide x asphalt | 2 | 0.0357 | 0.7500 |
| Rate x asphalt | 12 | 0.0635 | 1.3337 |
| Rate x asphalt x herbicide | 12 | 0.0357 | 0.7505 |
| Error (c) | 28 | 0.0476 | |
| TOTAL | 83 | 0.2788 | |

**Significant at 1 percent level.

Table 25. Comparison of means for control of annual grass for the combined effects of herbicides (EPTC and trifluralin).

| Methods of application of herbicides | Rate | Mean rating[+] for grass control |
|---|---|---|
| Preemergent | 2.0 | 5.00 a |
| Preemergent | 1.0 | 5.00 a |
| Incorporate | 2.0 | 5.00 a |
| Incorporate | 1.0 | 4.83 a |
| Incorporate | 0.5 | 4.75 a |
| Preemergent | 0.5 | 4.67 a |
| Control | | 3.75 b |

[+]5 = excellent control, 0 = no control.

a b = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 26. Analysis of Variance for broadleaf weed control rating in snap beans with trifluralin and EPTC at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean squares | F |
|---|---|---|---|
| Herbicide | 1 | 0.5833 | 0.6049 |
| Error (a) | 2 | 0.9643 | |
| Rate | 6 | 0.3571 | 2.2499 |
| Herbicide x rate | 6 | 0.5000 | 3.1499* |
| Error (b) | 12 | 0.1587 | |
| Asphalt | 2 | 0.0833 | 0.6363 |
| Herbicide x asphalt | 2 | 0.2976 | 2.2728 |
| Rate x asphalt | 12 | 0.0833 | 0.6364 |
| Rate x asphalt x herbicide | 12 | 0.2143 | 1.6364 |
| Error (c) | 28 | 0.1309 | |
| TOTAL | 83 | 0.2116 | |

*Significant at 5 percent level.

Table 27. Mean comparisons for broadleaf weed control in snap beans for methods of application of trifluralin and EPTC.

| Herbicide | Rate | Method of application | Mean rating+ for broadleaf control |
|---|---|---|---|
| Trifluralin | 2.0 | Preemergent | 4.33 a |
| " | 0.5 | Incorporate | 4.33 a |
| EPTC | | Control | 4.33 a |
| Trifluralin | 1.0 | Preemergent | 4.00 ab |
| " | 2.0 | Incorporate | 4.00 ab |
| " | 1.0 | " | 4.00 ab |
| EPTC | 1.0 | " | 4.00 ab |
| " | 2.0 | " | 3.83 ab |
| " | 0.5 | " | 3.83 ab |
| " | 0.5 | Preemergent | 3.83 ab |
| " | 2.0 | " | 3.67 ab |
| " | 1.0 | " | 3.50 b |
| Trifluralin | 0.5 | " | 3.50 b |
| " | | Control | 3.50 b |

+5 = excellent control, 0 = no control.
a b = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 28. Analysis of Variance for snap beans of sieve size one with trifluralin and EPTC at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 4.3393 | 3.2400 |
| Error (a) | 2 | 1.3393 | |
| Rate | 6 | 23.7560 | 3.1826* |
| Herbicide x rate | 6 | 4.6726 | 0.6260 |
| Error (b) | 12 | 7.4643 | |
| Asphalt | 2 | 9.6845 | 1.3163 |
| Herbicide x asphalt | 2 | 5.4821 | 0.7451 |
| Rate x asphalt | 12 | 8.7679 | 1.1917 |
| Rate x asphalt x herbicide | 12 | 2.8988 | 0.3940 |
| Error (c) | 28 | 7.3572 | |
| Sampling | 84 | 9.0655 | |
| TOTAL | 167 | 8.4131 | |

*Significant at 5 percent level.

Table 29. Comparison of means for sieve size one snap beans for the combined effects of herbicides (EPTC and trifluralin).

| Method of application of herbicide | Rate | Mean number of bean pods |
|---|---|---|
| Incorporate | 2.0 | 5.54 a |
| " | 0.5 | 5.29 ab |
| " | 1.0 | 3.62 abc |
| Control | | 3.58 bc |
| Preemergent | 1.0 | 3.54 bc |
| " | 2.0 | 3.50 bc |
| " | 0.5 | 3.00 c |

a b c = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 30. Analysis of Variance for snap beans at sieve size two with trifluralin and EPTC at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean squares | F |
|---|---|---|---|
| Herbicide | 1 | 0.7202 | 0.2396 |
| Error (a) | 2 | 3.0059 | |
| Rate | 6 | 9.6110 | 2.6674 |
| Herbicide x rate | 6 | 8.7619 | 2.4317 |
| Error (b) | 12 | 3.6032 | |
| Asphalt | 2 | 1.6250 | 0.2900 |
| Herbicide x asphalt | 2 | 0.0416 | 0.0074 |
| Rate x asphalt | 12 | 5.0278 | 0.8967 |
| Rate x asphalt x herbicide | 12 | 4.4167 | 0.7877 |
| Error (c) | 28 | 5.6071 | |
| Sampling | 84 | 4.2679 | |
| TOTAL | 167 | 4.7448 | |

Table 31. Analysis of Variance for snap beans at sieve size three with trifluralin and EPTC at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 1.9287 | 0.7331 |
| Error (a) | 2 | 2.6310 | |
| Rate | 6 | 10.2461 | 1.7300 |
| Herbicide x rate | 6 | 13.8452 | 2.3377 |
| Error (b) | 12 | 5.9226 | |
| Asphalt | 2 | 3.0536 | 0.2270 |
| Herbicide x asphalt | 2 | 11.0536 | 0.8217 |
| Rate x asphalt | 12 | 11.3799 | 0.8459 |
| Rate x asphalt x herbicide | 12 | 4.5744 | 0.3400 |
| Error (c) | 28 | 13.4523 | |
| Sampling | 84 | 8.8571 | |
| TOTAL | 167 | 9.3601 | |

Table 32. Analysis of Variance for snap beans at sieve size four with trifluralin and EPTC at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 2.1488 | 0.0555 |
| Error (a) | 2 | 38.7202 | |
| Rate | 6 | 16.0615 | 0.8150 |
| Herbicide x rate | 6 | 14.5099 | 0.7363 |
| Error (b) | 12 | 10.7063 | |
| Asphalt | 2 | 10.6488 | 1.0359 |
| Herbicide x asphalt | 2 | 17.7917 | 1.7483 |
| Rate x asphalt | 12 | 16.0585 | 1.5622 |
| Rate x asphalt x herbicide | 12 | 24.6319 | 2.3962* |
| Error (c) | 28 | 10.2798 | |
| Sampling | 84 | 13.6369 | |
| TOTAL | 167 | 14.8383 | |

*Significant at 5 percent level.

Table 33. Comparison of means for sieve size four snap beans for methods of application of trifluralin and EPTC with hard and soft asphalt overlay.

| Herbicide | Rate | Method of application | Mulch (asphalt) | Mean number of bean pods |
|---|---|---|---|---|
| EPTC | 2.0 | Incorporated | Soft | 16.25 a |
| Trifluralin | 1.0 | " | Hard | 15.00 ab |
| " | | Control | Soft | 14.25 abc |
| EPTC | 2.0 | Incorporated | No | 13.50 abcd |
| " | 0.5 | Preemergent | Hard | 12.50 abcde |
| Trifluralin | 1.0 | " | " | 12.25 abcde |
| " | 0.5 | " | Soft | 12.25 abcde |
| EPTC | 0.5 | Incorporated | Hard | 12.25 abcde |
| " | 1.0 | " | No | 12.00 abcde |
| " | | Control | " | 11.50 abcde |
| Trifluralin | 0.5 | Incorporated | Hard | 11.50 abcde |
| " | 2.0 | Preemergent | No | 11.25 abcde |
| " | 2.0 | Incorporated | Hard | 11.25 abcde |
| " | 2.0 | " | Soft | 11.25 abcde |
| EPTC | 1.0 | " | " | 11.25 abcde |
| Trifluralin | 2.0 | Preemergent | " | 10.75 abcde |
| EPTC | 2.0 | Incorporated | Hard | 10.50 bcde |
| Trifluralin | 2.0 | Preemergent | " | 10.50 bcde |
| EPTC | 2.0 | " | " | 10.25 bcde |
| " | 2.0 | " | Soft | 10.25 bcde |
| " | 0.5 | " | " | 10.00 bcde |
| Trifluralin | 0.5 | " | Hard | 9.75 bcde |
| " | | Control | No | 9.50 bcde |
| " | 1.0 | Preemergent | " | 9.50 bcde |
| " | 0.5 | Incorporated | Soft | 9.25 cde |
| " | 0.5 | " | No | 9.25 cde |
| EPTC | | Control | Hard | 9.25 cde |
| " | 0.5 | Incorporated | No | 9.25 cde |
| " | 1.0 | Preemergent | " | 9.25 cde |
| Trifluralin | 2.0 | Incorporated | " | 9.00 cde |
| EPTC | 0.5 | " | Soft | 9.00 cde |

Table 33. Continued.

| Herbicide | Rate | Method of application | Mulch (asphalt) | Mean number of bean pods | |
|---|---|---|---|---|---|
| EPTC | 1.0 | Incorporated | Hard | 9.00 | cde |
| " | 2.0 | Preemergent | No | 9.00 | cde |
| " | 0.5 | " | " | 8.75 | de |
| " | | Control | Soft | 8.50 | de |
| Trifluralin | 1.0 | Preemergent | " | 8.25 | de |
| EPTC | 1.0 | " | " | 8.00 | de |
| " | 1.0 | " | Hard | 7.50 | e |
| Trifluralin | 1.0 | Incorporated | No | 7.50 | e |
| " | 0.5 | Preemergent | " | 7.50 | e |
| " | | Control | Hard | 7.00 | e |
| " | 1.0 | Incorporated | Soft | 7.00 | e |

a b c d e = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 34. Analysis of Variance for snap beans at sieve size five with trifluralin and EPTC at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 60.7202 | 167.1999** |
| Error (a) | 2 | 0.3632 | |
| Rate | 6 | 28.4445 | 1.3341 |
| Herbicide x rate | 6 | 18.7619 | 0.8800 |
| Error (b) | 12 | 21.3214 | |
| Asphalt | 2 | 2.8988 | 0.1271 |
| Herbicide x asphalt | 2 | 2.3988 | 0.1052 |
| Rate x asphalt | 12 | 11.7391 | 0.5147 |
| Rate x asphalt x herbicide | 12 | 6.3780 | 0.2796 |
| Error (c) | 28 | 22.8095 | |
| Sampling | 84 | 13.8393 | |
| TOTAL | 167 | 15.7468 | |

**Significant at 1 percent level.

Table 35. Analysis of Variance for snap beans at sieve size six or larger with trifluralin and EPTC at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 0.8572 | 0.0101 |
| Error (a) | 2 | 85.1906 | |
| Rate | 6 | 121.1905 | 3.8959* |
| Herbicide x rate | 6 | 11.1905 | 0.3597 |
| Error (b) | 12 | 31.1071 | |
| Asphalt | 2 | 19.5179 | 0.8796 |
| Herbicide x asphalt | 2 | 16.7321 | 0.7540 |
| Rate x asphalt | 12 | 25.1845 | 1.1349 |
| Rate x asphalt x herbicide | 12 | 35.5238 | 1.6009 |
| Error (c) | 28 | 22.1905 | |
| Sampling | 84 | 17.4524 | |
| TOTAL | 167 | 25.3122 | |

*Significant at 5 percent level.

Table 36. Comparison of means for sieve size six and larger snap beans for the combined effects of herbicides (EPTC and trifluralin).

| Method of application of herbicide | Rate | Mean number of bean pods |
|---|---|---|
| Preemergent | 0.5 | 17.04 a |
| Preemergent | 1.0 | 15.63 ab |
| Control | | 15.58 ab |
| Preemergent | 2.0 | 13.46 abc |
| Incorporate | 0.5 | 12.79 bc |
| Incorporate | 1.0 | 12.42 bc |
| Incorporate | 2.0 | 10.58 c |

a b c = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 37. Analysis of Variance for yield of snap beans with trifluralin and EPTC at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 0.1042 | 0.0116 |
| Error (a) | 2 | 8.9972 | |
| Rate | 6 | 46.9616 | 9.1703** |
| Herbicide x rate | 6 | 6.8664 | 1.3405 |
| Error (b) | 12 | 5.1222 | |
| Asphalt | 2 | 3.6867 | 1.0006 |
| Herbicide x asphalt | 2 | 2.1885 | 0.5540 |
| Rate x asphalt | 12 | 4.7093 | 1.2782 |
| Rate x asphalt x herbicide | 12 | 4.6007 | 1.2487 |
| Error (c) | 28 | 3.6844 | |
| Sampling | 84 | 0.8572 | |
| TOTAL | 167 | 4.1990 | |

**Significant at 1 percent level.

Table 38. Mean comparison for yield of snap beans for the combined effect of herbicides (EPTC and trifluralin).

| Method of application of herbicide | Rate | Mean yield in lb/plot |
|---|---|---|
| Preemergent | 2.0 | 6.53 a |
| Preemergent | 1.0 | 5.22 a |
| Preemergent | 0.5 | 5.04 a |
| Control | | 3.42 b |
| Incorporate | 0.5 | 3.19 b |
| Incorporate | 2.0 | 2.98 b |
| Incorporate | 1.0 | 2.98 b |

a b = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

## Tomato Experiments 1967

The results of the tomato experiments with petroleum mulch and herbicides at Farmington are shown in Table 39 through 60. The Analysis of Variance indicated significant differences at odds of 19:1 for the overall rating of tomatoes (Table 41). The overall rating of tomatoes (Table 44) demonstrated that hard and soft asphalt plots produced significantly better plants than plots without asphalt mulches.

Analysis of Variance showed that the interactions of asphalts with diphenamid and PEBC were not significant for emergence of tomato seedlings (Table 39), overall crop rating (Table 41), annual grass control (Table 45), broadleaf weed control (Table 47), weight of fruit (Table 50), number of fruit (Table 53) and percent solids (Table 56). The interaction of rate x asphalt (Table 56) was highly significant for percent soluble solids in tomatoes. A comparison of means (Table 58) showed that the rates of the herbicides with asphalt treatments did not differ significantly from the controls in the percent of solids in the fruit. There were, however, isolated differences between asphalt treatments which tend to favor the soft asphalt.

The interaction of rate x asphalt x picking date (Table 56) was significant at odds of 19:1 in percent solids of the fruit. An examination of the means (Table 59) showed the interaction of rate x asphalt x picking date, did not significantly affect the soluble solids when compared to the control.

There were significant differences between the rates of both herbicides. Analyses of Variance for emergence (Table 39), overall crop response (Table 41), grass control (Table 45), broadleaf weed control (Table 47) and yield of fruit (Table 50), number of fruit (Table 53), indicated significance at the one percent level. The emergence of tomatoes (Table 40) showed the control to be significantly better than the high rates of both the incorporated and preemergent treatments and the low rate of the preemergent treatment at the five percent level of Duncan's multiple range test. The control is not significantly different from other treatments at odds of 19:1.

The overall crop ratings for tomatoes (Table 42) demonstrated that the control and the incorporated method at one half the recommended rate are significantly better than the incorporated treatments for both the double and normal recommended rates. The incorporated treatments were significantly better than the pre-emergent plots at odds of 19:1.

Means for annual grass control (Table 46) and broadleaf weed control (Table 48) showed the treatments of both herbicides to be significantly better than the check plots. The number of tomatoes (Table 54) harvested in the control was significantly higher than for the treated plots. The check for the yield of tomatoes (Table 51) was not significantly different from the incorporated methods at the double and normal recommended rates, but was significantly better than the preemergent treatments and the incorporated method at one half the normal rate.

The interaction of herbicide x rate was highly significant on overall crop response (Table 41), yield in pounds per plot (Table 50), number of fruit (Table 53), percent solids (Table 56) and significant for broadleaf weed control (Table 47). A comparison of means for overall crop rating (Table 43) showed the controls to be nonsignificant from PEBC at one half the recommended rate incorporated, but were significantly better than the other treatments of both chemicals.

The mean ratings for broadleaf weed control for all herbicide treatments (Table 49) were significantly better than the check plots. The interaction of herbicide with rate (Table 57) indicates lack of a clear cut effect of herbicides or rates on soluble solids as compared to the controls. A comparison of means for number of fruit harvested (Table 55) showed the control to be superior to the treated plots. PEBC applied preemergent at the double recommended rate resulted in a reduction of every response measured except size of fruit. The size of fruit was not affected by any of the concentrations of PEBC of diphenamid. The yield in weight corresponded with the number of fruit produced.

Table 39. Analysis of Variance for emergence of tomato seedlings with diphenamid and PEBC at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 1386.2970 | 12.6246 |
| Error (a) | 2 | 347.4395 | |
| Rate | 6 | 4619.0000 | 6.1660** |
| Herbicide x rate | 6 | 2018.8810 | 2.6950 |
| Error (b) | 12 | 749.1074 | |
| Asphalt | 2 | 1994.3930 | 2.3925 |
| Herbicide x asphalt | 2 | 21.7969 | 0.0261 |
| Rate x asphalt | 12 | 858.4346 | 1.2975 |
| Rate x asphalt x herbicide | 12 | 1110.0890 | 1.3317 |
| Error (c) | 28 | 833.6189 | |
| TOTAL | 83 | 1263.7800 | |

**Significant at 1 percent level.

Table 40. Combined effect of herbicides (diphenamid and PEBC) on emergence of tomato seedlings.

| Method of application of herbicide | Rate | Mean number of seedlings |
|---|---|---|
| Control | | 133.83 a |
| Incorporated | 0.5 | 126.17 ab |
| Incorporated | 1.0 | 119.92 ab |
| Preemergent | 1.0 | 113.33 abc |
| Incorporated | 2.0 | 105.42 bc |
| Preemergent | 0.5 | 91.08 cd |
| Preemergent | 2.0 | 78.50 d |

a b c d = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 41. Analysis of Variance for overall growth rating of tomato plants with diphenamid and PEBC at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 2.6787 | 9.0004 |
| Error (a) | 2 | 0.2976 | |
| Rate | 6 | 28.6508 | 106.1783** |
| Herbicide x rate | 6 | 5.9841 | 22.1769** |
| Error (b) | 12 | 0.2698 | |
| Asphalt | 2 | 2.0476 | 4.9142* |
| Herbicide x asphalt | 2 | 0.5714 | 1.3714 |
| Rate x asphalt | 12 | 0.5615 | 1.3477 |
| Rate x asphalt x herbicide | 12 | 0.4186 | 1.0047 |
| Error (c) | 28 | 0.4167 | |
| TOTAL | 84 | 2.9276 | |

**Significant at 1 percent level.
*Significant at 5 percent level.

Table 42. Combined effects of herbicides (diphenamid and PEBC) on means of overall crop rating of tomato plant growth.

| Method of application of herbicide | Rate | Mean rating+ for crop response |
|---|---|---|
| Control | | 4.83 a |
| Incorporated | 0.5 | 4.42 a |
| " | 1.0 | 3.33 b |
| " | 2.0 | 3.17 b |
| Preemergent | 1.0 | 1.92 c |
| " | 0.5 | 1.75 c |
| " | 2.0 | 0.50 d |

+5 = best growth, 0 = no crop.
a b c d = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 43. Mean ratings of tomato plant growth for rates and methods of application of diphenamid and PEBC.

| Herbicide | Rate | Method of application | Mean rating+ for crop response |
|---|---|---|---|
| PEBC | | Control | 4.00 a |
| " | 0.5 | Incorporated | 4.67 ab |
| Diphenamid | | Control | 4.67 ab |
| " | 0.5 | Incorporated | 4.17 bc |
| " | 1.0 | Preemergent | 3.50 cd |
| " | 1.0 | Incorporated | 3.50 cd |
| PEBC | 1.0 | Preemergent | 3.33 d |
| Diphenamid | 2.0 | Incorporated | 3.17 d |
| PEBC | 1.0 | " | 3.17 d |
| " | 2.0 | " | 3.17 d |
| " | 0.5 | Preemergent | 2.33 e |
| Diphenamid | 0.5 | " | 1.17 f |
| " | 2.0 | " | 1.00 f |
| PEBC | 2.0 | " | 0.00 g |

+5 = excellent growth, 0 = no crop growth.
a b c d e f g = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 44. Comparison of means of tomato plant growth for hard and soft asphalt.

| Mulch | Mean rating+ for crop response |
|---|---|
| Hard asphalt | 3.0357 a |
| Soft asphalt | 2.9643 a |
| Control | 2.5357 b |

+5 = excellent growth, 0 = no crop growth.
a b = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 45. Analysis of Variance for grass control ratings in tomatoes with diphenamid and PEBC at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 1.19050 | 0.0000 |
| Error (a) | 2 | 0.00000 | |
| Rate | 6 | 1.96430 | 8.8393** |
| Herbicide x rate | 6 | 0.60710 | 2.7321 |
| Error (b) | 12 | 0.22220 | |
| Asphalt | 2 | 0.03571 | 0.2999 |
| Herbicide x asphalt | 2 | 0.08333 | 0.7000 |
| Rate x asphalt | 12 | 0.11910 | 1.0000 |
| Rate x asphalt x herbicide | 12 | 0.08330 | 0.7000 |
| Error (c) | 28 | 0.11910 | |
| TOTAL | 83 | 0.30470 | |

**Significant at 1 percent level.

Table 46. Comparison of means for annual grass control for combined effects of diphenamid and PEBC.

| Method of application of herbicide | Rate | Mean rating+ for grass control |
|---|---|---|
| Preemergent | 1.0 | 5.00 a |
| " | 0.5 | 4.92 a |
| " | 2.0 | 4.83 ab |
| Incorporated | 1.0 | 4.83 ab |
| " | 2.0 | 4.67 ab |
| " | 0.5 | 4.42 b |
| Control | | 3.83 c |

+5 = excellent control, 0 = no control.
a b c = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 47. Analysis of Variance for broadleaf weed control ratings of tomatoes with diphenamid and PEBC at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 1.1904 | 0.7353 |
| Error (a) | 2 | 1.6190 | |
| Rate | 6 | 14.3254 | 55.5345** |
| Herbicide x rate | 6 | 2.4127 | 9.3531* |
| Error (b) | 12 | 0.2580 | |
| Asphalt | 2 | 0.0476 | 0.1652 |
| Herbicide x asphalt | 2 | 0.6190 | 1.5275 |
| Rate x asphalt | 12 | 0.1171 | 0.2588 |
| Rate x asphalt x herbicide | 12 | 0.3830 | 0.8465 |
| Error (c) | 28 | 0.4524 | |
| TOTAL | 83 | 1.5416 | |

**Significant at the 1 percent level.
*Significant at the 5 percent level.

Table 48. Comparison of means for broadleaf weed control in tomatoes for the combined effects of diphenamid and PEBC.

| Method of application of herbicide | Rate | Mean rating[+] for broadleaf weed control |
|---|---|---|
| Incorporated | 1.0 | 3.9167 a |
| Preemergent | 1.0 | 3.6670 a |
| " | 2.0 | 3.5000 ab |
| Incorporated | 2.0 | 3.5167 ab |
| " | 0.5 | 3.0833 bc |
| Preemergent | 0.5 | 2.9167 c |
| Control | | 0.6667 d |

[+]5 = excellent control, 0 = no control.
a b c e = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 49. Mean ratings of control of broadleaf weeds for rates and methods of application of diphenamid and PEBC.

| Herbicide | Rate | Method of application | Mean rating+ for broadleaf control |
|---|---|---|---|
| Diphenamid | 1.0 | Preemergent | 4.00 a |
| PEBC | 1.0 | Incorporated | 4.00 a |
| Diphenamid | 1.0 | " | 3.80 a |
| " | 0.5 | " | 3.80 a |
| " | 2.0 | Preemergent | 3.50 a |
| " | 2.0 | Incorporated | 3.50 a |
| PEBC | 2.0 | Preemergent | 3.50 a |
| " | 1.0 | " | 3.33 a |
| Diphenamid | 1.0 | " | 3.33 a |
| PEBC | 2.0 | Incorporated | 3.33 a |
| " | 0.5 | Preemergent | 2.50 b |
| " | 0.5 | Incorporated | 2.33 b |
| " | | Control | 1.33 c |
| Diphenamid | | " | 0.00 d |

+5 = excellent control, 0 = no control.

a b c d = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 50. Analysis of Variance for yield of tomatoes with diphenamid and PEBC at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 26.8328 | 0.7898 |
| Error (a) | 2 | 33.9725 | |
| Rate | 6 | 332.5088 | 9.9735** |
| Rate x herbicide | 6 | 252.4556 | 7.5723** |
| Error (b) | 12 | 33.3392 | |
| Asphalt | 2 | 3.5288 | 0.0798 |
| Asphalt x herbicide | 2 | 101.2129 | 2.2895 |
| Asphalt x rate | 12 | 26.4357 | 0.5980 |
| Asphalt x rate x herbicide | 12 | 40.6737 | 0.9200 |
| Error (c) | 28 | 44.2066 | |
| Picking date | 1 | 13945.9300 | 5644.8594** |
| Date x herbicide | 1 | 6.0969 | 0.2468 |
| Date x rate | 6 | 57.4478 | 2.3252* |
| Date x asphalt | 2 | 2.2642 | 0.0916 |
| Date x asphalt x herbicide | 2 | 13.5862 | 0.5499 |
| Date x asphalt x rate | 12 | 18.5904 | 0.7525 |
| Date x rate x herbicide | 6 | 85.7098 | 3.4693** |
| Date x rate x asphalt x herb | 12 | 29.0575 | 1.1762 |
| Error (d) | 42 | 24.7055 | |
| Sampling | 168 | 24.8201 | |
| TOTAL | 335 | 80.2360 | |

**Significant at 1 percent level.
*Significant at 5 percent level.

Table 51. Combined effects of herbicides (diphenamid and PEBC) on means for yield of tomatoes.

| Method of application of herbicide | Rate | Mean yield in pounds/plot |
|---|---|---|
| Incorporated | 1.0 | 13.952 a |
| Control | | 13.729 ab |
| Incorporated | 2.0 | 11.821 abc |
| Preemergent | 1.0 | 11.085 bc |
| Incorporated | 0.5 | 11.035 bc |
| Preemergent | 0.5 | 10.671 c |
| Preemergent | 2.0 | 6.015 d |

a b c d = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 52. Means in yield for tomatoes on methods of application of diphenamid and PEBC.

| Herbicide | Rate | Method of application | Mean yield in lbs/plot |
|---|---|---|---|
| Diphenamid | 1.0 | Incorporated | 16.57 a |
| PEBC | | Control | 16.02 ab |
| Diphenamid | 0.5 | Incorporated | 13.78 abc |
| PEBC | 2.0 | " | 13.51 abcd |
| " | 0.5 | Preemergent | 11.97 bcde |
| " | 1.0 | " | 11.89 cde |
| Diphenamid | | Control | 11.44 cde |
| PEBC | 1.0 | Incorporated | 11.34 cde |
| Diphenamid | 1.0 | Preemergent | 10.28 cde |
| " | 2.0 | Incorporated | 10.13 cde |
| " | 0.5 | Preemergent | 9.37 e |
| " | 2.0 | " | 8.72 e |
| PEBC | 0.5 | Incorporated | 8.30 e |
| " | 2.0 | Preemergent | 3.31 f |

a b c d e f = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 53. Analysis of Variance for number of tomatoes harvested with diphenamid and PEBC at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 210.5833 | 0.6379 |
| Error (a) | 2 | 330.1011 | |
| Rate | 6 | 3789.2750 | 24.0509** |
| Herbicide x rate | 6 | 2477.2500 | 15.8503** |
| Error (b) | 12 | 157.5525 | |
| Asphalt | 2 | 72.1458 | 0.2395 |
| Asphalt x herbicide | 2 | 978.2168 | 3.2472 |
| Rate x asphalt | 12 | 139.3162 | 0.4625 |
| Rate x asphalt x herbicide | 12 | 173.5194 | 0.5760 |
| Error (c) | 28 | 301.2471 | |
| Picking dates | 1 | 166073.9000 | 1886.1768** |
| Date x herbicide | 1 | 58.4167 | 0.4181 |
| Date x rate | 6 | 970.4121 | 6.9454** |
| Date x asphalt | 2 | 28.1042 | 0.2011 |
| Date x asphalt x herbicide | 2 | 163.9746 | 1.1174 |
| Date x rate x herbicide | 6 | 849.0410 | 6.7672** |
| Date x rate x asphalt | 12 | 125.2985 | 0.8968 |
| Date x rate x asphalt x herb | 12 | 108.3237 | 0.7753 |
| Error (d) | 42 | 139.7202 | |
| Sampling | 168 | 135.1131 | |
| TOTAL | 335 | 786.7886 | |

**Significant at 1 percent level.

Table 54. Combined effects of herbicides (diphenamid and PEBC) on means for number of tomatoes harvested.

| Method of application of herbicide | Rate | Mean yield in number of fruit/plot |
|---|---|---|
| Control | | 47.104 a |
| Incorporated | 1.0 | 37.750 b |
| " | 2.0 | 37.170 bc |
| Preemergent | 1.0 | 36.770 bc |
| Incorporated | 0.5 | 36.350 bc |
| Preemergent | 0.5 | 32.520 c |
| " | 2.0 | 31.792 d |

a b c d = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 55. Means for number of fruit harvested in tomatoes for methods of application of diphenamid and PEBC.

| Herbicide | Rate | Method of application | Mean number of fruit/plot |
|---|---|---|---|
| PEBC | | Control | 56.208 a |
| Diphenamid | 0.5 | Incorporated | 46.042 b |
| " | 1.0 | " | 43.167 bc |
| PEBC | 2.0 | " | 42.583 bc |
| Diphenamid | | Control | 38.000 bcd |
| " | 1.0 | Preemergent | 37.666 bcde |
| PEBC | 0.5 | " | 36.208 cde |
| " | 1.0 | " | 35.875 cde |
| " | 1.0 | Incorporated | 34.333 cdef |
| Diphenamid | 2.0 | " | 31.750 def |
| " | 0.5 | Preemergent | 28.333 ef |
| PEBC | 0.5 | Incorporated | 26.667 f |
| Diphenamid | 2.0 | Preemergent | 26.500 f |
| PEBC | 2.0 | " | 9.000 g |

a b c d e f g = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 56. Analysis of Variance for percent solids in tomato fruit with diphenamid and PEBC at three rates with hard and soft asphalt and a control.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 0.4429 | 7.4569* |
| Rate | 6 | 0.0927 | 1.5617 |
| Herbicide x rate | 6 | 0.2099 | 3.5337** |
| Asphalt | 2 | 0.1308 | 1.7479 |
| Herbicide x asphalt | 2 | 0.1686 | 2.8397 |
| Rate x asphalt | 12 | 0.1444 | 2.4315** |
| Herbicide x rate x asphalt | 12 | 0.0914 | 1.5397 |
| Picking date | 1 | 0.0201 | 0.3387 |
| Herbicide x date | 1 | 0.3096 | 5.2124** |
| Rate x date | 6 | 0.1287 | 2.1669 |
| Asphalt x date | 2 | 0.0715 | 1.2044 |
| Herbicide x date x rate | 6 | 0.1071 | 1.8036 |
| Herbicide x date x asphalt | 2 | 0.0260 | 0.4389 |
| Rate x asphalt x date | 12 | 0.1851 | 3.1169 |
| Error | 12 | 0.0594 | |
| TOTAL | 83 | 0.1272 | |

**Significant at 1 percent level.
*Significant at 5 percent level.

Table 57. Means for percent solids in tomatoes for methods of application of diphenamid and PEBC.

| Herbicides | Rate | Method of application | Means for percent solids |
|---|---|---|---|
| Diphenamid | 2.0 | Incoporated | 6.10 a |
| " | 1.0 | Preemergent | 5.92 ab |
| PEBC | 1.0 | Incorporated | 5.95 ab |
| Diphenamid | 0.5 | " | 5.95 ab |
| PEBC | 0.5 | " | 5.85 ab |
| Diphenamid | 0.5 | Preemergent | 5.82 ab |
| " | | Control | 5.77 ab |
| PEBC | 2.0 | Preemergent | 5.75 ab |
| " | | Control | 5.67 bc |
| Diphenamid | 2.0 | Preemergent | 5.66 bc |
| " | 1.0 | Incorporated | 5.66 bc |
| PEBC | 1.0 | Preemergent | 5.62 bc |
| " | 2.0 | Incorporated | 5.62 bc |
| " | 0.5 | Preemergent | 5.42 c |

a b c = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 58. Means for percent solids in tomatoes for the combined effects of herbicides (diphenamid and PEBC) and asphalts.

| Method of application of herbicide | Rate | Mulch | | Means for percent solids |
|---|---|---|---|---|
| Incorporated | 0.5 | No | asphalt | 6.1 a |
| " | 2.0 | Soft | " | 6.0 ab |
| " | 1.0 | No | " | 6.0 ab |
| " | 0.5 | Soft | " | 6.0 ab |
| " | 2.0 | Hard | " | 5.9 abc |
| Preemergent | 1.0 | Soft | " | 5.9 abc |
| Incorporated | 1.0 | Soft | " | 5.8 abc |
| Control | | No | " | 5.8 abc |
| Preemergent | 1.0 | No | " | 5.8 abc |
| " | 0.5 | No | " | 5.8 abc |
| " | 2.0 | Soft | " | 5.8 abc |
| " | 0.5 | Hard | " | 5.8 abc |
| " | 2.0 | Hard | " | 5.7 abc |
| " | 1.0 | Hard | " | 5.7 abc |
| Control | | Soft | " | 5.7 abc |
| Incorporated | 2.0 | No | " | 5.7 abc |
| Preemergent | 2.0 | No | " | 5.7 abc |
| Control | | Hard | " | 5.7 abc |
| Incorporated | 0.5 | Hard | " | 5.6 bc |
| " | 1.0 | Hard | " | 5.5 c |
| Preemergent | 0.5 | Soft | " | 5.3 c |

a b c = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 59. Comparison of means for percent solids in tomatoes for combined effects of herbicides (diphenamid and PEBC) with hard and soft asphalt and two picking dates.

| Method of application of herbicide | Rate | Asphalt | Picking date | Mean for percent solids |
|---|---|---|---|---|
| Incorporated | 1.0 | No | 1 | 6.25 a |
| " | 0.5 | Soft | 2 | 6.25 a |
| " | 0.5 | No | 2 | 6.25 a |
| Preemergent | 0.5 | No | 1 | 6.20 ab |
| Control | 0.0 | No | 2 | 6.20 ab |
| Preemergent | 1.0 | Soft | 1 | 6.05 abc |
| Incorporated | 2.0 | Soft | 2 | 6.05 abc |
| " | 2.0 | Hard | 1 | 6.05 abc |
| Preemergent | 2.0 | Soft | 1 | 6.00 abc |
| Incorporated | 2.0 | Soft | 1 | 5.95 abcd |
| Preemergent | 1.0 | No | 1 | 5.90 abcd |
| Incorporated | 0.5 | No | 1 | 5.90 abcd |
| Preemergent | 1.0 | Hard | 2 | 5.85 abcde |
| Incorporated | 1.0 | Soft | 2 | 5.85 abcde |
| " | 2.0 | Hard | 2 | 5.80 abcdef |
| " | 1.0 | Soft | 1 | 5.80 abcdef |
| Control | 0.0 | Soft | 1 | 5.80 abcdef |
| Preemergent | 2.0 | Hard | 2 | 5.80 abcdef |
| " | 0.5 | Hard | 1 | 5.75 abcdef |
| " | 0.5 | Hard | 2 | 5.75 abcdef |
| Incorporated | 2.0 | No | 1 | 5.75 abcdef |
| " | 1.0 | Hard | 2 | 5.75 abcdef |
| " | 1.0 | No | 2 | 5.75 abcdef |
| Preemergent | 2.0 | No | 2 | 5.70 abcdef |
| " | 2.0 | Hard | 1 | 5.65 abcdef |
| " | 1.0 | Soft | 2 | 5.65 abcdef |
| " | 1.0 | No | 2 | 5.65 abcdef |
| Incorporated | 0.5 | Soft | 1 | 5.65 abcdef |
| " | 0.5 | Hard | 1 | 5.65 abcdef |
| Control | 0.0 | Hard | 2 | 5.65 abcdef |
| " | 0.0 | Hard | 1 | 5.65 abcdef |

Table 59. Continued.

| Method of application of herbicide | Rate | Asphalt | Picking date | Mean for percent solids | |
|---|---|---|---|---|---|
| Preemergent | 2.0 | No | 1 | 5.60 | bcdef |
| " | 1.0 | Hard | 1 | 5.55 | cdef |
| Incorporated | 2.0 | No | 2 | 5.55 | cdef |
| Control | 0.0 | Soft | 2 | 5.55 | cdef |
| Preemergent | 2.0 | Soft | 2 | 5.50 | cdef |
| Incorporated | 0.5 | Hard | 2 | 5.50 | cdef |
| Control | 0.0 | No | 1 | 5.45 | cdef |
| Preemergent | 0.5 | Soft | 1 | 5.45 | cdef |
| " | 0.5 | No | 2 | 5.35 | def |
| Incorporated | 1.0 | Hard | 1 | 5.25 | ef |
| Preemergent | 0.5 | Soft | 2 | 5.20 | f |

a b c d e f = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

## Logarithmic Herbicide Experiments with Petroleum Mulch

The results of logarithmic application of herbicide with asphalt overlay on snap beans, sweet corn and tomatoes are shown in Tables 60 through 70.

Analysis of Variance are indicated for emergence of sweet corn (Table 68), snap beans (Table 69), and tomatoes (Table 70). There were no significant differences for emergence of the three crops. The two dates of emergence were highly significant for snap beans (Table 69) and for tomatoes (Table 70). The emergence dates for sweet corn (Table 68) were not significantly different.

Analysis of Variance for annual grass control (Table 60) and broadleafed weed control (Table 64) were highly significant for method of application of herbicide, herbicide, concentration, concentration x herbicide, and method of application of herbicide x herbicide.

An examination of means for methods of application of herbicides (Table 66) showed the incorporated application of herbicides to be significantly better than preemergent application with hard and soft asphalt overlay. The methods of application of herbicide for grass control (Table 62) showed incorporated and preemergent herbicides capped with hard asphalt to be significantly better than preemergent herbicides without asphalt overlay.

A rating of annual grass and broadleaf weed control for Atrazine, Ramrod, EPTC, trifluralin, PEBC, and diphenamid under similar conditions of application (Table 61 and 65), showed Atrazine to give significantly better weed control than the other herbicides tested.

The interaction of herbicide x method was significant for the control of annual grass. A comparison of means for each herbicide and methods of application (Table 63) are shown.

Atrazine was not significantly influenced by any of the methods of application of the herbicide. The incorporation of Ramrod significantly increased the control of weeds over preemergent soft asphalt plots. The incorporated plots of Ramrod were not significantly different from the preemergent and preemergent hard asphalt plots.

Trifluralin incorporated gave significantly better grass control than preemergent plots and preemergent plots with soft asphalt overlay. Trifluralin incorporated did not significantly influence grass control over the preemergent hard asphalt plots. The different methods of application did not significantly influence the control of grass with EPTC.

The preemergent application of diphenamid with soft asphalt gave significantly better weed control than did the preemergent plots without asphalt overlay. The soft asphalt plots were nonsignificant from the incorporated and preemergent hard asphalt, plots. The incorporation of PEBC gave significantly better results than the preemergent plots and preemergent plots capped with hard and soft asphalt.

An examination of means for broadleaf weed control (Table 67) for the interaction of herbicide x method of application indicates significance at the five percent level.

The response of Atrazine was not significantly influenced by any of the four methods used. The incorporation of Ramrod significantly increased broadleaf weed control over the preemergent application of the herbicide. However, incorporation of Ramrod was not significant from preemergent application with hard and soft asphalt overlay.

The incorporation of trifluralin gave significantly better weed control than with the preemergent plots and preemergent plots with soft asphalt overlay. EPTC incorporated into the soil increased the action of that herbicide to give better weed control than the three other methods of application.

Diphenamid incorporated, and preemergent application with hard and soft asphalt covering gave significantly better weed control than the preemergent plots. The incorporation and preemergent hard asphalt plots of PEBC gave significantly better weed control than the surface application of the herbicide without the mulch.

The results of the logarithmic application of herbicides with asphalt overlay for the three crops are shown in Figures 1 through 20.

Figures 1 through 12 indicate relative control of annual grass and broadleafed weeds for each of the six herbicides. Figures 13 through 20 indicate herbicide response to methods of application.

Table 60. Analysis of Variance for annual grass control with logarithmic application of six herbicides with hard and soft asphalt overlay.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 5 | 5.03 | 9.67** |
| Method of application of herbicide | 3 | 3.39 | 6.52** |
| Concentration | 7 | 8.95 | 17.21** |
| Concentration x herbicide | 35 | 1.17 | 2.25** |
| Concentration x method | 21 | 0.79 | 1.52 |
| Herbicide x method | 15 | 1.34 | 2.58** |
| Concentration x method x herbicide | 105 | 0.52 | |
| TOTAL | 191 | 1.26 | |

**Significant at 1 percent level.

Table 61. Comparison of means for annual grass control with six herbicides.

| Herbicides | Mean rating[+] for grass control |
|---|---|
| Atrazine | 9.78 a |
| Diphenamid | 9.15 b |
| Trifluralin | 9.03 bc |
| Ramrod | 9.03 bc |
| EPTC | 8.72 c |
| PEBC | 8.69 c |

[+]10 = excellent control, 1 = no grass control.

a b c = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 62. Comparison of means for annual grass control with methods of application of herbicides.

| Method of application of herbicide | Mean rating[+] for grass control |
|---|---|
| Incorporated | 9.40 a |
| Hard asphalt | 9.17 ab |
| Soft asphalt | 8.90 bc |
| Preemergent | 8.81 c |

[+]10 = excellent control, 1 = no grass control.
a b c = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 63. Comparison of means for annual grass control for methods of application with six herbicides.

| Herbicides | Method of application | Mean rating+ for grass control |
|---|---|---|
| Trifluralin | Incorporated | 10.00 a |
| Atrazine | Preemergent | 10.00 a |
| " | Hard asphalt | 9.88 ab |
| " | Soft asphalt | 9.75 ab |
| " | Incorporated | 9.50 abc |
| Ramrod | " | 9.50 abc |
| PEBC | " | 9.50 abc |
| Diphenamid | Soft asphalt | 9.50 abc |
| " | Hard asphalt | 9.25 abcd |
| Ramrod | " | 9.25 abcd |
| Trifluralin | " | 9.25 abcd |
| Diphenamid | Incorporated | 9.13 bcde |
| EPTC | Hard asphalt | 9.00 cdef |
| " | Incorporated | 8.75 cdef |
| " | Preemergent | 8.75 cdef |
| Ramrod | " | 8.75 cdef |
| Diphenamid | " | 8.75 cdef |
| PEBC | Soft asphalt | 8.63 def |
| Ramrod | " | 8.63 def |
| Trifluralin | " | 8.60 def |
| " | Preemergent | 8.38 def |
| EPTC | Soft asphalt | 8.38 def |
| PEBC | Hard asphalt | 8.38 def |
| " | Preemergent | 8.25 def |

+10 = excellent control, 1 = no grass control.

a b c d e f = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 64. Analysis of Variance for broadleaf weed control with logarithmic application of six herbicides with hard and soft asphalt overlay.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 5 | 53.030 | 58.53** |
| Method of application of herbicide | 3 | 19.090 | 21.07** |
| Concentration | 7 | 12.530 | 13.83** |
| Concentration x herbicide | 35 | 3.840 | 4.23** |
| Concentration x methods | 21 | 1.340 | 1.48 |
| Herbicide x method | 15 | 3.350 | 3.70** |
| Concentration x herbicide x method | 105 | 0.906 | |
| TOTAL | 191 | 3.760 | |

**Significant at 1 percent level.

Table 65. Comparison of means for broadleaf weed control with six herbicides.

| Herbicide | Mean rating[+] for broadleaf control |
|---|---|
| Atrazine | 9.38 a |
| Trifluralin | 7.94 b |
| EPTC | 7.28 c |
| Ramrod | 6.84 c |
| Diphenamid | 5.53 c |
| PEBC | 5.81 d |

[+]10 = excellent control, 1 = no weed control.

a b c d = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 66. Comparison of means for broadleaf weed control with methods of application of herbicides.

| Method of application of herbicide | Mean rating[+] for broadleaf control |
|---|---|
| Incorporated | 8.17 a |
| Hard asphalt | 7.29 b |
| Soft asphalt | 7.04 bc |
| Preemergent | 6.69 c |

[+]10 = excellent control, 1 = no weed control.
a b c = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 67. Comparison of means for broadleaf weed control for methods of application with six herbicides.

| Herbicide | Method of application | Mean rating[+] for broadleaf control |
|---|---|---|
| Atrazine | Hard asphalt | 9.50 a |
| " | Soft asphalt | 9.50 a |
| " | Incorporated | 9.25 a |
| " | Preemergent | 9.25 a |
| Trifluralin | Incorporated | 9.25 a |
| EPTC | " | 8.50 ab |
| Trifluralin | Hard asphalt | 8.00 ab |
| Ramrod | Incorporated | 7.63 bcd |
| Trifluralin | Preemergent | 7.50 bcd |
| Diphenamid | Soft asphalt | 7.38 bcd |
| PEBC | Incorporated | 7.38 bcd |
| EPTC | Preemergent | 7.25 cde |
| Trifluralin | Soft asphalt | 7.00 cde |
| Ramrod | Hard asphalt | 7.00 cde |
| Diphenamid | " | 7.00 cde |
| " | Incorporated | 7.00 cde |
| EPTC | Soft asphalt | 6.88 cdef |
| Ramrod | " | 6.63 defg |
| EPTC | Hard asphalt | 6.50 defg |
| Ramrod | Preemergent | 6.13 efg |
| Diphenamid | " | 5.88 fgh |
| PEBC | Hard asphalt | 5.75 gh |
| " | Soft asphalt | 4.88 hi |
| " | Preemergent | 4.13 i |

[+]10 = excellent control, 1 = no weed control.

a b c d e f g h i = Any two means with the same subscript are not significantly different at the 5 percent significant level, according to Duncan's multiple range test.

Table 68. Analysis of Variance for emergence of sweet corn with logarithmic application of Atrazine and Ramrod with hard and soft asphalt overlay.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 15.12 | 0.106 |
| Method of application of herbicide | 3 | 169.46 | 1.191 |
| Herbicide x method | 3 | 183.13 | 1.287 |
| Error (a) | 8 | 142.33 | |
| Emergence date | 1 | 24.50 | 0.068 |
| Date x herbicide | 1 | 4.50 | 0.013 |
| Date x method | 3 | 2.83 | 0.008 |
| Date x method x herbicide | 3 | 3.25 | 0.009 |
| Error (b) | 8 | 359.05 | |
| TOTAL | 31 | 165.42 | |

Table 69. Analysis of Variance for emergence of snap beans with logarithmic application of Trifluralin and EPTC with hard and soft asphalt overlay.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 12680.28 | 0.4511 |
| Method of application of herbicide | 3 | 29116.28 | 1.0360 |
| Herbicide x method | 3 | 3064.62 | 0.1090 |
| Error (a) | 8 | 28107.15 | |
| Emergence date | 1 | 27086.28 | 21.225** |
| Date x herbicide | 1 | 2397.78 | 1.879 |
| Date x method | 3 | 72.62 | 0.057 |
| Date x method x herbicide | 3 | 403.61 | 0.316 |
| Error (b) | 8 | 1276.16 | |
| TOTAL | 31 | 12103.30 | |

**Significant at 1 percent level.

Table 70. Analysis of Variance for emergence of tomatoes with logarithmic application of Diphenamid and PEBC with hard and soft asphalt overlay.

| Source of variation | Degrees of freedom | Mean square | F |
|---|---|---|---|
| Herbicide | 1 | 3838.28 | 3.002 |
| Method of application of herbicide | 3 | 9.70 | 0.076 |
| Herbicide x method | 3 | 1513.86 | 1.184 |
| Error (a) | 8 | 1278.70 | |
| Emergence date | 1 | 41256.28 | 43.309** |
| Date x herbicide | 1 | 1498.79 | 1.573 |
| Date x method | 3 | 176.36 | 0.185 |
| Date x method x herbicide | 3 | 358.70 | 0.377 |
| Error (b) | 8 | 952.61 | |
| TOTAL | 31 | 2278.06 | |

**Significant at 1 percent level.

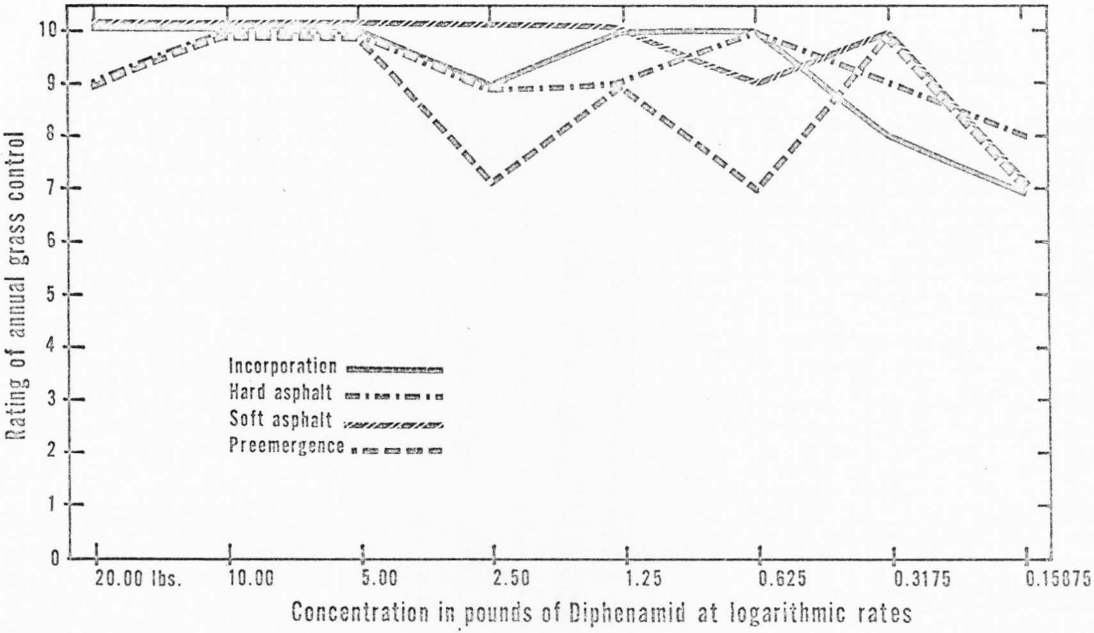


Figure 1. Control of annual grass in tomatoes with Diphenamid applied preemergent with incorporation and preemergent with hard and soft asphalt overlay.

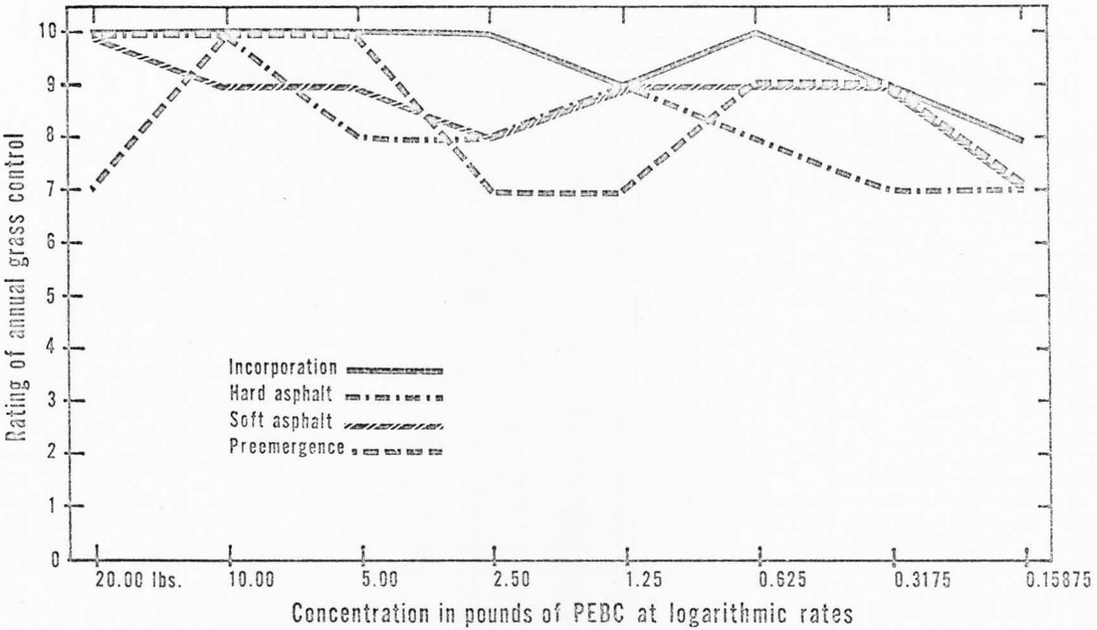


Figure 2. Control of annual grasses in tomatoes with PEBC applied preemergent with incorporation, and preemergent with hard and soft asphalt overlay.

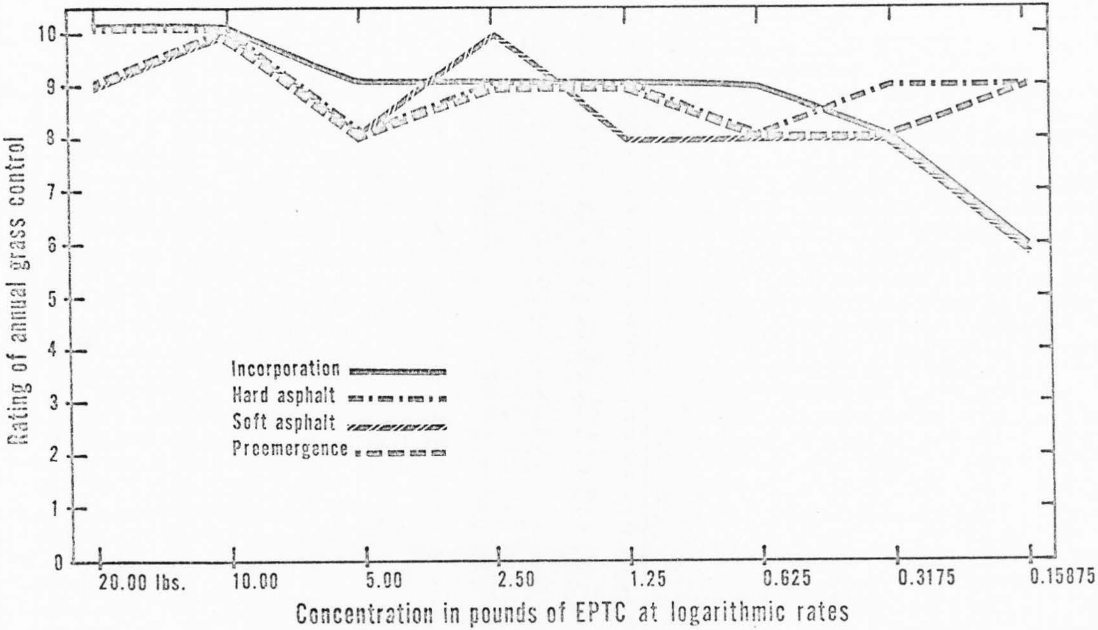


Figure 3. Control of annual grasses in snap beans with EPTC applied preemergent with incorporation, and preemergent with hard and soft asphalt overlay.

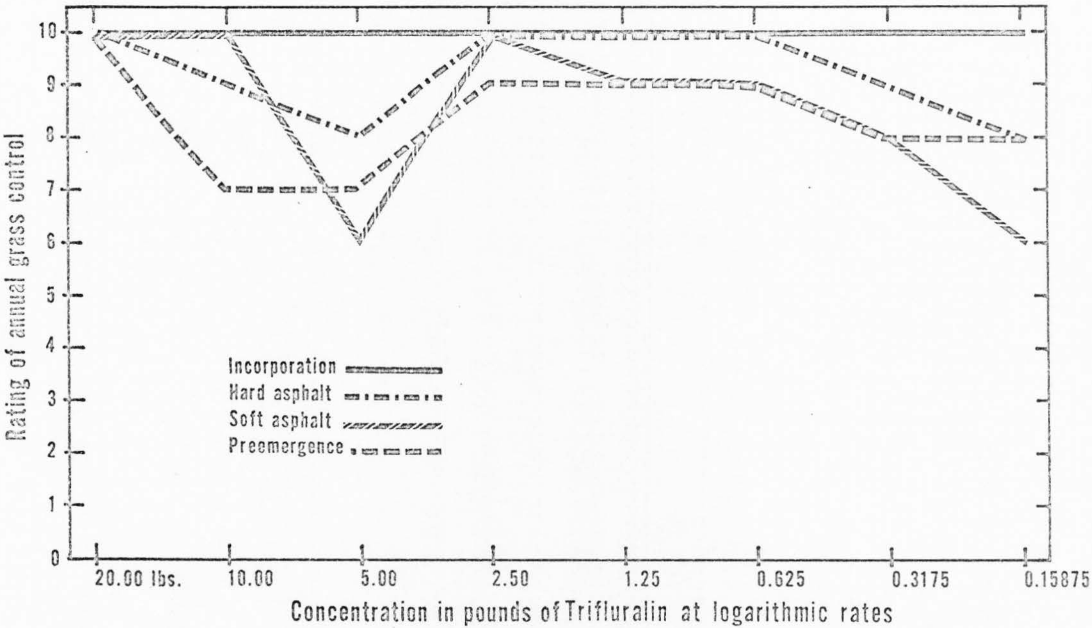


Figure 4. Control of annual grasses in snap beans with Trifluralin applied preemergent with incorporation, and preemergent with hard and soft asphalt overlay.

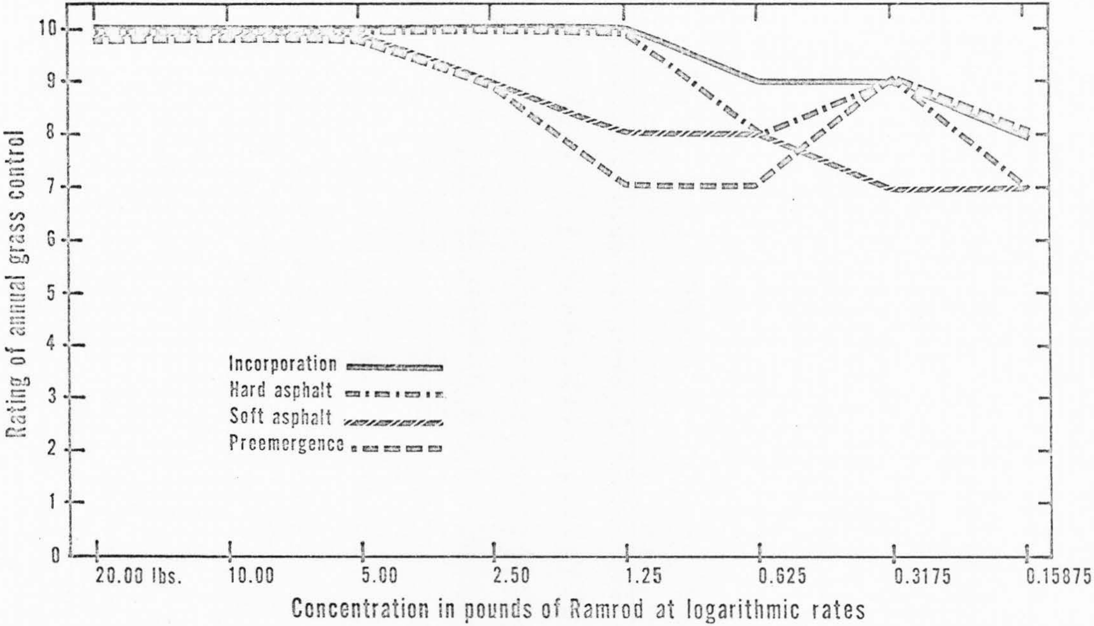


Figure 5. Control of annual grass in sweet corn with Ramrod applied preemergent by incorporation, and preemergent with hard and soft asphalt overlay.

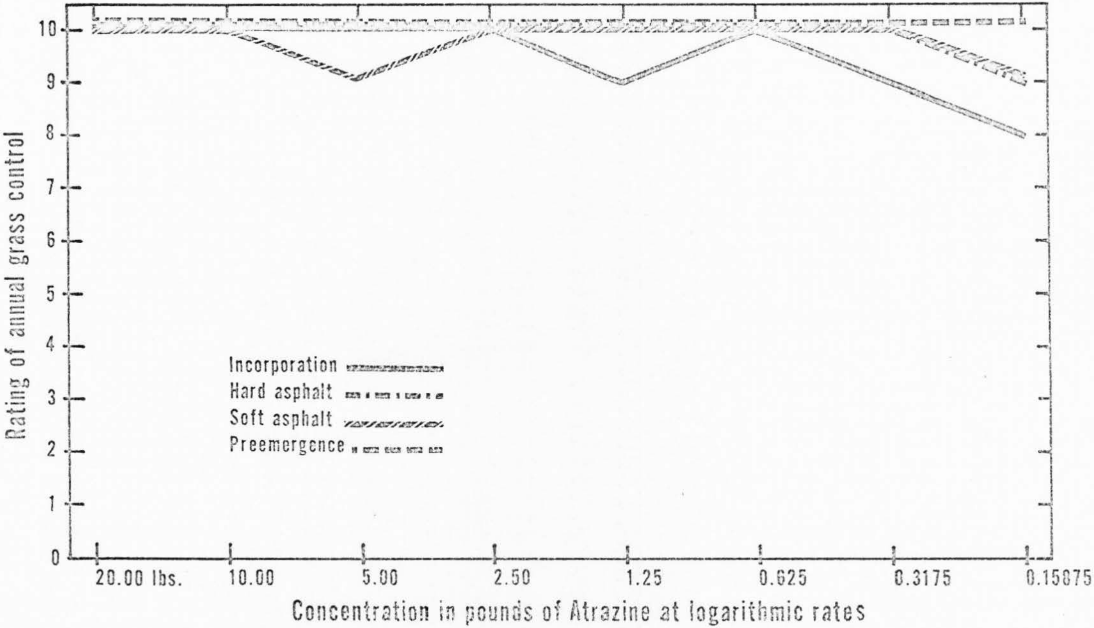


Figure 6. Control of annual grass in sweet corn with Atrazine applied preemergent by incorporation, and preemergent with hard and soft asphalt overlay.

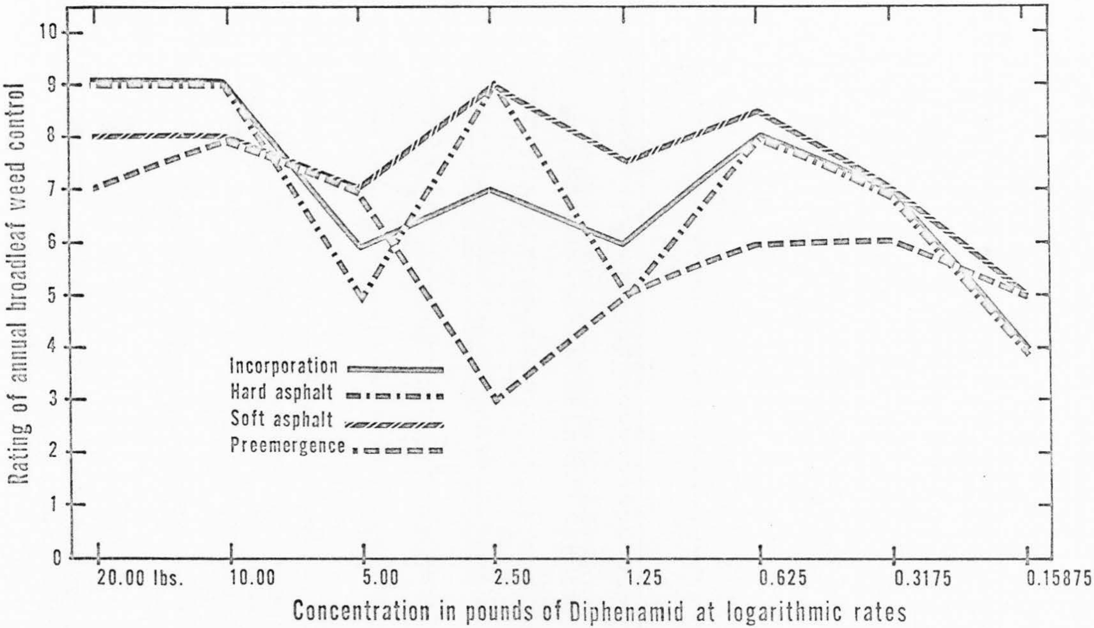


Figure 7. Control of annual broadleaf weeds in tomatoes with Diphenamid applied preemergent by incorporation, and preemergent with hard and soft asphalt overlay.

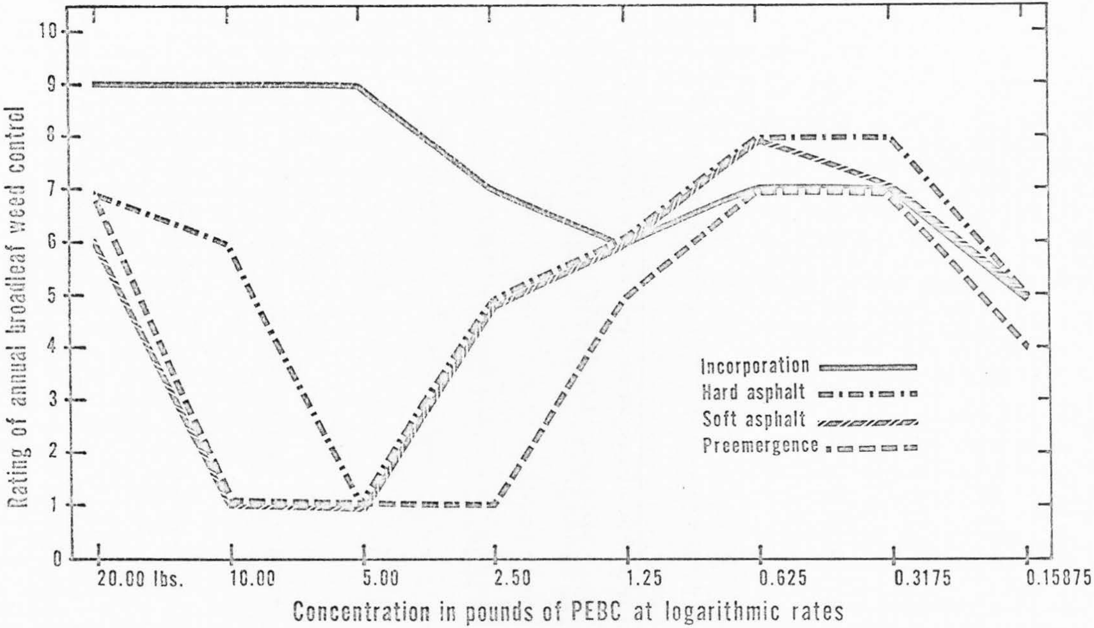


Figure 8. Control of annual broadleaf weeds in tomatoes with PEBC applied preemergent, by incorporation, and preemergent with hard and soft asphalt overlay.

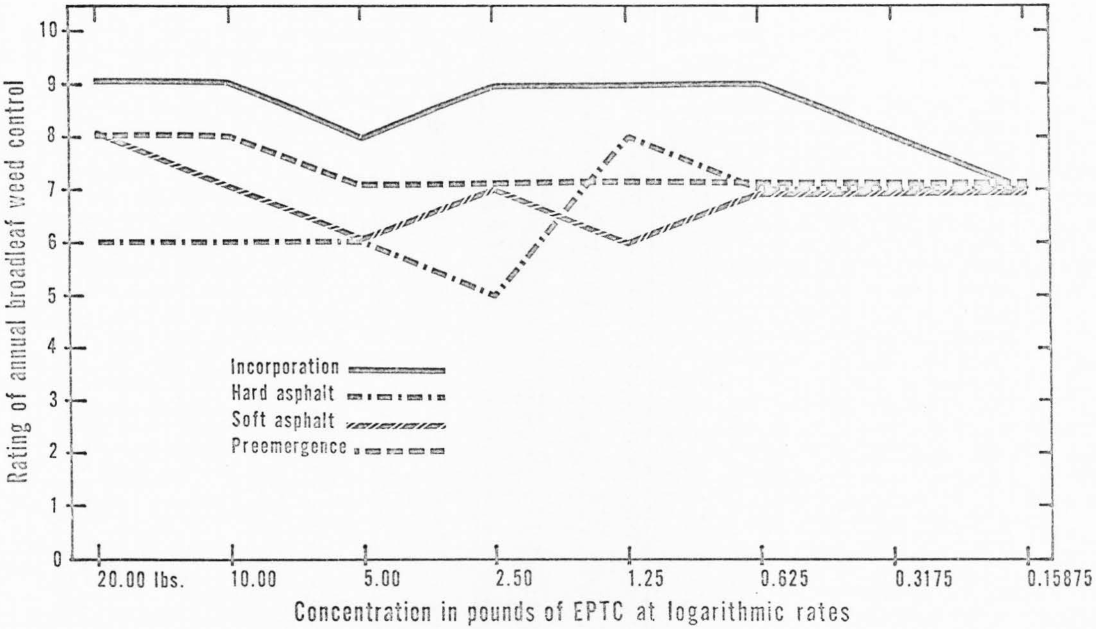


Figure 9. Control of annual broadleaf weeds in snap beans with EPTC applied preemergent, by incorporation, and preemergent with hard and soft asphalt overlay.

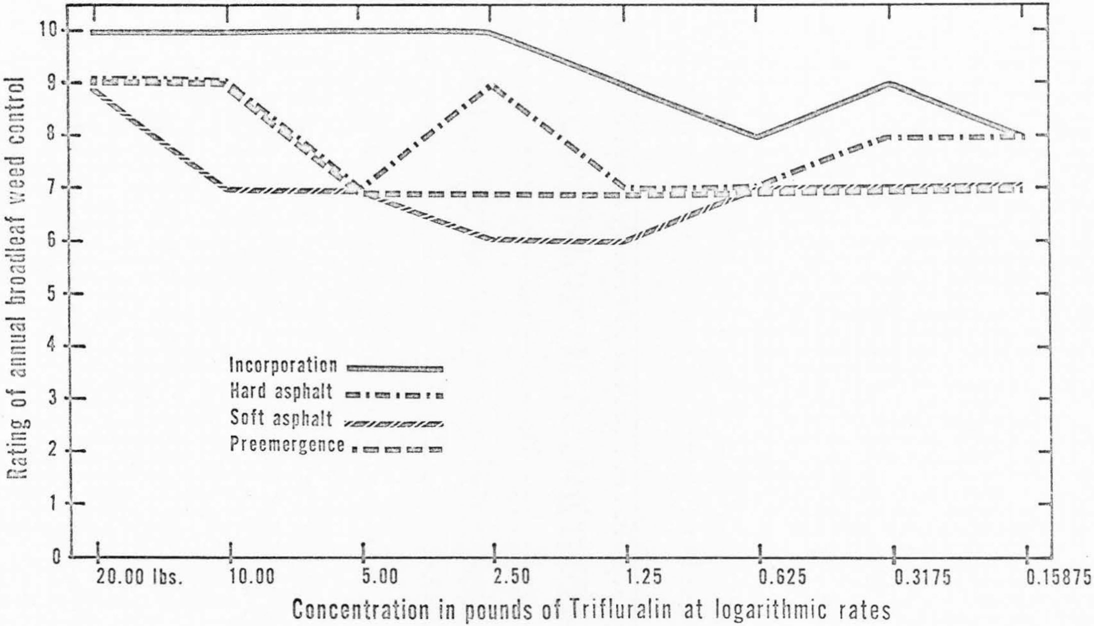


Figure 10. Control of annual broadleaf weeds in snap beans with Trifluralin applied preemergent, by incorporation, and preemergent with hard and soft asphalt overlay.

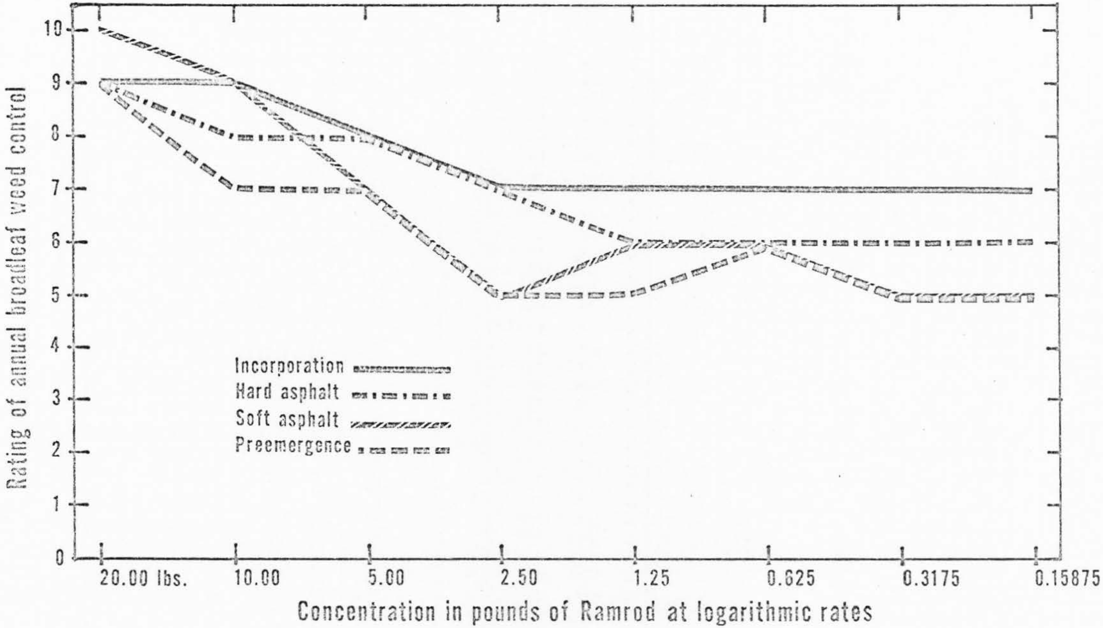


Figure 11. Control of annual broadleaf weeds in sweet corn with Ramrod applied preemergent, by incorporation, and preemergent with hard and soft asphalt overlay.

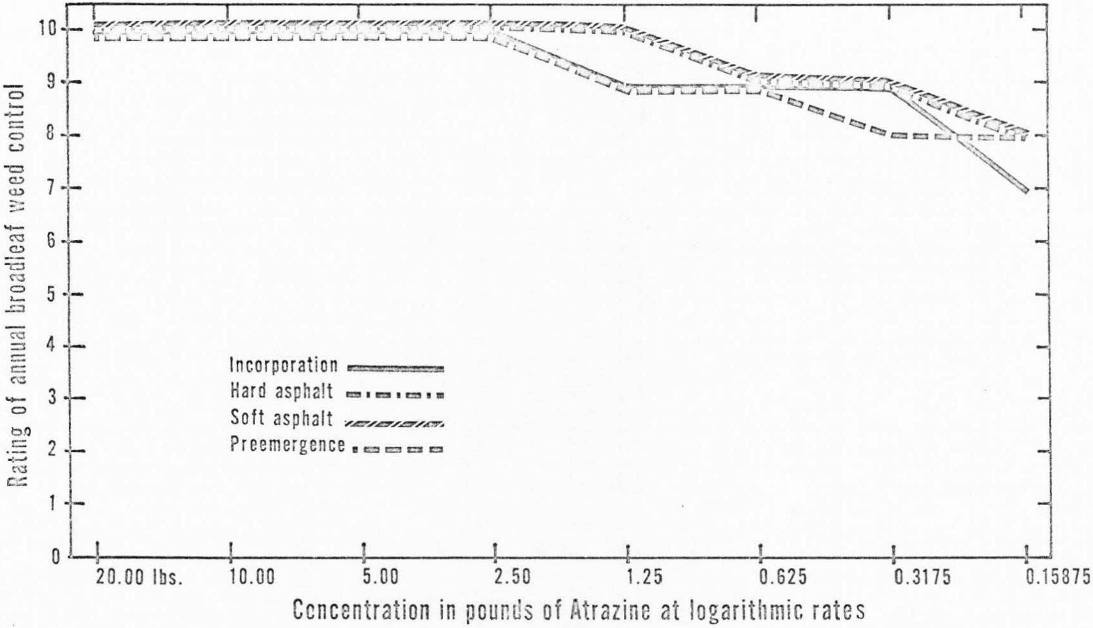


Figure 12. Control of annual broadleaf weeds in sweet corn with Atrazine applied preemergent, by incorporation, and preemergent with hard and soft asphalt overlay.

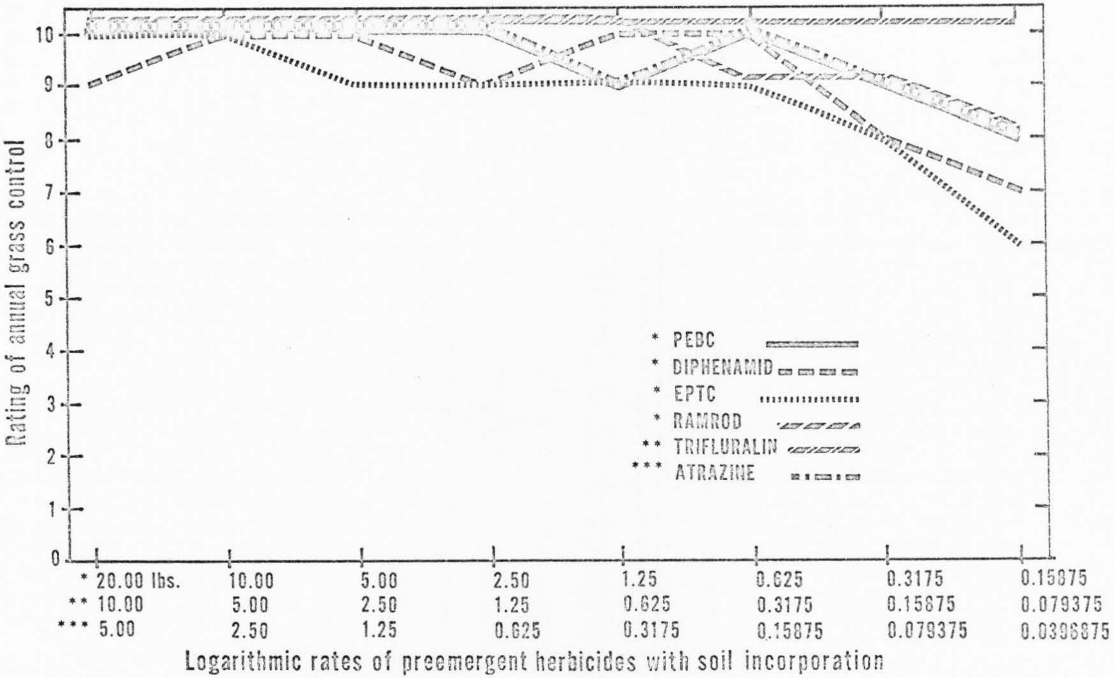


Figure 13. Control of annual grass in tomatoes, snap beans and sweet corn with selected herbicides incorporated.

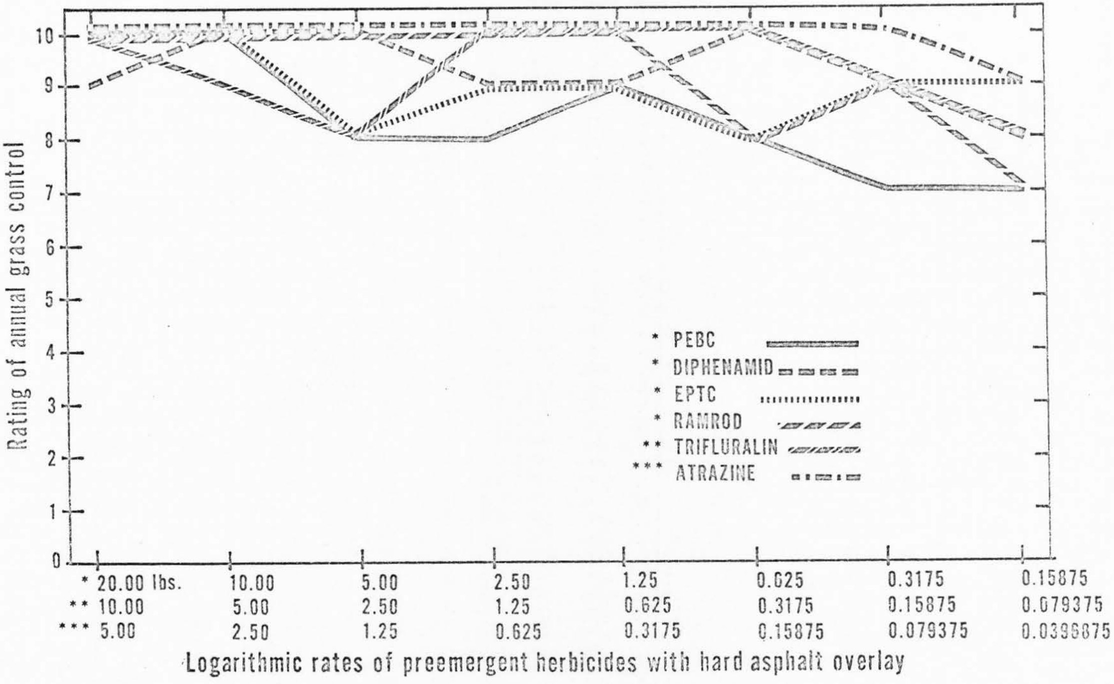


Figure 14. Control of annual grass in tomatoes, snap beans and sweet corn with selected herbicides with hard asphalt overlay.

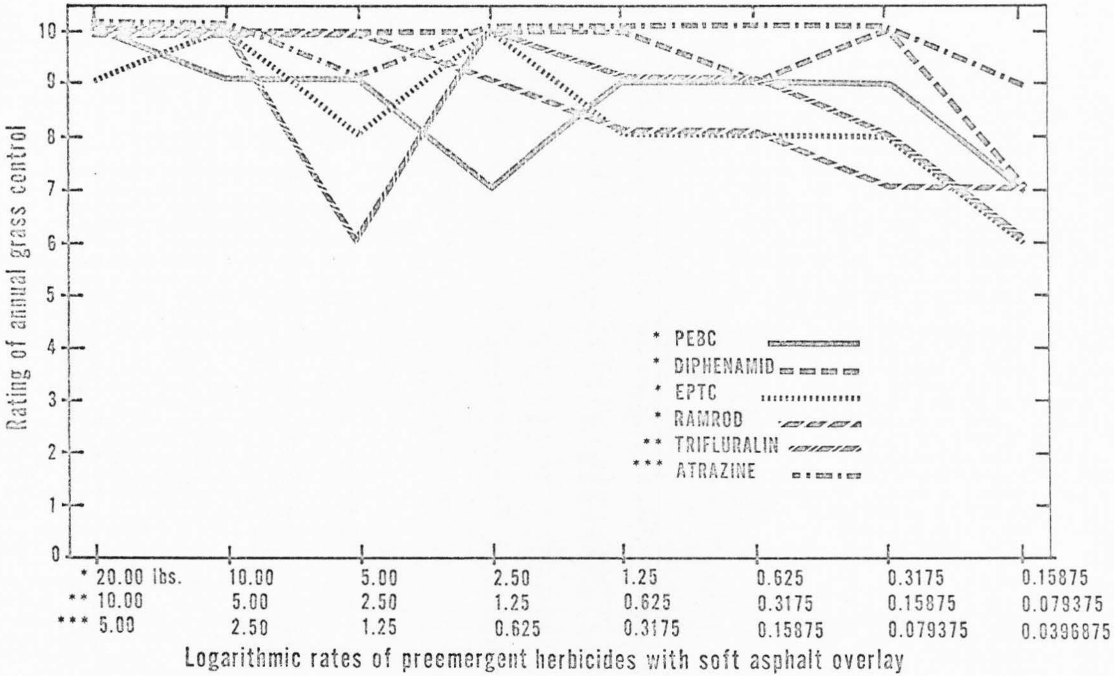


Figure 15. Control of annual grass in tomatoes, snap beans and sweet corn with selected herbicides with soft asphalt overlay.

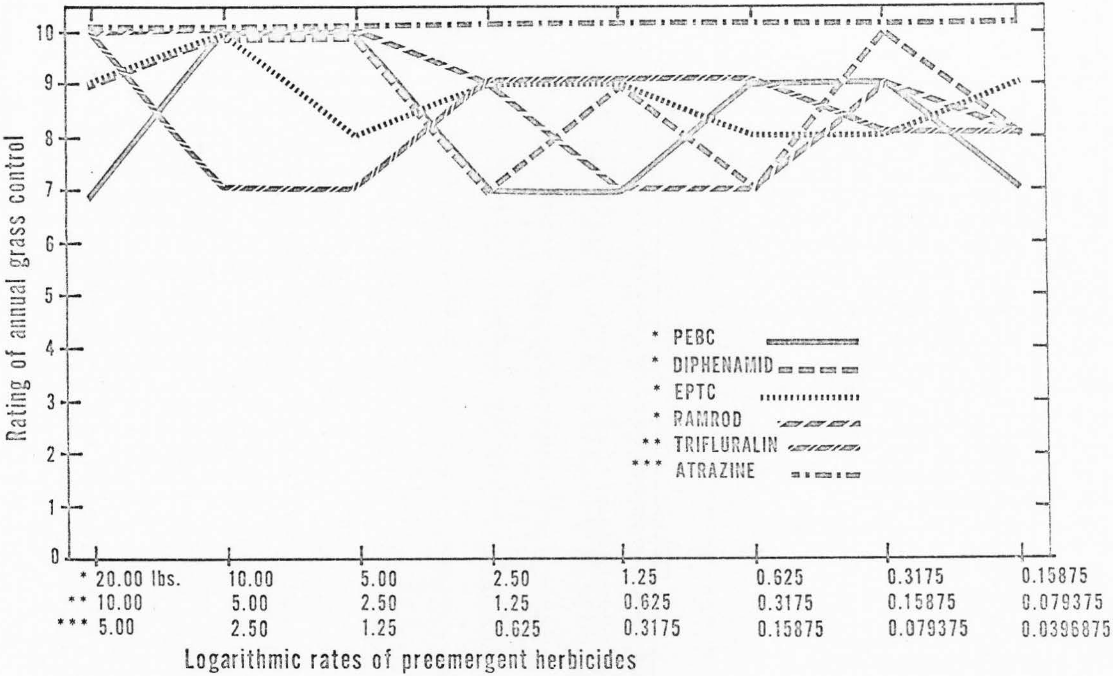


Figure 16. Control of annual grass in tomatoes, snap beans and sweet corn with selected herbicides applied by preemergence.

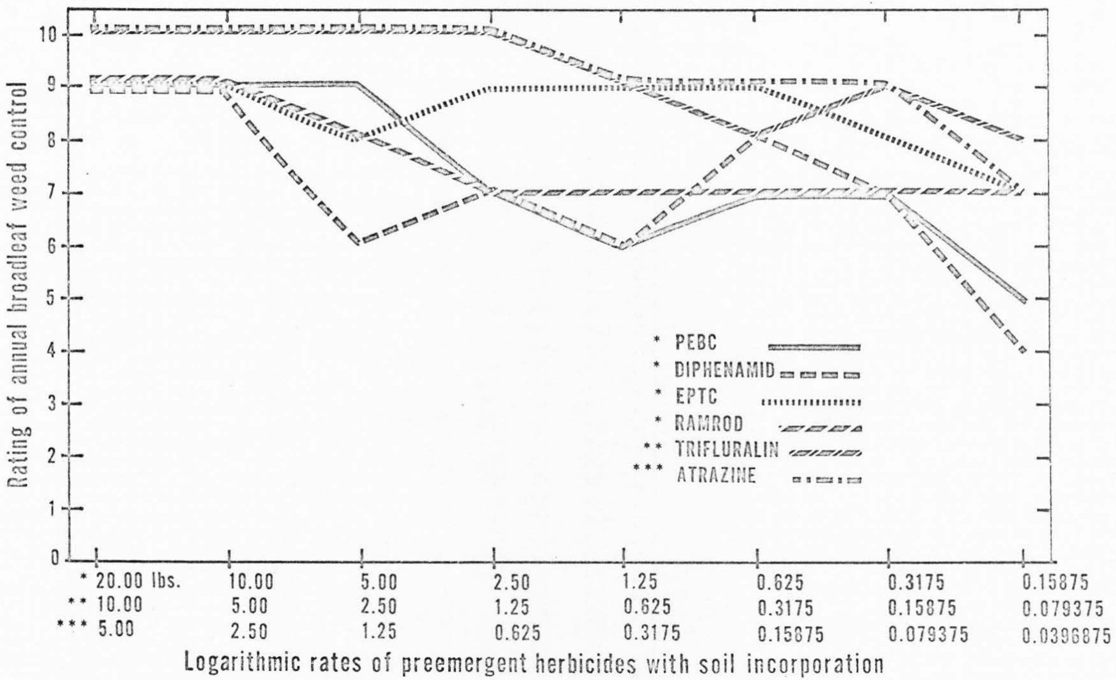


Figure 17. Control of annual broadleaf weeds in tomatoes, snap beans and sweet corn with selected herbicides incorporated.

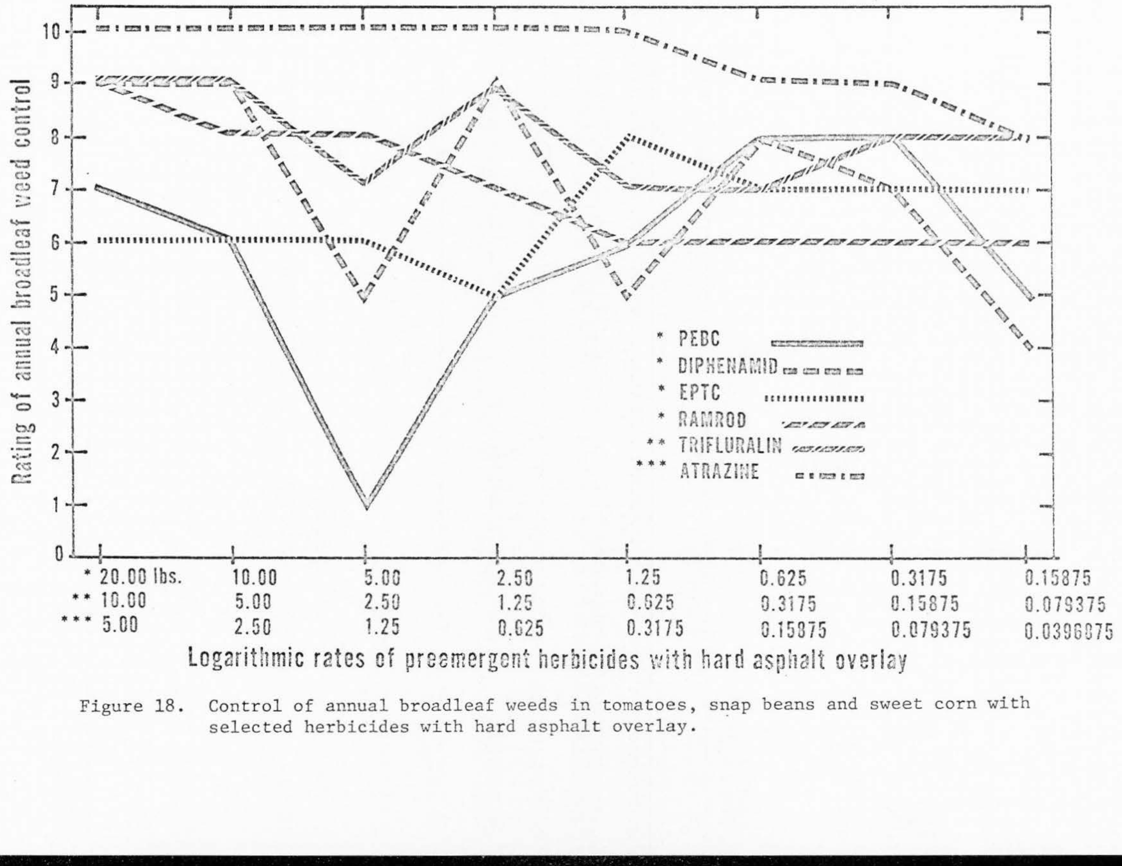


Figure 18. Control of annual broadleaf weeds in tomatoes, snap beans and sweet corn with selected herbicides with hard asphalt overlay.

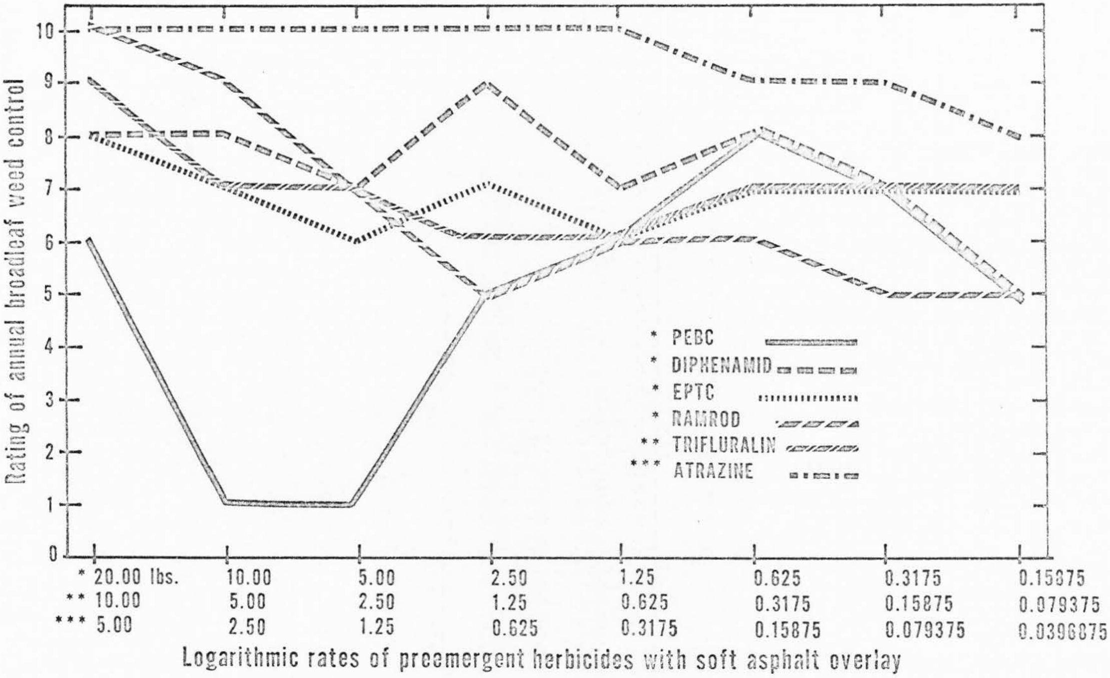


Figure 19. Control of annual broadleaf weeds in tomatoes, snap beans and sweet corn with selected herbicides with soft asphalt overlay.

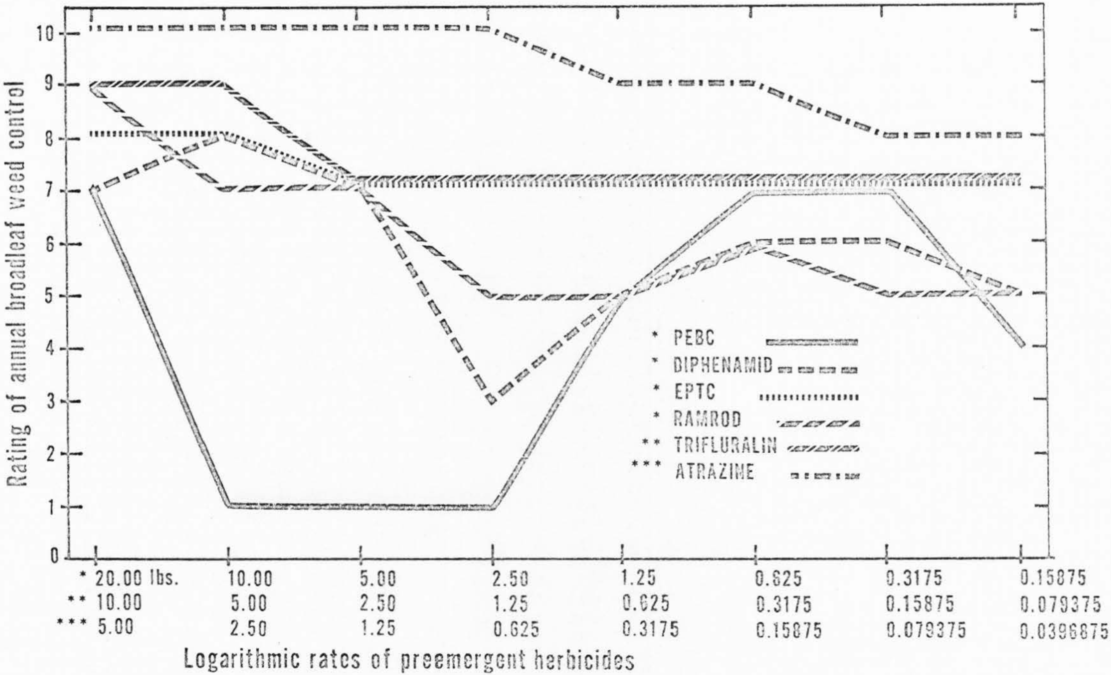


Figure 20. Control of annual broadleaf weeds in tomatoes, snap beans and sweet corn with selected herbicides applied by preemergence.

# DISCUSSION

## Petroleum Mulch and Herbicides

The application of petroleum mulch with herbicides can be a simple process without much added expense. Herbicides can be applied by incorporation or preemergence with the planting of vegetable crops. A tee jet nozzle for the petroleum mulch may be attached to the tool bar immediately following the planter. This would make it possible to apply the herbicide, fertilize, plant seed and spray on the asphalt in one process.

One of the main advantages of petroleum mulch is the increase of soil temperature for faster germination of a crop. It is also important to know the optimum soil temperature for germination. Since tomatoes germinate at 57°F, if the soil temperature is at 57° or above then the application of petroleum mulch would be of no value to the crop. If the soil temperature is lower than 55°F then petroleum mulch would increase the soiltemperature thus causing faster germination of the tomatoes. There must be adequate sunlight in order for petroleum mulch to be effective in increasing soil temperature. Overcast cloudy days will eliminate the effectiveness of the petroleum mulch.

Asphalts significantly increased the emergence of sweet corn but did not significantly increase the emergence of tomatoes or snap beans. Overcast cloudy days and relatively cool temperature in the spring were considered the cause of no significant increase in the germination of snap beans and tomatoes.

The interaction of asphalt x herbicide indicated that there were no deleterious or beneficial effects to the crops to significantly decrease or increase the growth and yield of crops studied. The control of grass and broadleafed weeds was not significantly increased by the application of asphalt with the herbicide. The petroleum mulch applied as an overlay over the herbicide did not reduce normal herbicidal activity.

Herbicides

The combined effects of Ramrod and Atrazine in sweet corn, EPTC and trifluralin in snap beans and PEBC and diphenamid in tomatoes gave significantly better weed control than plots without the herbicides.

Analyses of Variance for yield of sweet corn with husk, without husk, cobs and kernels were significantly different for the combined effects of Ramrod and Atrazine. An observation of the means for the combined effects showed that the preemergent plots yielded significantly more corn than the incorporated plots. The area which included the incorporated plots was low in fertility, thus causing a marked reduction in the yield of sweet corn from those plots.

Both Ramrod and Atrazine gave satisfactory weed control. Atrazine gave better broadleafed weed control than did Ramrod. Ramrod did not control purslane thus causing a significantly lower rating than Atrazine.

The combined effects of preemergent application of EPTC and trifluralin yielded significantly more fruit than the incorporated plots. This apparently resulted from variance attributed to a soil fertility gradient on an area of the experiment that had recently been leveled.

Results in the tomato trials showed PEBC at 8 lbs/A applied preemergent to be deleterious to the tomato plants in that plot. Germination, overall growth of the tomatoes, number of fruit harvested and yield was affected by the chemical. Observations during the growing season indicated injury to the crop. The injury was believed caused by the heavy rains after the application of the herbicide in the spring. The herbicide was leached into the seed bed and became toxic to the plants.

Picking dates

There were two picking dates for tomatoes which showed the second date to be highly significant from the first. The first picking was small and the second picking was larger due to the maturity of the fruit.

It is important that direct seeded tomatoes receive the proper amount of fertilizer and at the proper time. These plots were fertilized with 200 lbs. of ammonium phosphate in the spring. This excess amount of nitrogen caused an excessive amount of vegetative growth through the growing season which delayed the maturity and yield of ripe fruit considerably in these plots.

Methods of application of herbicides at logarithmic rates

The incorporated method of application was superior to the preemergent plots capped by hard and soft asphalt and preemergent plots without asphalt covering in the logarithmic trials. The volatile herbicides such as PEBC are retained in the soil thus giving it a longer residual life. On the soil surface the herbicide vaporizes thus reducing the activity of the herbicide. Petroleum mulch helped to reduce the volatility to some degree and caused the herbicides to be more effective than when applied preemergent without a mulch cover.

# SUMMARY AND CONCLUSIONS

These studies on the influence of petroleum mulches with several herbicides were made during the 1967 growing season. Snap beans, sweet corn, and tomatoes were used in the experiment at the Farmington station. Six herbicides were used; Atrazine and Ramrod with sweet corn; EPTC and trifluralin with snap beans and PEBC and diphenamid with tomatoes.

The herbicides were applied at the normal recommended rate, one half and double the recommended rates with preemergent or incorporated application of each herbicide.

Emergence, crop rating, grass and broadleaf weed control and yield for snap beans, sweet corn and tomatoes were recorded. Snap beans were graded into sieve sizes one through six. Tomatoes were tested in the laboratory for percent solids.

The emergence of sweet corn was significantly increased by the hard asphalt over the control. Soft asphalt was similar to the hard asphalt but was not significantly better than the control. Overall tomato growth was also significantly increased by the hard and soft asphalt when contrasted with the control.

The interaction of asphalt x herbicide indicates no beneficial or deteterious effects of the asphalt over the herbicide for sweet corn, snap beans, and tomatoes. The Analysis of Variance for sieve size four beans indicated that the interaction of asphalt with the combined effects of herbicide (EPTC and trifluralin) was significant at odds of 19:1. The interaction of asphalt with the combined effects of the two herbicides had no significant influence on the number of snap beans when compared to the control.

The combined effects of Atrazine and Ramrod in sweet corn, EPTC and trifluralin in snap beans, and PEBC and diphenamid in tomatoes were significant in many of the responses measured. The control of grass and broadleafed weeds in sweet corn, snap beans and tomatoes was significantly better than the control for the combined effects of the above mentioned herbicides.

The combined effects of Atrazine and Ramrod in sweet corn and EPTC and trifluralin in snap beans indicated that the preemergent plots yielded significantly more than the incorporated plots. Results for the combined effects of PEBC and diphenamid showed both chemicals at double the recommended rate applied by preemergence to yield significantly less tomatoes than the other treated plots. An examination of the means of herbicide x rate interaction showed PEBC at 8 lbs/A to be significantly less than any of the other treated plots.

This study also included experiments on the effect of herbicides applied at logarithmic rates with hard and soft asphalt overlay. Snap beans, sweet corn and tomatoes were used with their appropriate herbicides. The herbicides were applied by four methods; incorporation with no asphalt, preemergent with hard and soft asphalt overlay and preemergent with no asphalt. Emergence dates for snap beans and tomatoes were significant at odds of 99:1. The interaction of date x herbicide x asphalt was not significantly different from the control. Other factors such as herbicides, methods of application of the herbicide, the different concentrations, and their respective interactions did not significantly influence the germination of the three crops.

Analysis of Variance on the control of annual grass and broad-leafed weeds were highly significant for the recommended herbicides, methods of application, concentration of each herbicide, concentration x herbicide, and herbicide x method. The incorporated method of application for broadleaf weed control was superior to the other three methods of application. The control of annual grass in the incorporated plots was significantly better than the preemergent plots with asphalt overlay and the preemergent plots without asphalt. An examination of means for control of both grass and broadleaf weeds showed Atrazine to be superior to Ramrod, trifluralin, EPTC, PEBC and diphenamid when rated under similar conditions.

The interaction of herbicide x methods of application of herbicide was significant at the one percent level for both grass and broadleaf weed control. In general, incorporated plots for each herbicide gave better weed control than the preemergent plots. The preemergent herbicides capped with petroleum mulch in general gave better weed control than the preemergent plots.

The high concentrations of each herbicide gave excellent weed control. As the concentration decreased so did the control of weeds.

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