COMPARISON OF THREE METHODS OF TREATMENT ON FRUITING CHARACTERISTICS, PHYSIOLOGICAL SHED, INSECT DAMAGE, YIELD AND QUALITY OF COTTON

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COMPARISON OF THREE METHODS OF TREATMENT ON FRUITING
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DAMAGE, YIELD AND QUALITY OF COTTON

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TABLE OF CONTENTS

LIST OF TABLES

Table		Page

LIST OF FIGURES

Figure		Page

Figure | Page

CHAPTER I

INTRODUCTION

The loss of flowering buds (squares), flowers and bolls by abscission is a very common phenomenon, resulting frequently in a great reduction of the crop. In the cotton plant, Gossypium spp., under normal conditions of cultivation it is not unusual to loose one half or more of the total fruit produced by the Plant (Lloyd, 1921). Longenecker and Erie (1968) stated that as little as 20 percent of the squares formed and 40 to 60 percent of the bolls are harvested as open bolls. Dunlap (1945) states that it is more or less normal for the cotton plant at time of maturity to have shed from 20 to 50 percent of its immature fruit, with excessive shedding reaching as high as 80 percent of the fruit. E. C. Ewing's (1918) research has shown about 60 percent fruit shedding to be about normal.

Factors that cause shedding of fruit are physiological, diseases, mechanical damage and insect damage. For the purpose of this research losses due to diseases were placed with physiologically shed fruit.

Atkinson (1892) first contributed part of shedding to "purely physiological trouble" as well as insect damage and fungus. Later workers have attributed the cause of physiological shed to a number of factors. Some of these factors are: 1. Drought (Ewing, 1918;

Lloyd, 1921; Adams et al., 1942; and Dunlap, 1945); 2. Excessive water (Ewing, 1918; Lloyd, 1921; Longenecker and Erie, 1968); 3. High temperatures (Cook, 1921; Dunlap, 1945; Powell, 1968; and Ehilg and LeMert, 1973); 4. Cloudiness (Ewing, 1918; Dunlap, 1943, 1945; Eaton and Rigler, 1945; and Goodman, 1955b, 1956); 5. Impaired fertilization (Ewing, 1918; Lloyd, 1921; Wadleigh, 1944; and Eaton, 1955); 6. Nutritional deficiency (Ewing, 1918; Lloyd, 1921; Wadleigh, 1944; Dunlap, 1945; Eaton, 1955; Ergle and Eaton, 1957; and Hinkle and Brown, 1968); and 7. Genetic factors (Cook, 1921; Ewing, 1918; Kearney and Peebles; 1926, and Goodman, 1956).

Ewing (1918) stated that the amount of fruit lost by boll weevils could be offset in part or wholly by the ability of the plants to produce excess fruit over its needs. Goodman (1956) stated that possibly through the influence of the physiological regulation of shedding, insect caused damage is compensated for, so that losses due to insects become economically unimportant. Also there is an increase in vegetative growth and flower bud production (Dale, 1962).

The above statements agree with the nutritional theory of shedding, which has not yet been proved or disproved. The nutritional theory contends that the cotton plant retains only as much fruit as it can bring to maturity by virtue of its supply of carbohydrates, nitrogen and other nutrients (Longnecker and Erie, 1968). Support for this theory is seen in Goodman's (1955b, 1955c) research on shedding, where he concluded that although many fruiting forms are lost in association with insect damage, there is no evidence that losses from the plant because of this are any greater than would have occurred naturally in the absence of insects.

Insect damage to cotton is caused by more than 100 species that attack the crop from the time of planting until it is harvested. Of this large number only about two dozen are responsible for most of the annual losses that are estimated to amount to about 20 percent of the potential production (Newson and Brazzel, 1968). Over 80 percent of the losses attributed to cotton pests is caused by species that attack the fruit (Newson and Brazzel, 1968).

Atkinson as early as 1896 reported that shedding fruit had been attributed to the work of the cotton bollworm, Heliothis spp., and to punctures made by hemipterous insects. The amount of fruit lost during the growing season as a result of insect damage has not been studied extensively. Work by Dunlap (1945) indicates that about 45 percent of the total fruit shed can be attributed to the boll weevil, Anthonomus grandis (Boheman), and the cotton bollworm. Ewing (1918) indicated that only a small fraction of the fruit can be damaged by the boll weevil early in the season without lowering the yield, while about 60 percent of the fruit could be lost if evenly distributed throughout the season.

The effect of insecticides on shedding has not been studied very extensively. Work by Goodman, (1955a) showed that unsprayed plants did not shed more fruit than sprayed plants, but the application of DDT to the plants was associated with considerable change in the rate of shedding.

In this time of increased concern for the environment, higher cost and shortages of insecticides, as well as the development of resistance to insecticides, the adverse effect of insecticides on the natural enemies of cotton pests (Ewing and Ivy, 1943; Newsom and Smith, 1949; and Robinson, 1972) and the potential pest problems associated with a monoculture (Quaintance and Brues, 1905; and Turnbull, 1969) have caused researchers to look for different methods for pest control in cotton.

One such method is the use of strip-cropping of cotton with other crops, such as sorghum, to help build up the populations of natural enemies of the cotton pests (Deloach and Peters, 1971). Work by Robinson (1972a) and Burleigh (1972) showed that of several crops tested grain sorghum provided the most suitable habitat for the build up of predator populations. Massey (1973) showed that a 12-4 array of cotton and sorghum had the lowest amount of *Heliothis* spp. damage, the highest number of predators and the highest yield of the four arrays tested, with the 24-4 the next best.

In addition to yield the quality of the lint fiber is the next most important factor to the cotton producer, since it is used to determine the grade and price of the cotton harvested. The quality of the fiber can be affected by many factors, such as environmental conditions (Baker and Verhalen, 1973), insects (Bishopp, 1955; Adkinsson et al., 1964; Tugwell and Waddle, 1964; and Kittock and Pinkas, 1971), insecticides (Kamel et al., 1965; Matthews et al., 1967; Hacskaylo and Scales, 1959; and Robinson et al., 1972b) and genetic factors (Baker and Verhalen, 1973).

The lint quality is determined by the fiber fineness or micronaire, fiber strength, fiber length and uniformity index. Fiber fineness is determined on a micronaire and is expressed as micrograms per square inch; 1.8 to 2.9 micrograms is considered as extra fine, 3.0 to 3.9 fine, 4.0 to 4.9 average, 5.0 to 5.9 coarse and above 6.0 very coarse (Bishopp, 1956). Fiber strength is given in the force in 1000 pounds required to separate the equivalent of a surface area of one square inch. It is determined by multiplying the 0-in reading of the stelometer by 21,614.0 (Verhalen[1]). Ninety or above is considered excellent, 83 to 89 very good, 78 to 82 average, 72 to 77 fair, and below 72 is considered weak (Bishopp, 1956). Fiber length is determined on the digital fibrograph and is given as the 2.5 percent span length in inches. The 2.5 percent span length approximates Classer's staples, which is determined by the official standards of the United States (Ramey, et al., 1975).

The uniformity index is determined by dividing the 50 percent span length by the 2.5 percent span length and multiplying by 100. A value of 45.0 or above is respectable. The 2.5 percent span length and the fiber fineness are the two important quality factors that are used in determining the grade and price of the cotton (Verhalen[1]).

[1]L. M. Verhalen, Personal communication, Department of Agronomy, Oklahoma State University, Stillwater, Oklahoma, 1975.

CHAPTER II

METHODS AND MATERIALS 1973

This study was undertaken during the summer and fall of 1973 at the Irrigation Research Station at Altus, Oklahoma. The cotton was planted on 28 May 1973 at a rate of 20 pounds per acre using Westburn 70 variety. The grain sorghum used in the strip plots was Acco R1090 variety and it was planted at the same time. The experiment was run in a randomized block design with three treatments and two replications.

The three treatments used and plot sizes were as follows:

1. CONTROL - 116 rows of cotton in which no insect control procedures were used.
2. STRIP-CROPPING - 116 rows of cotton and sorghum planted in a 24-4 array.
3. INSECTICIDE - 116 rows of cotton which were treated as recommended by the Oklahoma State University Agricultural Extension Service.

Each row was 450 feet long.

Treatments for fleahopper, Pseudatomoscelis seriatus (Reuter), was made on 10 July 1973 with Cygon 267 at the rate of 0.22 lbs. per acre. Bollworms, Heliothis spp., were treated on 3 August 1973 with 4-4 Methyl parathion-toxaphene at the rate of 1 lb per acre.

Six plots each with 10-ten foot sample plots were used. Sample plots were selected at random by using numbers from a table of random numbers which were used to identify the row and the number of steps from the beginning of the row to locate the plot. The sample plots were used throughout the growing season and a record of the amount of insect damage and the fruiting characteristics was kept. Each sample plot was enclosed by a 2.5 foot high fence made of one inch mesh chicken wire. A total of 60-ten foot plots were checked weekly from 4 July 1973 to 30 August and on 13 and 29 September and on 13 October.

Data was collected on the number of healthy squares, blooms and bolls, number of physiologically shed squares, blooms and bolls, number of fleahopper damaged squares, number of bollworm and boll weevil damaged squares, blooms and bolls and the number of open bolls.

The cotton was picked by hand on 28 October 1973 and on 6 December 1973.

An analysis of variance of the data was performed by the Statistics Department at Oklahoma State University utilizing the Statistical Analysis System Program[1]. Fiber quality was determined by the Oklahoma State University Agricultural Experiment Station Cotton Fiber Laboratory.

The cotton was irrigated three times during the growing season, on 25 July, 9 and 20 August 1973.

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[1]The system was designed and implemented by Anthony James Barr and James Howard Goodnight, Department of Statistics, North Carolina State University, Raleigh, North Carolina.

CHAPTER III

RESULTS AND DISCUSSION 1973

Fruiting Characteristics

Cotton is an indeterminate fruiting plant (Ewing, 1918; Eaton, 1955; and Carns and Mauire, 1968), flowering throughout the entire growing season. Flower buds or squares appeared about three weeks after planting, around 25 June 1973, with the first blooms appearing around 20 July and continuing until the first killing frost.

The average number of total fruiting forms by treatment and date is given in Table I. The total fruiting forms include all squares, blooms and bolls that were found in the sample plots; this included all healthy fruit, insect damaged fruit and all shed fruit. There was a general increase in fruiting forms from 4 July 1973 to mid-season when a maximum was reached on 22 August for "control" and "strip" with 678.88 and 539.71 thousand fruiting forms per acre respectively, while "insecticide" reached a maximum one week later, 30 August 1973 with 614.46 thousand fruiting forms. After mid-season the number of fruiting forms declined. Differences between treatments were significant at the 10 percent level on two dates, 4 and 18 July 1973 with "insecticide" having a lower number of fruiting forms than "control" or "strip." Observations of the fruiting characters, although not all, show that there is a general pattern in which the "insecticide" plots have a lower number of fruiting forms during the early part of the season and a larger number during late season than "control" and "strip" and mid-season being about equal. This could be due to the effect of the insecticides on the rate of fruit maturity and shedding (Goodman, 1956; Hacskaylo and Scales, 1959).

Since the cotton field is a dynamic changing system, there is a constantly shifting number of squares, blooms and bolls during the growing season. Tables II, III and IV show the number of squares, blooms and bolls respectively by treatment and date. The number of squares, blooms and bolls show the same general pattern as the total fruiting forms. Differences in the number of squares between treatments were significant on 4 and 18 July with "insecticide" having a lower number of squares (Table II) and on 29 September with "insecticide" having a higher number of squares. The percentage of fruit that was in the square stage during the season varied from 100 during early season to as low as 2.0 to 4.0 percent in late season. The largest change occurred in the middle of August (Fig. 1).

The cotton began blooming about 20 July 1973 and continued throughout the rest of the season with the maximum occurring around 22 August 1973 with over 35.0 thousand blooms per acre for "control" and "strip," while "insecticide" reached a maxmimum a week later at 43.7 thousand blooms per acre (Table III). Total blooms represented only a small percentage of the total fruit on the cotton plants at any one time. The blooms accounted for no more than 7.10 percent of the total fruit, which occurred on 22 August 1973 in the "insecticide" plots (Fig. 2).

The total number of bolls per acre by treatment and date can be seen in Table IV. The first bolls were counted on 25 July 1973 at which time they were around one thousand per acre. The number of bolls rapidly increased until they reached nearly 300 thousand per acre by 13 October 1973. There was only one date when there was a significant difference between treatments in the number of bolls, 30 August 1973 when "control" had a lower number of bolls per acre. The percentage of bolls per total fruit was less than 10 percent until 15 August 1973 when it began to increase rapidly until reaching about 94 percent in late September (Fig. 3). The remainder of the fruit was squares that were produced during this time by the new growth that occurred after the late summer rains.

Fruit Loss

A fruiting form begins as a square or small bud, mature, opens as a bloom, develops into a boll which eventually opens upon maturity and is harvested or it can be lost at any time from several causes. Some of the primary causes of fruit loss are: physiological shed, bollworm damage, boll weevil damage, fleahopper damage, accidental removal and failure to reach maturity by the first killing frost.

The percentage of total fruit lost from all causes during the growing season varied from as low as 2.44 percent for "insecticide" on 18 July 1973 to as high as 28.56 percent for "control" on 13 September (Fig. 4). Two peaks of percent fruit loss occurred during the season, the first around 18-25 July 1973 and the second around 13 September 1973. The first peak is due to the increased amount of insect damage (Fig. 5), and the second peak is primarily due to physiological shed fruit (Fig. 6).

Table V shows what percentages of the fruit was lost from the various causes and what percent reached the open boll stage by treatment. Of the fruit produced by the cotton plant only 26 to 28 percent was harvested as open bolls. The remainder, about 72 to 74 percent, was lost. Of this loss 14 to 21 percent was as a result of bollworm damage, 5 to 10 percent from fleahopper damage and 27 to 31 percent from physiological shed. The remainder was lost from mechanical injury or never reached maturity by the end of the season.

The total physiological shed fruit reached a maximum around 13 September 1973 and then declined. The maximum shed was 103.8, 62.5 and 80.4 thousand for "control," "insecticide" and "strip" respectively (Table VI). The amount of physiological shed fruit per total fruit was less than 5.0 percent until 30 August 1973 (Fig. 7). The maximum percentage loss occurred on 13 September 1973 with over 24.8, 17.9, and 18.3 percent for "control," "insecticide" and "strip" respectively. This was followed by a decline to less than 10.0 percent by the last check date.

Treatment differences were significant at the 10.0 percent level only on three dates, 18 July 1973 with "insecticide" lower than "control" or "strip," 30 August 1973 with "control" lower than "strip" or "insecticide" and on 13 September 1973 with "control" higher than "strip" and "insecticide."

For the entire growing season between 27.99 and 31.18 percent of the total fruit was lost by physiological shedding. Of this, between 6.45 and 7.62 percent was lost as shed squares and from 20.42 to 22.57 percent was lost as shed bolls (Table VII).

Shed squares accounted for more than 50.0 percent of the total physiologically shed fruit during early and mid-season, then dropping to less than 10.0 percent by the end of the growing season. The reverse occurred for the shed bolls, which made up less than 10.0 percent of the shed fruit until 1 August 1973, and more than 90.0 percent by the end of the growing season (Figs. 8 and 9).

Physiological shed fruit made up from 5 to 90 percent of the total lost fruit, depending on the treatment and time of season (Fig. 6). The major part of the fruit was lost during the early season as a result of insect damage (Fig. 5), while during early and mid-season physiological shed accounted for less than 20.0 percent of the lost fruit in all treatments. During late season physiological shed caused from 50.0 to 90.0 percent of the lost fruit with a maximum occurring about 29 September 1973 among all treatments (Fig. 6).

Insect Damage

The major loss of fruit by insect damage was caused by fleahoppers and the bollworm. Fleahopper damage squares can be distinguished from physiological shed squares in that they are smaller, the largest fleahopper damaged squares are as small as or smaller than the normal physiological shed square. They are dark brown or black when shed, whereas the physiological shed squares are usually yellow (Ewing and Mcgarr, 1933).

Fleahopper damage was greatest during the first three or four weeks of the growing season. At this time fleahopper damage was as high as 14.0 percent, for "strip," and then dropped off during the remainder of the season to less than 1.0 percent (Fig. 11).

Loss from fleahopper damage was from 5 to 10 percent of the total fruit produced by the plants throughout the growing season with an overall average of 8.4 percent (Table V). Of the total lost fruit, fleahopper damage accounted for over 50 percent during the early season, except in the "insecticide" plots where it was significantly lower at the 10 percent level on three dates, 18 and 25 July and 8 August 1973 (Fig. 12). This is probably due to the spraying of Cygon 267 on 10 July 1973.

The remainder of the growing season fleahopper damaged fruit dropped to less than 2.0 percent of the total lost fruit (Fig. 12). Fleahopper damage accounted for nearly 50.0 percent of the total insect damaged fruit until about 8 August 1973, except for the "insecticide" plots which dropped below 50.0 percent about 25 July 1973. During the remainder of the season fleahopper damage dropped to less than 10.0 percent of the insect damaged fruit by the last three dates checked, except for "insecticide" plots (Fig. 13). This difference could be due to the insecticides that were used.

The bollworm caused the remainder of the insect damage. Bollworm damage first appeared around the last of July and increased to a maximum on 22 August 1973 with 42.3 and 29.9 thousand per acre for "control" and "strip" respectively and on 30 August 1973 with 65.8 thousand per acre for "insecticide." Significant differences between treatments occurred on 1 August 1973 with "insecticide" having a higher number of bollworm damaged fruit, and on 29 September with "strip" having a lower number of bollworm damaged fruit than "insecticide" (Table VIII).

The percentage of bollworm damaged fruit per total fruit was around 1 to 2 percent in early season, except for "insecticide" which was near 6.0 percent, then increased slowly to 4 to 6 percent, except for "insecticide" which increased to as high as 10.5 percent on 30 August 1973 (Fig. 14). This difference, although not significant, could be due to the destruction of beneficial insects by the insecticides used.

Bollworm damaged fruit accounted for 8 to 65 percent of the total lost fruit, depending on treatment and date (Fig. 15). A maximum was reached on 8 August 1973 for "insecticide" plots with 66.8 percent of the total lost fruit and 15 August 1973 for "control" and "strip" with 61.6 and 64.7 percent respectively. After these dates the amount of fruit lost by bollworm damage decreased to about 8 to 24 percent on 29 September 1973 and then started increasing by the last date checked.

Bollworm damage constituted less than 25.0 percent of the total insect damaged fruit through 1 August 1973, except for "insecticide" plots, then increased until it accounted for over 90.0 percent in late season (Fig. 16). The "insecticide" plots began with about 50.0 percent bollworm damage fruit of the total insect damage. This is probably due to the lower numbers of beneficial insects, thus, allowing more of the immature bollworms to survive and cause damage. This agrees with work done by E. K. Johnson[1] on beneficials at the same time and in the same plots, and work done by

[1]E. K. Johnson, Personal communication, Department of Entomology, Oklahoma State University, Stillwater, Oklahoma, 1975.

Newsom and Smith (1949).

Bollworms damaged 14 to 21 percent of the total fruit produced by the cotton plants throughout the growing season (Table V). The "insecticide" plots had the highest damage with 21.19 percent while "control" and "strip" were lower with 14.89 and 14.49 percent respectively. The overall average damage was about 16.8 percent.

Damage caused by boll weevils and other insects was so low that they were not of any importance.

Yield

The total amount of fruiting forms that were harvested averaged about 27.6 percent of the total fruit that was produced by the cotton plants. An average of 232.8 thousand open bolls per acre were produced with an average weight of 3563.2 pounds, developing an equivalent weight of lint cotton of 890.8 pounds which equaled about 1.78 bales (Table IX). From an analysis of variance on the number of open bolls per acre there was no significant difference between treatments. However, the "control" plots had the highest yield in both number of open bolls and weight at 245.2 thousand and 3780.6 pounds of stripper cotton respectively. "Strip" was second with 234.5 thousand open bolls and 3544.0 pounds of stripper cotton per acre. The "insecticide" plots were the lowest with 219.2 thousand open bolls and 3365.9 pounds of stripper cotton per acre (Fig. 17).

Fiber Quality

There was no significant difference between treatments in the quality of the lint fiber. The fiber fineness or micronaire was fine, 3.4 to 3.6 micrograms per square inch. The fiber strength was over 80 thousand pounds per square inch which is between good and very good. The uniformity index was respectable, above 45.0 (Table XXIII).

Summary

All of the fruit produced by the cotton plants during the growing season was lost except 26.5 to 28.7 percent. The major factor causing this large amount, 71.3 to 74.5, of loss was physiological shed, which accounted for 28.0 to 31.2 percent of the total fruit. Insect damage was the second major cause of fruit loss with 23.8 to 26.5 percent of the total fruit. Of this fleahoppers caused 5.4 to 10.5 percent and bollworms the remainder, 14.5 to 21.2 percent. The reaminder of the fruit was lost from damage caused by unknown factors and frost at the end of the season. There was no difference between treatments in the fiber quality of the lint.

CHAPTER IV

METHODS AND MATERIALS 1974

This part of the study was conducted on the Southwest Agronomy Research Station located four miles south of Tipton, Oklahoma in Tillman County during the summer and fall of 1974.

The cotton variety used was Thrope, which was planted on 9 May 1974 at a rate of 20 pounds per acre. The sorghum used in the strip plots was Acco (090 sorghum) variety which was planted at the same time at a rate of 12 pounds per acre.

For weed control Milogard and Treflan herbicides were applied on 19 April 1974 at a rate of 0.125 gallons per acre. Fertilizer used was 200 pounds per acre of 16-16-16 applied on 27 April 1974.

This experiment was run in a randomized block design with four replications of three treatments, which were as follows:

1. CONTROL - Twelve rows of cotton in which no insect control procedures were used.
2. STRIP-CROPPING - Twelve rows of cotton and four rows of sorghum with no other control procedures.
3. INSECTICIDE - Twelve rows of cotton which were treated as recommended by the Oklahoma State University Agricultural Extension Service based on type of insect and infestation levels.

The treatment dates, type of insecticide used and the rates of application used are as follows:

For fleahopper control;

1. 15 July 1974 - Cygon 267 at 0.1 lb. per acre.

2. 26 July 1974 - Cygon 267 at 0.1 lb. per acre.

For boll weevil control:

1. 14 August 1974 - Guthion at 0.25 lb. per acre.

2. 19 August 1974 - Guthion at 0.25 lb. per acre.

3. 22 August 1974 - Guthion at 0.50 lb. per acre.

4. 9 September 1974 - Methyl parathion at 0.5 lb. per acre.

5. 12 September 1974 - Methyl parathion at 0.5 lb. per acre.

A total of seven applications of insecticides were used.

A total of twelve plots were used. Within each plot 6-ten foot sample plots were selected at random by determining the row number and the number of steps from the beginning of the row from numbers selected from a table of random numbers. The sample plots were used throughout the growing season to a keep record of the fruiting characteristics and the insect damage. Each sample plot was enclosed by a 2.5 ft. high fence of one inch mesh chicken wire in order to keep count of all the fruit that was lost by the cotton plants. A total of 72-ten ft. sample plots were checked weekly from 17 June to 11 September and on 28 September and 9 October 1974. The cotton was picked by hand on 22 November and 18 December 1974.

The total number of healthy squares, blooms and bolls were counted each week and left on the plants. The fleahopper damaged squares, the physiologically shed fruit, the bollworm and boll weevil damaged fruit, the mechanical damaged fruit and the unknown damaged fruit were counted and removed from the plants and from the ground within the fenced area so as not to be counted the following week.

The plots were irrigated twice, on 10-12 July 1974 with approximately 3 inches of water and on 1 August with approximately 3.5 inches of water.

CHAPTER V

RESULTS AND DISCUSSION 1974

Fruiting Characteristics

Cotton plots were planted almost three weeks earlier in 1974 than in 1973; thus, data collecting began about two weeks earlier, on 17 June 1974. The number of fruiting forms by this time was 17.9, 17.6 and 23.6 thousand per acre for "control," "insecticide" and "strip" respectively (Table X). Two peaks in fruit production occurred during the season. The first on 23 July 1974 with 233.9, 251.0 and 309.2 thousand fruiting forms per acre for "control," "insecticide" and "strip" respectively. The number of fruiting forms decreased to below 200 thousand during the seventh week and then began to increase until the second peak was reached on 31 August 1974 with over 250.0 thousand fruiting forms per acre for all of three treatments. In 1973 there was one peak of fruit production which occurred during the last of August with over 525.0 thousand fruiting forms per acre (Table I). This large difference could be due to the differences in the varieties used, locations, irrigations, and fertilizers used. A small increase in the number of fruiting forms occurred near the end of the season. This increase could have resulted from the increase in rainfall in the fall months (Table XI).

For the entire growing season over 656.4, 626.9 and 670.4

thousand fruiting forms per acre for "control," "insecticide" and "strip" respectively, were produced by the cotton plants. Of this large amount of fruit only a small part was harvested, the remainder was lost from various causes which will be discussed later.

During the growing season there was a constantly changing number of squares, blooms, and bolls. Tables XII, XIV and XV show the number in thousands per acre for squares, blooms, and bolls respectively by treatment and date. The number of squares followed the same general pattern as the total fruit with two maximums occurring around 23 July 1974 and 31 August 1974 as with the total fruit. The total squares constituted from 100 percent of the total fruit during the first weeks of the growing season and then declined to around 50.0 to 60.0 percent in the middle of August and leveled off at about 40.0 percent by the end of the season (Fig. 18).

The total number of blooms per acre reamined below 10,000 throughout the growing season, except on 29 July 1974 in which the number climbed to 12,900 in the "strip" plots. The same general pattern is seen as with the total fruit (Table XIII). Differences were significant at the 10 percent level on two dates: 31 August 1974 with "insecticide" having a higher number of blooms than "control" and "strip" and on 25 September 1974 with "strip" having a lower number of blooms than "control" and "insecticide." Blooms never made up more than 5.0 percent of the total fruit on any date except the week of 29 July when it reached 5.44 percent for "strip" plots (Fig. 19).

Cotton bolls began developing around the first week of July and continued throughout the season to reach a maximum at the end of the season with between 97.2 and 125.9 thousand bolls per acre (Table XIV).

No differences were found to be significant in the number of bolls by treatment. Bolls accounted for a small percent of the total fruit during the early part of the season. By midseason bolls made up about 50.0 percent of the total fruit and as much as 65.0 percent by the end of the season (Fig. 20).

Fruit Loss

The fruiting forms were lost from the same factors as in 1973 except there was a considerably lower amount of cotton bollworm damaged fruit and a greater amount of boll weevil damage. Table XV shows what happened to all of the fruit that was produced by the cotton plants during the growing season. A total of 83.4 to 88.9 percent of the total fruit was lost from all causes. Of this, insects accounted for 59.0 to 67.0 percent and physiological shed for 16.3 to 20.8 percent.

The total number of lost fruit by treatment and date is seen in Table XVI. Two peaks of loss occurred, one on 23 July 1974 with around 50.0 thousand fruiting forms being lost and the second peak on 31 August 1974 with between 50.0 and 63.3 thousand fruiting forms lost. These two dates correspond with the dates of maximum total fruit (Table X). During the growing season the total lost fruit reached a maximum on 29 July 1974 at 31.3 percent of the total fruit in the "control" plots (Fig. 21). The fruit loss followed the same pattern in the three treatments. There were three peaks of high loss by the middle of August which were followed by a general decline through September and a rise during late September and early October. This pattern tends to follow that of insect damage (Fig. 24).

Differences between treatments were significant on six dates, 8 July, 6, 14 and 31 August and 7 and 11 September with "control" having higher amount of loss than "insecticide" or "strip" or both (Fig. 21).

Physiological Shed

Physiological shed fruit occurred at a much lower level than during 1973. Physiological shed reached a maximum around 29 July 1974 with 28.3, 17.5 and 33.1 thousand shed fruiting forms per acre for "control," "insecticide" and "strip" respectively, and then gradually declined to 1500 or less by the end of the growing season (Table XVII).

Physiological shed accounted for about 1.5 to 2.0 percent of the total fruit during most of the season except from 23 July to 19 August 1974 when it increased to just over 16.0 percent for "strip" on 29 July 1974 (Fig. 22). This sudden increase in shedding could be due to the stressed condition created by drought conditions during the first half of 1974.

Differences were significant at the 10 percent level on three dates: 23 and 29 July 1974 with "insecticide" plots having a lower percent shed fruit than "control" and "strip" and on 11 September 1974 with "strip" having a lower percent of shed fruit than "insecticide" and "control."

Physiological shed fruit made up from 1.73 to 58.7 percent of the total lost fruit. The maximum loss occurred around 29 July 1974 when 32.5 to 58.7 percent of the lost fruit was a result of physiological shed. Differences between treatments were significant at the

10 percent level on three dates: 23 and 29 July and 11 September, with "insecticide" plots having less physiological shed fruit per total lost fruit than "control" or "strip."

Insect Damage

Insect damage was the major cause of fruit loss throughout the growing season. The cotton fleahopper and the boll weevil were the major insect pests; whereas, the bollworm damaged less than 1.0 percent of the total fruit. The total number of insect damaged fruiting forms can be seen in Figure 24. There were four dates when damage occurred to more than 40,000 fruiting forms: 2 and 23 July, 31 August and 28 September 1974. The major difference is seen on 14 August 1974 in the "insecticide" plots, where the number of damaged fruiting forms decreased to 17.9 thousand while "control" and "strip" were increasing. This difference is probably due to the spraying of Cygon 267 on 15 and 26 July 1974 to control fleahoppers. Other than this one difference the three treatments followed about the same general pattern of insect damage.

Insect damaged fruit varied from 5.0 to 27.0 percent of the total fruit depending on the date and treatment (Fig. 25). There is no general pattern or consistency in one treatment or the other having more or less insect damaged fruit (Fig. 24). One trend noticed is that of less insect damaged fruit per total fruit in the "strip" plots during the early season, until about 14 August 1974, then becoming intermediate between "control" and "insecticide" plots. This could be due to the greater number of predators in the "strip" plots, as indicated by work done by E. K. Johnson[1] on predators at the same time. From the middle of the season until the last of September the "insecticide" plots had the lowest amount of damaged fruit per total fruit. This was most likely due to the five sprayings of insecticide to control boll weevils.

Fleahopper Damage

Fleahoppers caused the highest amount of fruit loss for the entire season with 49.6, 36.8 and 35.4 percent of the total fruit damaged for "control," "insecticide" and "strip" respectively (Table XXIII). Through the season the amount of fruit lost from fleahopper damage ranged as high as 26.7 percent (Fig. 26).

Fleahopper damage remained relatively high in the "control" plots until the last of August when it began declining. It continued to decline until it reached less than 3.0 percent of the total fruit by 11 September 1974. This pattern was not seen in the "insecticide" and "strip" plots. They showed a general decline from 8 July until 11 September 1974 when fleahopper damage made up less than 3.0 percent of the total fruit. The slight increase in fleahopper damage during the last of September and the first of October was most likely due to the renewed growth caused by the fall rains and possible increase in number of fleahoppers.

Differences between treatments were significant at the 10 percent level on six dates, 8 July, 6, 14 and 31 August and 7 and 28 September

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[1]E. K. Johnson, Unpublished Data, Department of Entomology, Oklahoma State University, Stillwater, Oklahoma, 1975.

1974 with "control" having higher amount of damage than "strip" or "insecticide" or both (Fig. 26).

Fleahopper damaged fruit accounted for all or almost all of the insect damaged fruit during the first five weeks of fruiting (Fig. 27). Then it began decreasing until it accounted for about 25.0 percent of the insect damage by the end of the season. "Control" consistantly had the higher level of fleahopper damage during the season, except for the first four weeks (Fig. 26 and 27).

Boll Weevil Damage

Boll weevils were the only other pest that were abundant enough to cause significant damage. Boll weevil damage accounted for a loss of 15.0 to 22.0 percent of the total fruit produced by the plants during the growing season (Table XV). The number of boll weevil damaged fruit remained less than 10.0 thousand until 19 August 1974 when it began increasing and continued to increase until it reached nearly 39.0 thousand by the end of the season.

Boll weevil damaged fruit accounted for less than 5.0 percent of the total fruit until the middle of August and less than 10.0 percent until the last two weeks when it was as high as 16.1 percent for "strip" on 28 September 1974 (Fig. 28). Differences between treatments were significant at the 10.0 percent level on three dates, 14 August 1974 with "control" having less damage than "insecticide" but not "strip," 11 September 1974 with "insecticide" having less damage than "control" and "strip" and 28 September 1974 with "control" having less damage than "strip" but not "insecticide" (Fig. 28).

The percent boll weevil damaged fruit of the total insect damaged fruit remained under 50.0 percent until 7 September 1974 when it reached 55.2 percent for "strip" plots. By the end of the growing season boll weevil damage made up nearly 75.0 percent of the total insect damaged fruit (Fig. 29). "Control" plots generally had less boll weevil damaged fruit per insect damage during the season than "strip" or "insecticide" plots, except during September when "insecticide" plots had a lower amount of damage than "strip" (Fig. 29).

At times the presence of boll weevils in developing bolls is difficult to determine until the bolls open up. Table XXI shows what percent of the open bolls had boll weevil, bollworm and boll rot damage at the time of picking. From 70.5 to 82.1 percent of the open bolls were not damaged. The remainder, 17.9 to 29.5 percent had one or more locules damaged. The boll weevils were the major cause of boll damage at the time of picking, with 10.7, 9.8 and 6.9 percent of the open bolls with one locule damaged for "control," "insecticide" and "strip" respectively. From 6.4 to 10.1 percent had two locules damaged by boll weevils. Less than 5.0 percent of the open bolls had three or more locules damaged by boll weevils. Damage caused by bollworms and rot accounted for less than 5.0 percent of the open bolls.

Yield

The yield is represented by the number of fruiting forms that remained on the plant long enough to reach maturity and become open bolls. The amount of open bolls per total fruit by treatment was 11.14, 16.68 and 15.45 percent for "control," "insecticide" and "strip" respectively. This represented 76.4, 100.5 and 101.4 thousand bolls or 1,235.8, 1,644.7 and 1,538.7 pounds of stripper cotton per acre for "control," "insecticide" and "strip" respectively (Fig. 30). This amounted to less than one bale of lint cotton per acre. From an analysis of variance (Table XXII) there was no significant difference in the three methods in terms of yield.

Fiber Quality

Fiber quality was not effected by the different treatments. No differences were found to be significant. The fiber fineness or micronaire was average for "control" and "insecticide" and coarse for "strip." The fiber strength was above 90 thousand pounds per square inch which is excellent. The uniformity index was above 45.0 which is respectable (Table XXIII).

Summary

An average of 650.0 thousand fruiting forms per acre were produced by the cotton plants throughout the growing season. Of this amount 11.0 to 16.0 percent was harvested as open bolls. The remainder, 84.0 to 89.0 percent, was lost by physiological shed, fleahopper damage and boll weevil damage. Physiological shed accounted for 16.0 to 27.0 percent of the loss and insect damage for 59.0 to 67.0 percent.

Fleahoppers and boll weevils were the major insect pests and accounted for 35.0 to 49.0 percent and 15.0 to 22.0 percent of the total fruit respectively. The remainder was lost from bollworms and by frost at the end of the season.

Although significant differences occurred with some of the factors studied and not for others, there is no clear distinction as to which method studied was the better.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Three methods of insect control: no control procedures, strip-cropping and the use of insecticides as recommended by the Oklahoma State University Extension Service, were compared in relation to fruiting characteristics, physiological shed, insect damage, yield and quality of cotton.

There was a difference of about 72,000 fruiting forms produced by the cotton plants during the growing season in the two years. In 1973 there was over 723.3 thousand fruiting forms while in 1974 about 651.2 thousand were produced. In looking at total squares throughout the season the most noticeable difference is that in 1974 the amount of squares per total fruit did not drop below 30.0 percent of the total fruit; whereas, in 1973 it dropped to below 10.0 percent (Figs. 1 and 18).

The number of bolls per total fruit followed about the same general pattern during the early season but not in late season. In 1974 the number of bolls never made up more than 80.0 percent of the total fruit, while in 1973 the number of bolls made up over 90.0 percent of the total fruit during late season (Figs. 3 and 20).

In 1973 from 71.3 to 73.5 percent of the total fruit was lost from physiological shed and insect damage while in 1974 84.0 to 89.0 percent was lost from the same causes (Tables V and XV).

Physiological shed fruit accounted for 28.0 to 31.2 percent of the total fruit in 1973 and 28.0 to 31.2 percent in 1974. Insects caused from 23.8 to 26.5 percent loss of the total fruit in 1973 and 59.0 to 67.0 percent in 1974 (Tables V and XV).

The main insects causing damage were fleahoppers and bollworms in 1973 and fleahoppers and boll weevils in 1974. Fleahoppers accounted for 5.4 to 10.5 percent in 1973 and from 35.0 to 49.0 percent in 1974 of the total fruit. Bollworms were the second major pest in 1973 with 14.5 to 21.2 percent of the total fruit lost from their damage. In 1974 bollworms occurred at such a low level as to be unimportant. This was the opposite for boll weevils. They caused from 15.0 to 22.0 percent damage to the total fruit in 1974 depending on treatment. In 1973 they did not occur in large enough numbers to be of any importance.

Yield was higher in 1973 with 26.5 to 28.7 percent of the fruit harvested as open bolls, than in 1974 when only 11.0 to 16.0 percent was harvested (Tables V and XV). Yield of stripper cotton in 1973 was the highest in "control" with about 3,780.6 pounds per acre harvested (Fig. 17). In 1974 "insecticide" had the largest amount with over 1,640.0 pounds per acre harvested.

The three methods studied did not have any effect on the quality of the fiber as determined by fiber fineness, strength, length and uniformity index. The fiber fineness was rated as fine, between 3.0 to 3.9 in 1973 and average, 4.0 to 4.9, to coarse, 5.0 to 5.9, in 1974. The fiber strength was good to very good in 1973 and excellent in 1974. The uniformity index was respectable in both years at about 45.5 (Table XXIII).

The yearly differences were most likely due to different varieties used, different locations, different insect pests and infestation levels and the different environmental conditions between the two years. Thus, yearly comparisons cannot be made.

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APPENDIX

TABLE I

TOTAL NUMBER OF FRUITING FORMS PER ACRE OF WESTBURN 70 COTTON BY TREATMENT AND DATE, ALTUS, OKLAHOMA, 1973

DATE	CONTROL	INSECTICIDE	STRIP
4 July	4,900[b]	2,875[a]	5,162[b]
11 "	56,715	32,866	58,871
18 "	102,126[b]	48,155[a]	109,379[b]
25 "	196,151	205,625	213,531
1 August	366,753	359,239	389,165
8 "	441,110	344,146	399,816
15 "	549,182	434,000	467,508
22 "	678,883	570,680	539,708
30 "	545,524	614,457	518,342
13 September	415,170	351,203	442,025
29 "	313,763	346,237	251,494
13 October	277,564	285,078	257,374

Means followed by the same letter are not significantly different at the 10.0 percent level.

TABLE II

TOTAL NUMBER OF SQUARES PER ACRE OF WESTBURN 70 COTTON BY TREATMENT AND DATE, ALTUS, OKLAHOMA, 1973

DATE	CONTROL	INSECTICIDE	STRIP
4 July	4,900[b]	2,874[a]	5,161[b]
11 "	56,715	32,866	58,871
18 "	102,126[b]	48,155[a]	109,248[b]
25 "	194,190	204,318	210,852
1 August	351,725	348,784	371,327
8 "	406,218	317,421	351,790
15 "	464,698	358,716	349,307
22 "	504,947	398,247	359,500
30 "	279,328	290,044	207,454
13 September	59,786	65,928	61,419
29 "	12,675[b]	23,587[a]	6,011[b]
13 October	13,133	21,954	12,022

Means followed by the same letter are not significantly different at the 10.0 percent level.

TABLE III

TOTAL NUMBER OF BLOOMS PER ACRE OF WESTBURN 70 COTTON BY TREATMENT AND DATE, ALTUS, OKLAHOMA, 1973

DATE	CONTROL	INSECTICIDE	STRIP
25 July	1,176	849	1,502
1 August	4,704	3,855	5,619
8 "	11,826	11,303	16,269
15 "	18,817	25,874	26,658
22 "	36,263	30,709	36,525
30 "	33,258	43,647	32,996
13 September	21,104	10,389	16,857
29 "	6,664	12,872	4,051
13 October	1,960	2,875	1,372

TABLE IV

TOTAL NUMBER OF BOLLS PER ACRE OF WESTBURN 70 COTTON BY TREATMENT AND DATE, ALTUS, OKLAHOMA, 1973

DATE	CONTROL	INSECTICIDE	STRIP
25 July	784	457	1,176
1 August	9,866	6,599	12,218
8 "	22,934	15,420	31,689
15 "	65,732	55,408	91,541
22 "	136,234	142,114	143,682
30 "	232,871[a]	280,700[b]	277,825[b]
13 September	334,279	274,885	363,225
29 "	294,422	309,580	241,431
13 October	262,470	260,183	243,914

Means with the same letter not significantly different at the 10.0 percent level of probability.

TABLE V

AVERAGE PERCENT OPEN BOLLS, BOLLWORM DAMAGED FRUIT, PHYSIOLOGICALLY SHED FRUIT, FLEAHOPPER DAMAGED FRUIT, MECHANICALLY DAMAGED FRUIT, UNKNOWN DAMAGED FRUIT AND FROST KILLED FRUIT PER TOTAL FRUIT PER ACRE OF WESTBURN 70 COTTON BY TREATMENT, ALTUS, OKLAHOMA, 1973

TREATMENT	OPBO	WMGD	PHSD	FLDG	MEDG	UKDG	FRST
CONTROL	27.50	14.89	31.18	10.47	0.73	1.16	14.07
INSECTICIDE	28.69	14.49	27.99	9.33	1.82	0.72	16.96
STRIP	26.57	21.19	29.27	5.35	0.33	0.99	16.30
OVERALL MEAN	27.61	16.86	29.44	8.44	1.02	0.96	15.78

TABLE VI

TOTAL PHYSIOLOGICAL SHED FRUIT PER ACRE OF WESTBURN 70 COTTON BY TREATMENT AND DATE, ALTUS, OKLAHOMA, 1973

DATE	CONTROL	INSECTICIDE	STRIP
11 July	653	457	653
18 "	1,829[b]	261[a]	2,613[b]
25 "	5,161	7,318	2,678
1 August	2,613	3,463	1,110
8 "	2,156	1,829	2,221
15 "	1,829	1,176	3,070
22 "	26,854	30,971	24,437
30 "	34,695[a]	57,629[b]	54,166[b]
13 September	103,759	62,465	80,368
29 "	74,552	57,499	44,306
13 October	23,587	17,707	13,002

Means followed by the same letter are not significantly different at the 10.0 percent level.

TABLE VII

AVERAGE PERCENT TOTAL PHYSIOLOGICALLY SHED SQUARES AND BOLLS PER TOTAL FRUIT PER ACRE OF WESTBURN 70 COTTON BY TREATMENT, ALTUS, OKLAHOMA, 1973

TREATMENT	SQUARES	BOLLS
CONTROL	6.99	22.57
INSECTICIDE	7.62	20.42
STRIP	6.45	20.87

TABLE VIII

TOTAL NUMBER OF BOLLWORM DAMAGED FRUIT PER ACRE OF WESTBURN 70 COTTON BY TREATMENT AND DATE, ALTUS, OKLAHOMA, 1973

DATE	CONTROL	INSECTICIDE	STRIP
25 July	1,502	3,267	1,764
1 August	4,639[b]	19,013[a]	5,031[b]
8 "	9,344	12,545	8,429
15 "	19,209	8,886	20,582
22 "	42,274	24,045	29,860
30 "	19,405	65,797	21,301
13 September	14,702	17,053	18,818
29 "	11,239[b]	15,420[b]	3,528[a]
13 October	10,258	8,298	9,017

Means followed by the same letter are not significantly different at the 10.0 percent level.

TABLE IX

TOTAL NUMBER AND WEIGHT OF OPEN BOLLS AND YIELD IN BALES OF LINT COTTON PER ACRE OF WESTBURN 70 COTTON BY TREATMENT, ALTUS, OKLAHOMA, 1973

TREATMENT	NO. BOLLS	WEIGHT IN LBS	BALES
CONTROL	245,160	3,780.6	1.89
STRIP	234,440	3,544.0	1.78
INSECTICIDE	219,150	3,365.9	1.69

TABLE X

TOTAL FRUIT, SQUARES, BLOOMS AND BOLLS, PER ACRE
OF THORPE COTTON BY TREATMENT AND DATE,
TIPTON, OKLAHOMA, 1974

DATE	CONTROL	INSECTICIDE	STRIP
17 June	17,914	17,587	23,631
24 "	55,865	50,257	63,053
1 July	98,990	87,718	122,730
8 "	159,865	138,357	175,437
15 "	203,751	187,689	245,515
23 "	233,917	250,960	309,221
29 "	185,293	201,029	237,020
6 August	163,676	184,041	199,341
14 "	213,389	188,451	197,871
19 "	221,502	257,385	233,644
31 "	264,899	277,041	269,255
7 September	189,812	243,337	226,566
11 "	165,691	195,584	211,157
28 "	167,161	197,871	214,641
9 October	186,219	206,910	240,832

TABLE XI

PRECIPITATION TOTALS IN INCHES BY MONTH FOR 1974 AT SOUTHWEST AGRONOMY RESEARCH STATION, TIPTON, OKLAHOMA

J	F	M	A	M	J	J	A	S	O	N	D
0.07	0.06	1.23	3.27	2.76	3.65[a]	0.37	5.81[b]	5.45[c]	3.12	0.58	0.97

[a]3.44 inches fell on 3rd and 4th.

[b]2.95 fell on 10th.

[c]All of the rain fell during the period from 16th to 25th.

TABLE XII

TOTAL NUMBER OF SQUARES PER ACRE OF THORPE COTTON BY TREATMENT AND DATE, TIPTON, OKLAHOMA, 1974

DATE	CONTROL	INSECTICIDE	STRIP
17 June	17,941	17,587	23,631
24 "	55,865	50,257	63,053
1 July	98,881	87,501	122,403
8 "	153,440	131,987	165,909
15 "	170,482	161,607	207,781
23 "	173,641	199,014	234,516
29 "	112,929	137,704	144,455
6 August	89,624	104,381	89,625
14 "	129,209	94,743	90,006
19 "	133,729	162,097	124,581
31 "	167,978	152,841	149,247
7 September	94,035	117,230	109,771
11 "	70,622	68,443	86,575
28 "	68,117	75,794	97,792
9 October	86,466	78,408	102,280

TABLE XIII

TOTAL NUMBER OF BLOOMS PER ACRE OF THORPE COTTON BY TREATMENT AND DATE, TIPTON, OKLAHOMA, 1974

DATE	CONTROL	INSECTICIDE	STRIP
17 June	---	---	---
24 "	---	---	---
1 July	54	217	326
8 "	2,123	1,905	2,450
15 "	8,167	6,261	8,113
23 "	7,895	6,207	8,385
29 "	8,058	6,642	12,904
6 August	3,648	7,241	8,385
14 "	2,995	6,806	5,118
19 "	1,851	2,450	2,178
31 "	1,361[b]	6,697[a]	2,069[b]
7 September	2,995	5,717	3,212
11 "	2,995	2,884	2,995
28 "	1,906[a]	2,015[a]	871[b]
9 October	2,559	2,559	2,069

Means followed by the same letter are not significantly different at the 10.0 percent level.

TABLE XIV

TOTAL NUMBER OF BOLLS PER ACRE OF THORPE COTTON BY TREATMENT AND DATE, TIPTON, OKLAHOMA, 1974

DATE	CONTROL	INSECTICIDE	STRIP
17 June	---	---	---
24 "	---	---	---
1 July	54	---	- ---
8 "	4,301	4,465	7,079
15 "	25,101	19,819	29,621
23 "	52,381	45,738	66,320
29 "	64,305	56,682	79,660
6 August	70,404	72,418	101,331
14 "	81,185	86,902	102,747
19 "	85,922	92,837	106,885
31 "	95,560	117,503	117,938
7 September	92,728	120,389	113,583
11 "	92,075	124,254	121,587
28 "	97,139	120,062	115,978
9 October	97,193	125,942	118,483

TABLE XV

AVERAGE PERCENT OPEN BOLLS, PHYSIOLOGICAL SHED FRUIT, INSECT DAMAGE FRUIT, FLEAHOPPER DAMAGED FRUIT, BOLL WEEVIL DAMAGED FRUIT, BOLLWORM DAMAGED FRUIT, UNKNOWN DAMAGED FRUIT, FROST KILLED FRUIT AND TOTAL LOST FRUIT PER TOTAL FRUIT PER ACRE OF THORPE COTTON BY TREATMENT, TIPTON, OKLAHOMA, 1974

TREATMENT	OPBO	PHY. SHED	INSDMG	FLDMG	BWEVDG	BWOMDG	UNKDG	FROST	TOTLST
CONTROL	11.14	16.26	67.16	49.46	15.55	1.19	0.94	8.17	88.86
INSECTICIDE	16.68	17.07	63.38	36.82	22.98	2.43	1.38	3.79	83.32
STRIP	15.45	20.83	59.19	34.41	20.76	1.83	1.14	8.03	84.55

TABLE XVI

TOTAL NUMBER OF LOST FRUITING FORMS PER ACRE OF THORPE COTTON BY TREATMENT AND DATE, TIPTON, OKLAHOMA, 1974

DATE	CONTROL	INSECTICIDE	STRIP
17 June	1,361	1,089	1,198
24 "	12,905	15,137	11,598
1 July	17,424	17,246	19,166
8 "	43,451	33,377	30,056
15 "	27,388	29,838	25,645
23 "	52,000	48,079	54,232
29 "	52,980	49,223	56,029
6 August	42,580	32,507	39,150
14 "	47,698	27,443	40,949
19 "	50,421	51,455	47,099
31 "	63,325	51,945	53,415
7 September	41,545	43,451	38,714
11 "	21,998	18,731	21,453
28 "	36,644	46,010	53,143
9 October	33,160	39,749	47,208

TABLE XVII

TOTAL NUMBER OF PHYSIOLOGICALLY SHED FRUIT PER ACRE OF THORPE COTTON BY TREATMENT AND DATE, TIPTON, OKLAHOMA, 1974

DATE	CONTROL	INSECTICIDE	STRIP
17 June	327	272	163
24 "	1,089	762	926
1 July	925	1,198	1,306
8 "	1,524	1,035	871
15 "	2,341	1,089	1,361
23 "	11,870	6,534	14,538
29 "	28,260	17,478	33,051
6 August	6,806	6,207	12,523
14 "	3,430	8,929	7,731
19 "	7,296	11,326	10,073
31 "	3,866[a]	4,683[b]	4,900[b]
7 September	2,722	2,940	2,614
11 "	2,885[ab]	3,484[b]	1,579[a]
28 "	3,484	3,757	3,757
9 October	1,034	1,579	925

TABLE XVIII

AVERAGE PERCENT INSECT DAMAGED FRUIT PER TOTAL LOST FRUIT PER ACRE OF THORPE COTTON BY TREATMENT AND DATE, TIPTON, OKLAHOMA, 1974

DATE	CONTROL	INSECTICIDE	STRIP
17 June	76.00	71.42	86.00
24 "	87.23	86.38	93.98
1 July	93.78	86.29	90.38
8 "	95.33	96.90	92.29
15 "	89.06	96.35	94.22
23 "	78.03[b]	87.78[a]	73.22[b]
29 "	51.11	67.36	41.06
6 August	83.45	82.93	70.69
14 "	91.04	66.57	78.73
19 "	78.49	74.67	77.32
31 "	93.90	88.40	89.55
7 September	92.16	92.40	91.02
11 "	84.22[ab]	76.66[b]	90.18[a]
28 "	89.65[ab]	87.57[b]	91.37[a]
9 October	95.64	93.54	97.30

Means followed by the same letter are not significantly different at the 10.0 percent level.

TABLE XIX

TOTAL NUMBER OF FLEAHOPPER, *Pseudatomoscelis seriatus*, (Reuter) DAMAGED SQUARES PER ACRE OF THORPE COTTON BY TREATMENT AND DATE, TIPTON, OKLAHOMA, 1974

DATE	CONTROL	INSECTICIDE	STRIP
17 June	1,034	817	1,034
24 "	11,706	14,375	10,400
1 July	16,117	14,048	16,879
8 "	41,000	31,527	27,770
15 "	24,393	27,933	22,706
23 "	35,883	35,066	31,962
29 "	20,092	23,196	16,008
6 August	33,596	20,310	19,765
14 "	42,035[a]	9,637[b]	26,109[a]
19 "	31,363	25,591	24,775
31 "	35,992[a]	21,236[b]	24,448[ab]
7 September	15,137	11,870	10,182
11 "	3,539	1,034	1,687
28 "	6,860	2,341	4,683
9 October	8,929	5,009	6,588

Means followed by the same letter are not significantly different at the 10.0 percent level.

TABLE XX

TOTAL NUMBER OF BOLL WEEVIL, *Anthonomus grandis* Boheman, DAMAGED FRUIT PER ACRE OF THORPE COTTON BY TREATMENT AND DATE, TIPTON, OKLAHOMA, 1974

DATE	CONTROL	INSECTICIDE	STRIP
17 June	---	---	---
24 "	109	---	55
1 July	55	---	653
8 "	762	544	817
15 "	163	109	545
23 "	2,504	3,213	4,846
29 "	3,430	5,881	4,138
6 August	1,307	5,445	5,881
14 "	1,416	6,588	5,663
19 "	10,127	12,796	11,108
31 "	21,998	23,795	22,488
7 September	19,220	23,740	22,651
11 "	12,632	9,747	14,266
28	23,141	33,596	38,877
9 October	21,453	29,403	36,155

TABLE XXI

BREAKDOWN OF AVERAGE PERCENT OF BOLL ROT, BOLL WEEVIL, BOLLWORM, AND TOTAL DAMAGED LOCULES PER TOTAL OPEN BOLLS OF THORPE COTTON BY TREATMENT, TIPTON, OKLAHOMA, 1974

			BOLL WEEVILS				BOLLWORM		ROT	
TREATMENT	NON-DAMAGED	TOT DAMAGED	1	2	3	4	1	2	1	2
CONTROL	73.52	26.48	10.65	7.39	3.85	1.44	0.95	0.33	0.49	0.17
INSECTICIDE	70.49	29.51	9.77	10.08	4.60	1.72	1.02	0.65	0.87	0.12
STRIP	82.10	17.90	6.93	6.35	2.88	0.86	0.10	0.03	0.07	0.14

TABLE XXII

ANALYSIS OF VARIANCE OF THE YIELD OF THE THREE METHODS OF TREATMENT OF THORPE COTTON, TIPTON, OKLAHOMA, 1974

SOURCE	DF	SS	MS	F
Total	11	197493.7		
Rep	3	98499.0	32933.0	2.57599
Trt	2	22520.1	11260.1	0.8834
R x T (Error)	6	76474.6	12745.8	

Required F for Trt at 0.05 = 5.14

TABLE XXIII

AVERAGE VALUES FOR LINT QUALITY FROM COTTON HARVESTED IN 1973 AT ALTUS, OKLAHOMA AND IN 1974 AT TIPTON, OKLAHOMA BY TREATMENT

	Fibrograph				Micronaire		Stelometer			
	2.5% span length (in.)		Uniformity index		Micrograms per inch		"0" in. gague		1/8 in. gague	
TREATMENT	1973	1974	1973	1974	1973	1974	1973	1974	1973	1974
CONTROL	1.074	0.971	46.03	46.16	3.635	4.850	3.85	4.30	1.86	1.92
							83[a]	93[a]		
STRIP	1.071	0.994	46.32	46.77	3.565	5.021	3.80	4.25	1.97	1.97
							82[a]	92[b]		
INSECTICIDE	1.087	0.994	45.41	46.76	3.490	4.567	3.77	4.39	1.92	2.15
							81[a]	95[b]		

[a]The fiber strength in 1000 pound of force required to separate the equivalent of a 1 sq. in. in 1973

[b]The fiber strength in 1974.

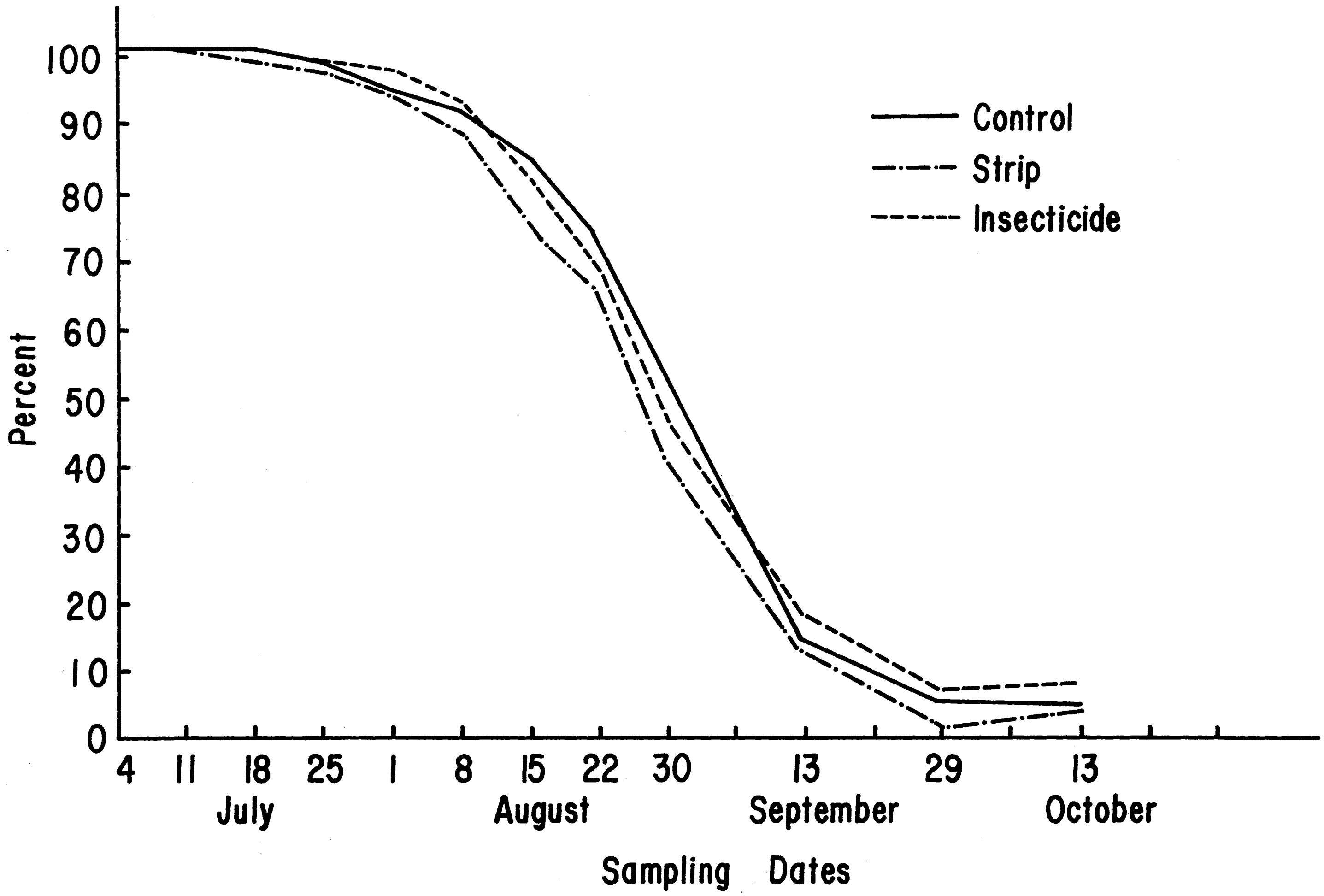

Figure 1. Average Percent of Total Squares per Total Fruit per Acre of Westburn 70 Cotton by Treatment and Date, Altus, Oklahoma, 1973

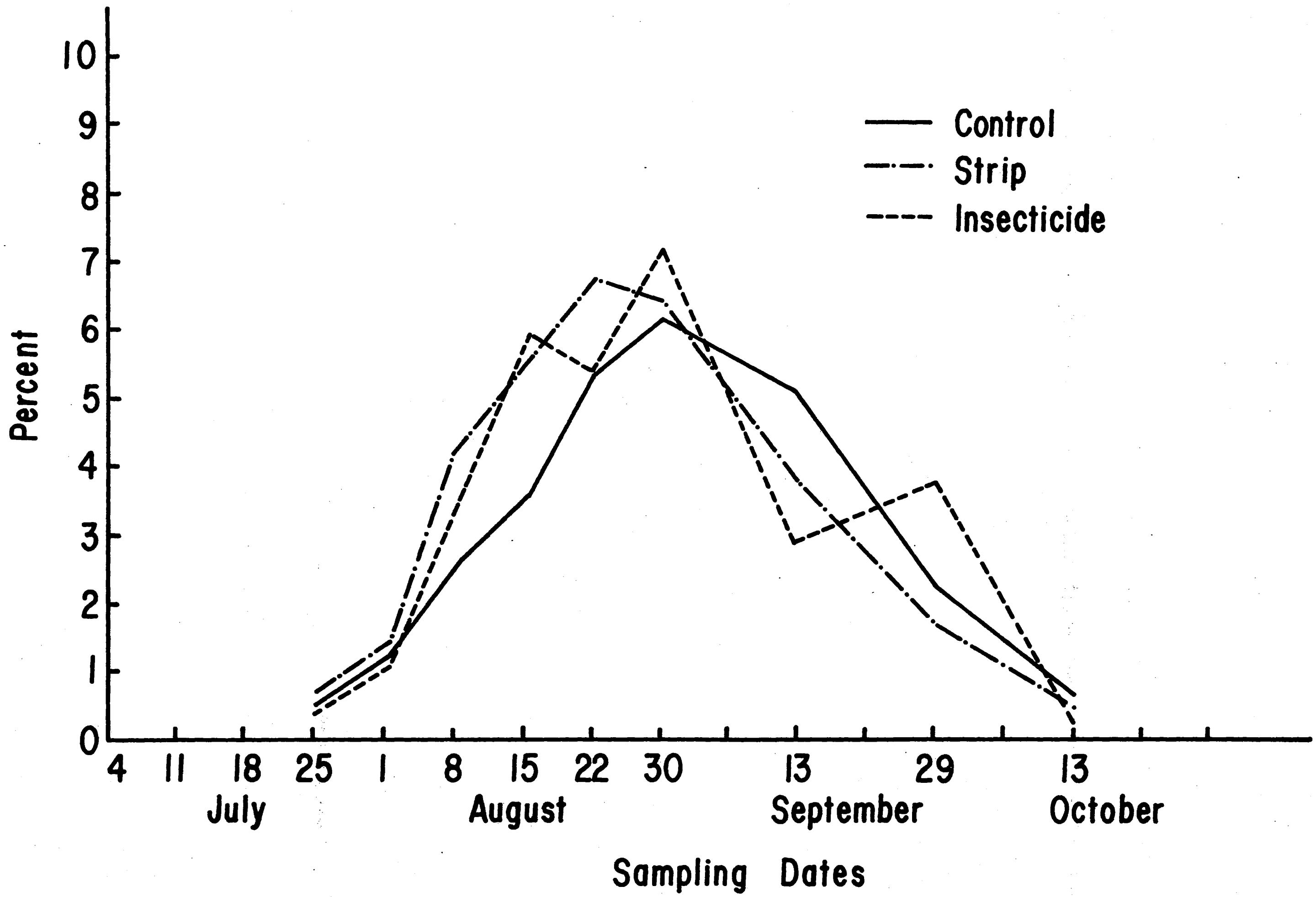

Figure 2. Average Percent Total Blooms per Total Fruit per Acre of Westburn 70 Cotton by Treatment and Date, Altus, Oklahoma, 1973

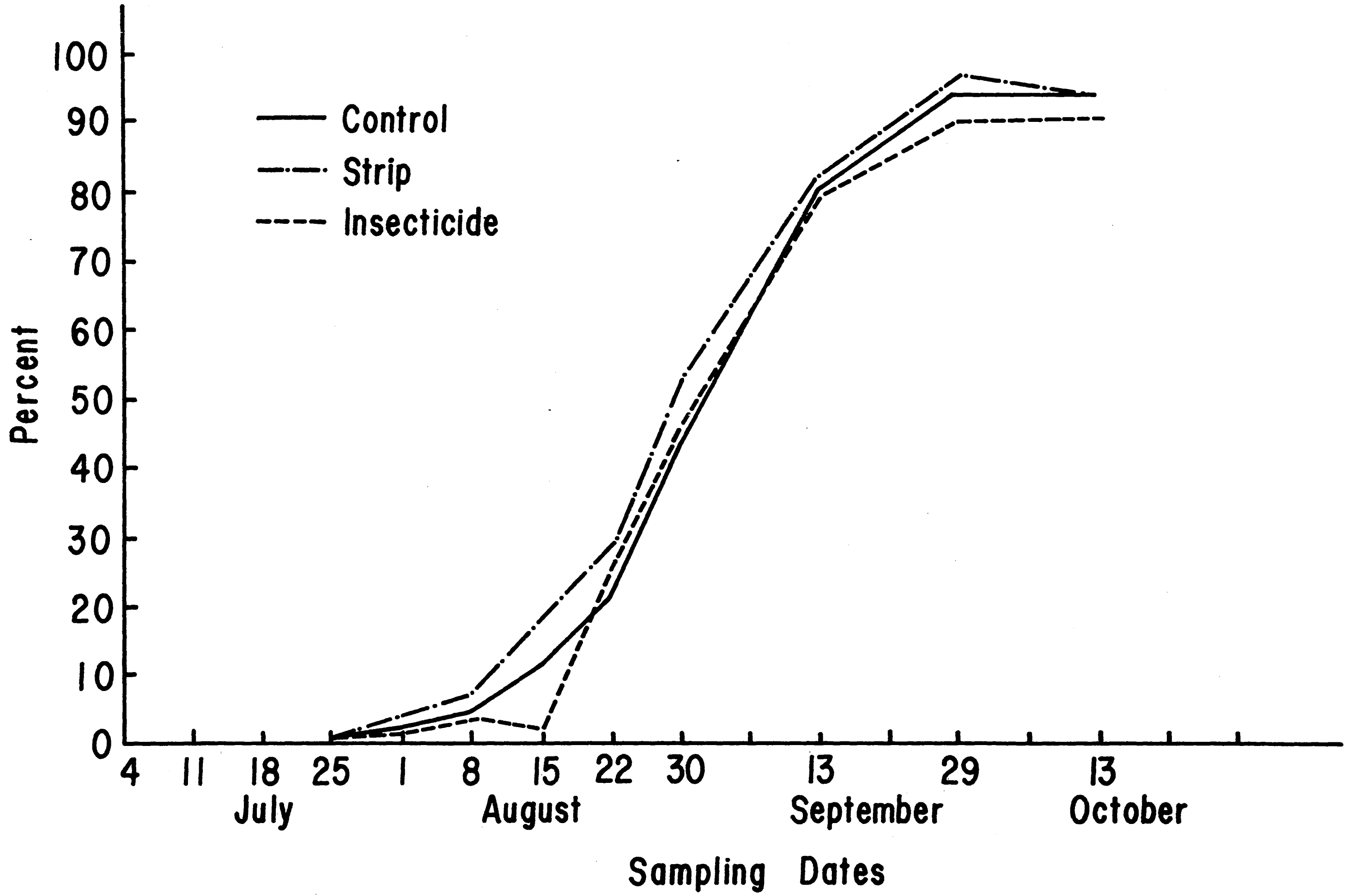

Figure 3. Average Percent Total Bolls per Total Fruit per Acre of Westburn 70 Cotton by Treatment and Date, Altus, Oklahoma, 1973

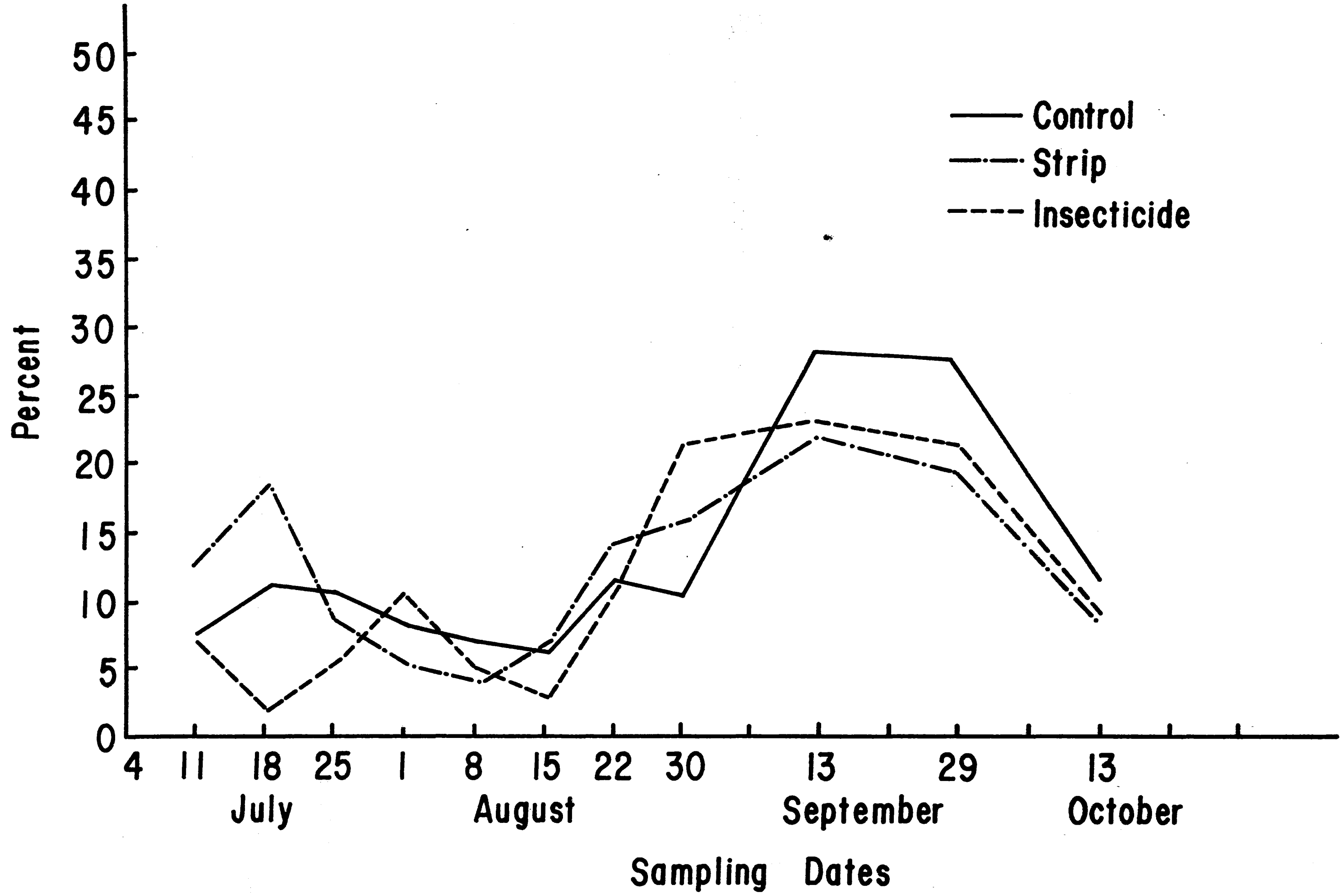

Figure 4. Average Percent Total Lost Fruiting Forms per Total Fruit per Acre of Westburn 70 Cotton by Treatment and Date, Altus, Oklahoma, 1973

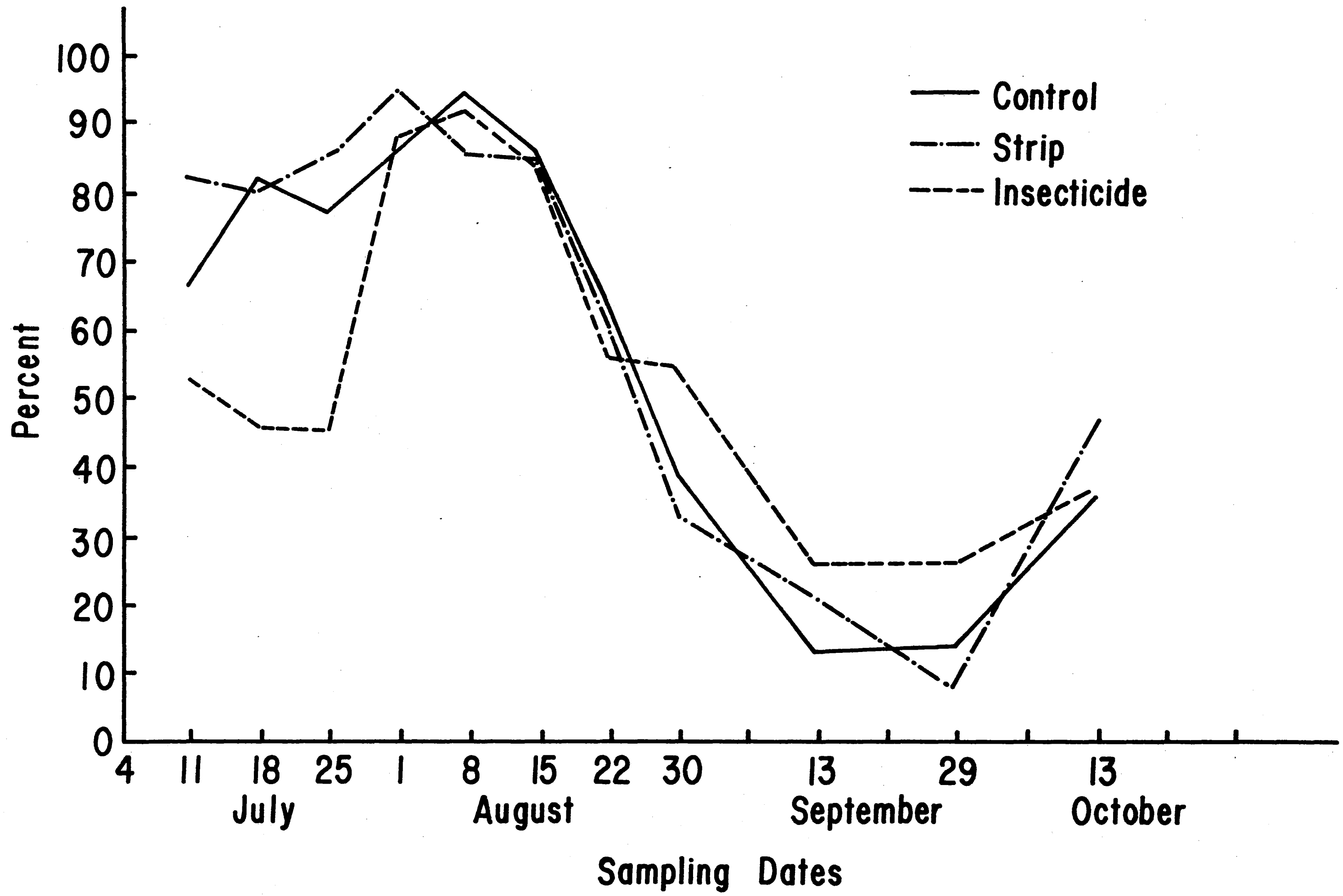

Figure 5. Average Percent Insect Damaged Fruit per Total Lost Fruit per Acre of Westburn 70 Cotton by Treatment and Date, 1973

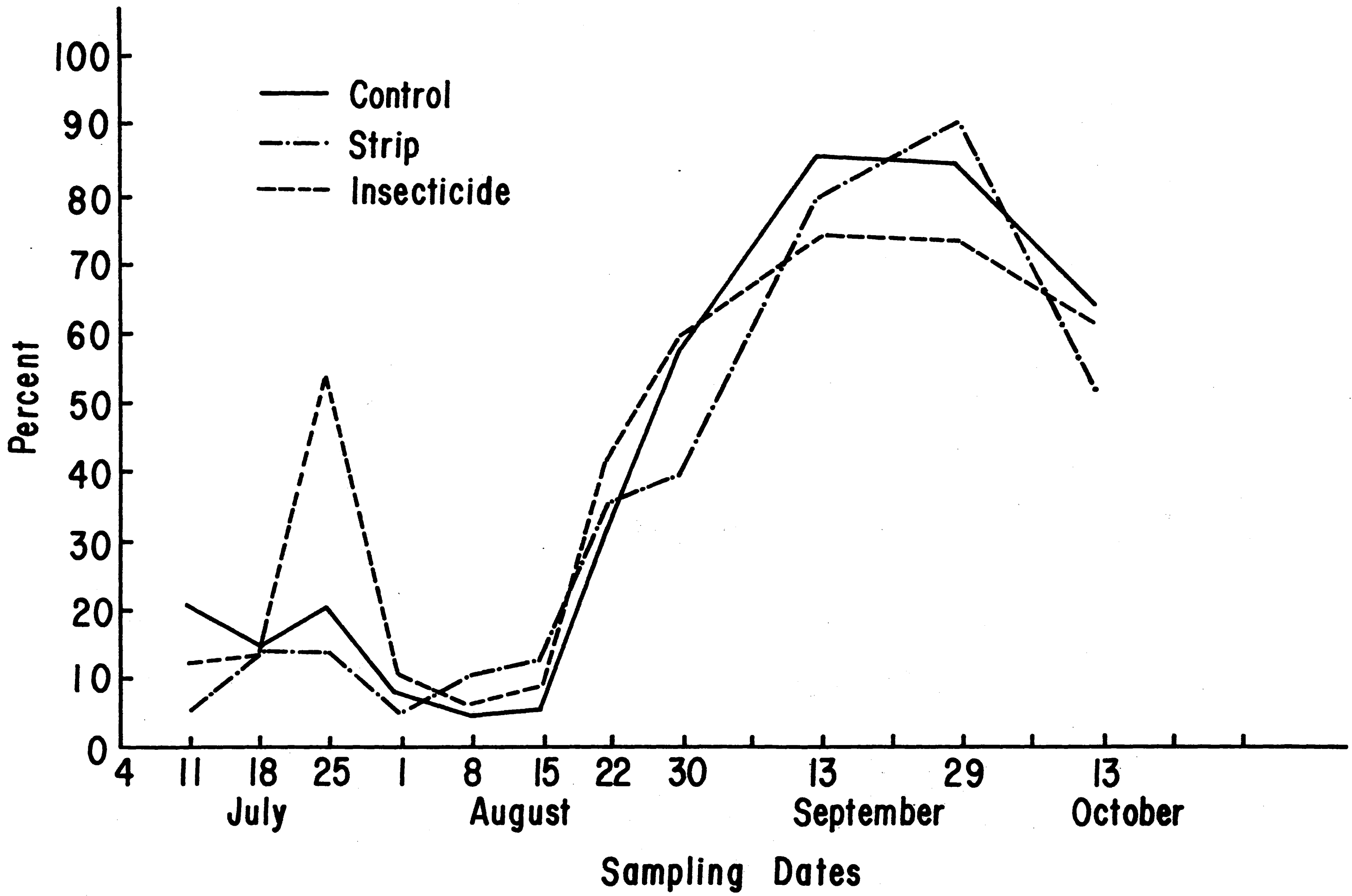

Figure 6. Average Percent Physiologically Shed Fruit per Total Lost Fruit per Acre of Westburn 70 Cotton by Treatment and Date, Altus, Oklahoma, 1973

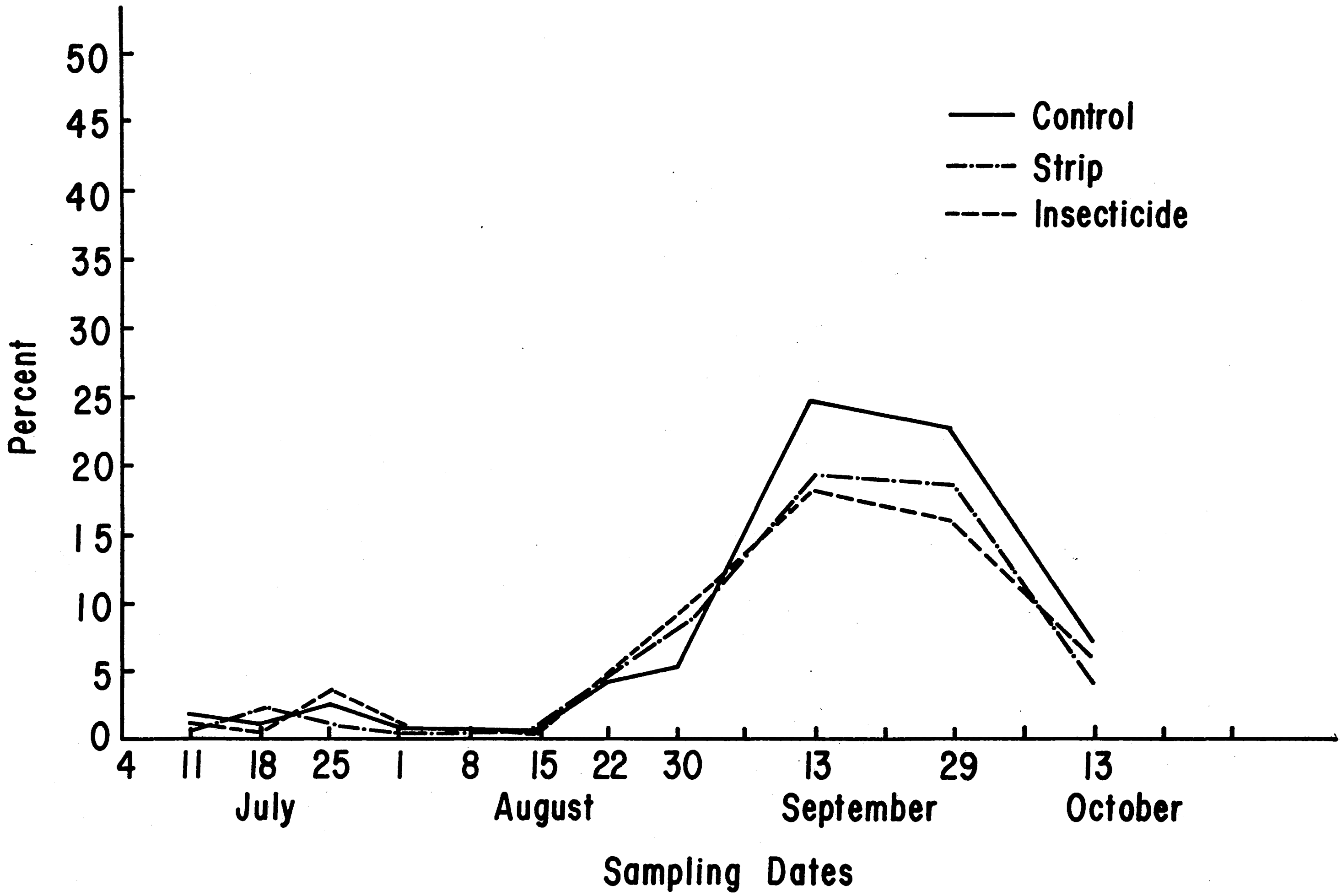

Figure 7. Average Percent Physiologically Shed Fruit per Total Fruit per Acre of Westburn 70 Cotton by Treatment and Date, Altus, Oklahoma, 1973

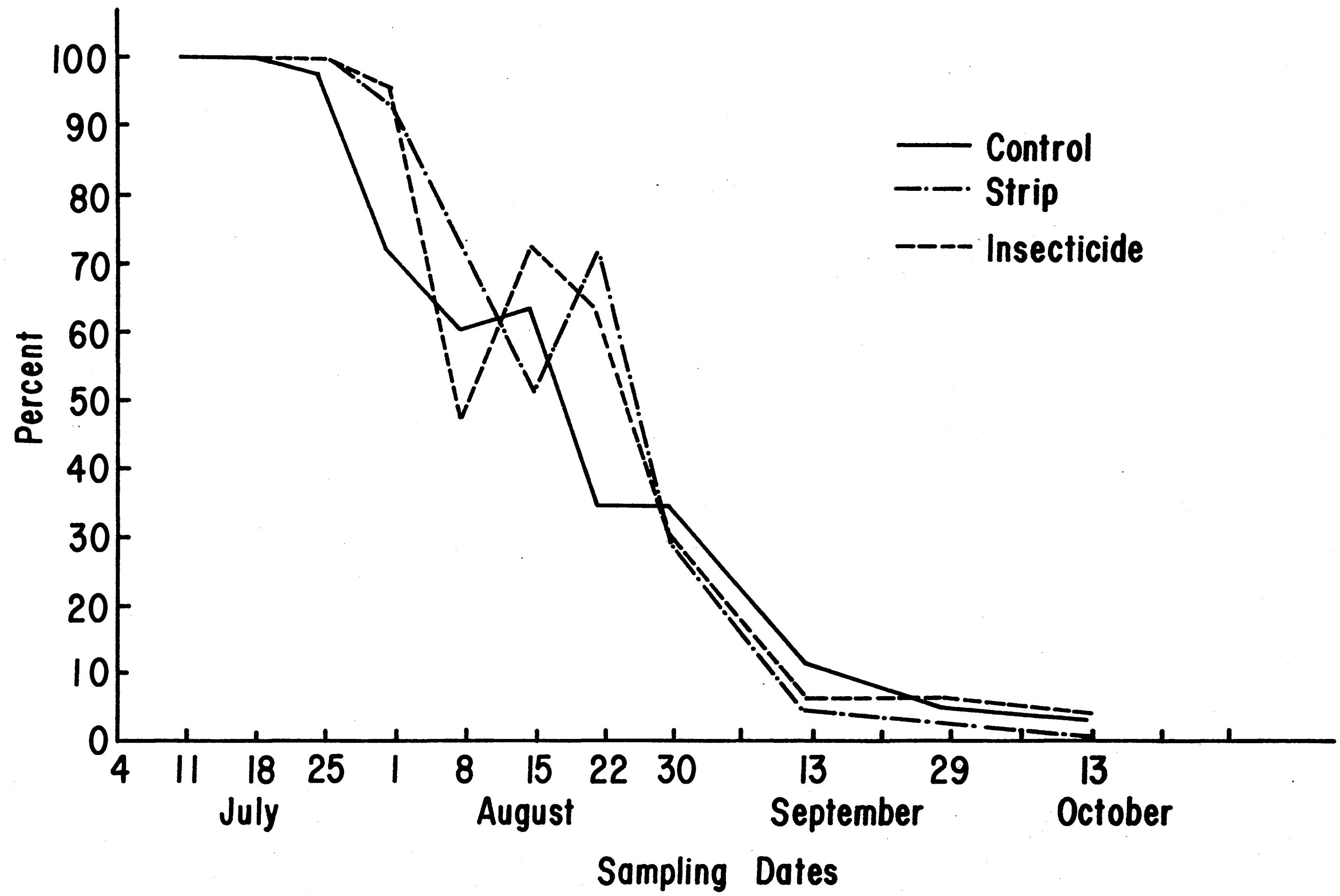

Figure 8. Average Percent Physiologically Shed Squares per Total Physiologically Shed Fruit per Acre of Westburn 70 Cotton by Treatment and Date, Altus, Oklahoma, 1973

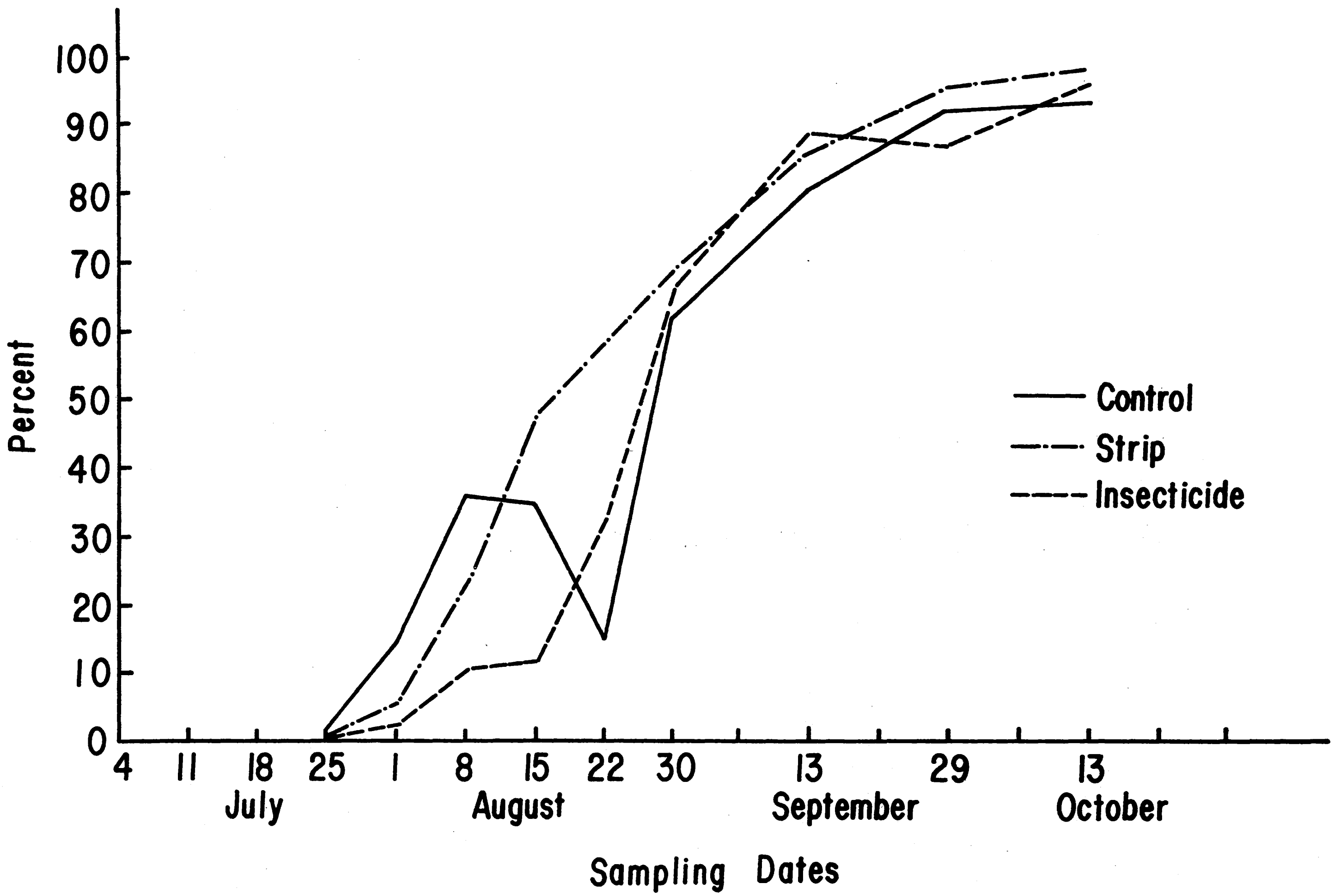

Figure 9. Average Percent Physiologically Shed Bolls per Total Physiologically Shed Fruit per Acre of Westburn 70 Cotton by Treatment and Date, Altus, Oklahoma, 1973

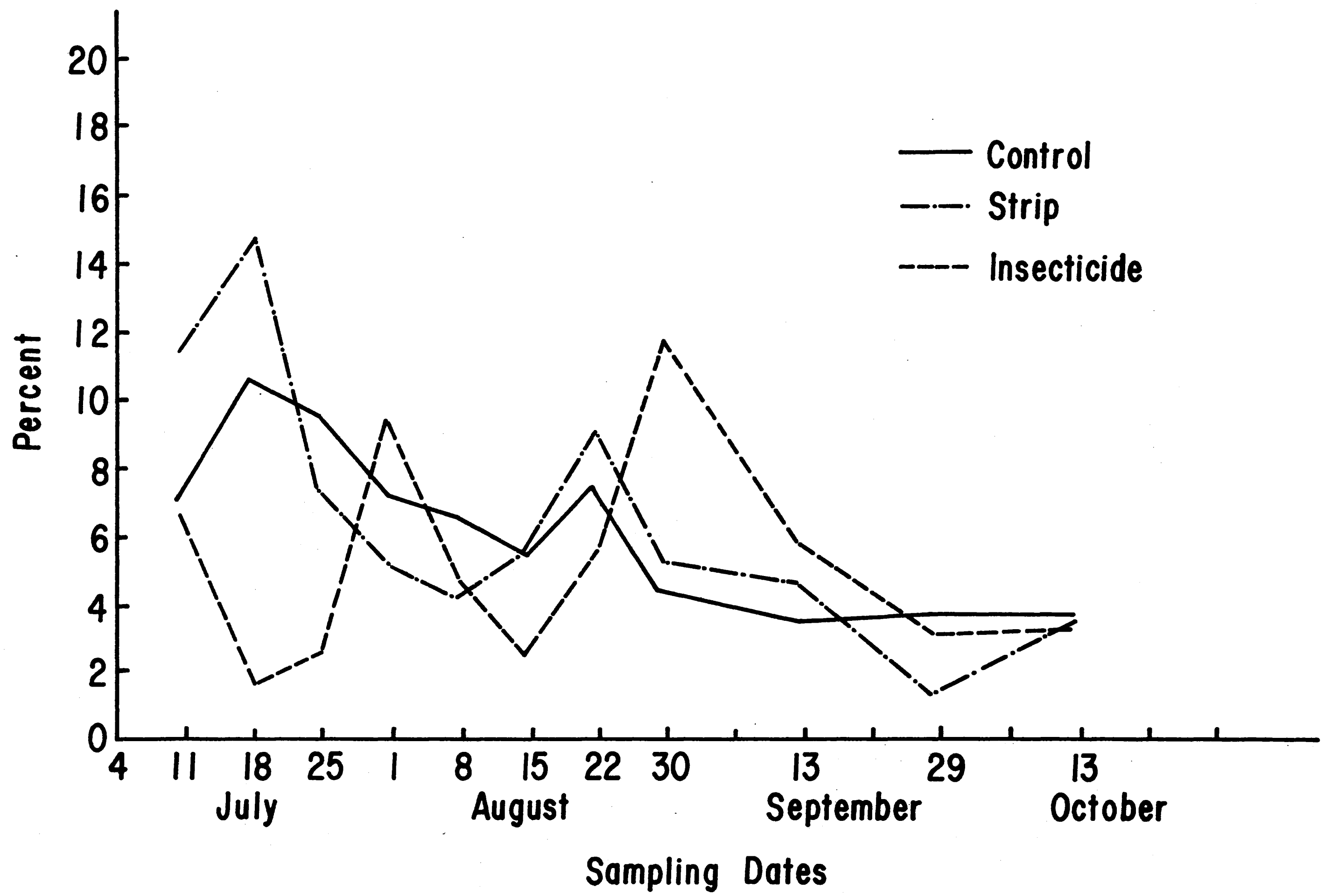

Figure 10. Average Percent Total Insect Damaged Fruit per Total Fruit per Acre of Westburn 70 Cotton by Treatment and Date, Altus, Oklahoma, 1973

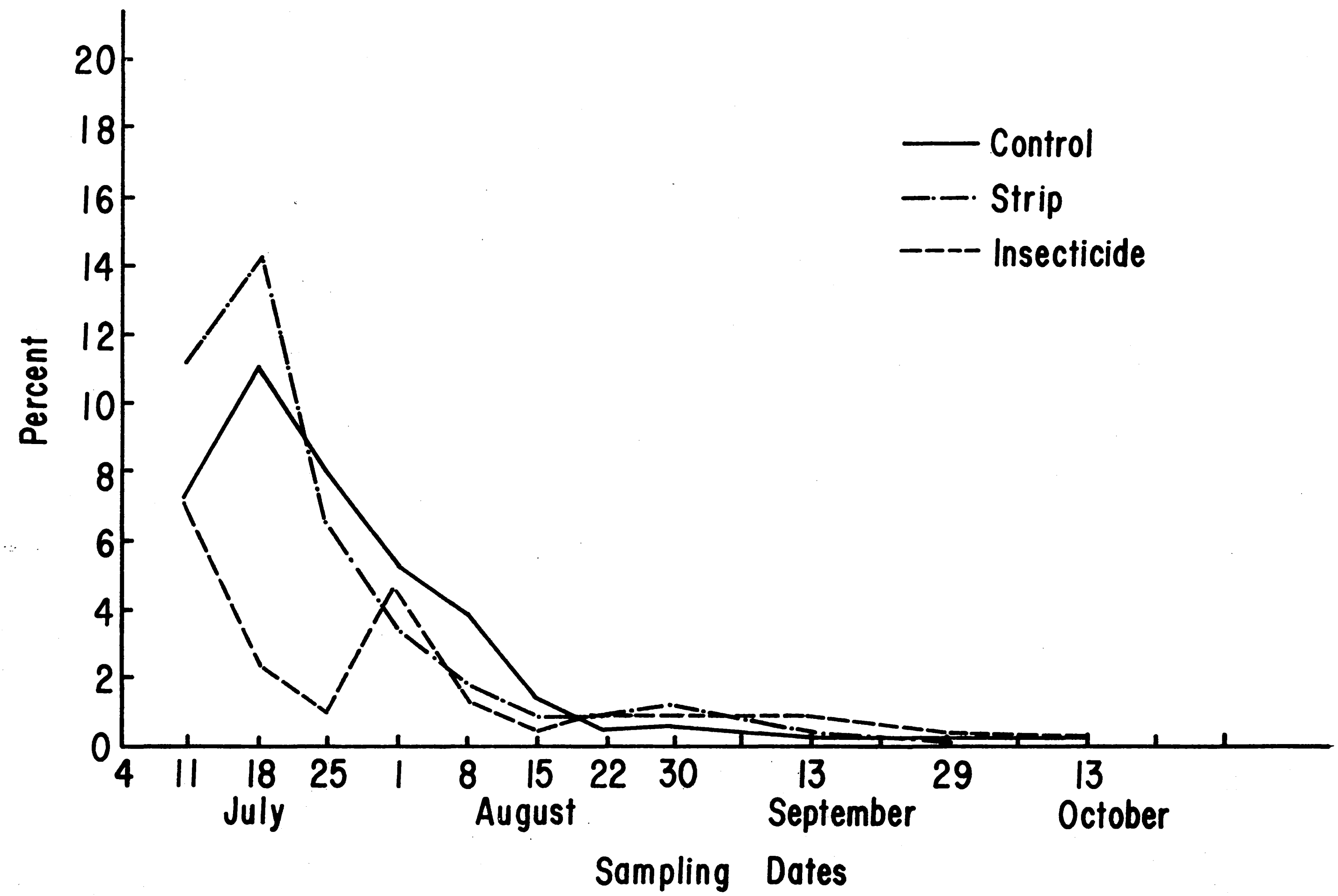

Figure 11. Average Percent Fleahopper Damaged Squares per Total Fruit per Acre of Westburn 70 Cotton by Treatment and Date, Altus, Oklahoma, 1973

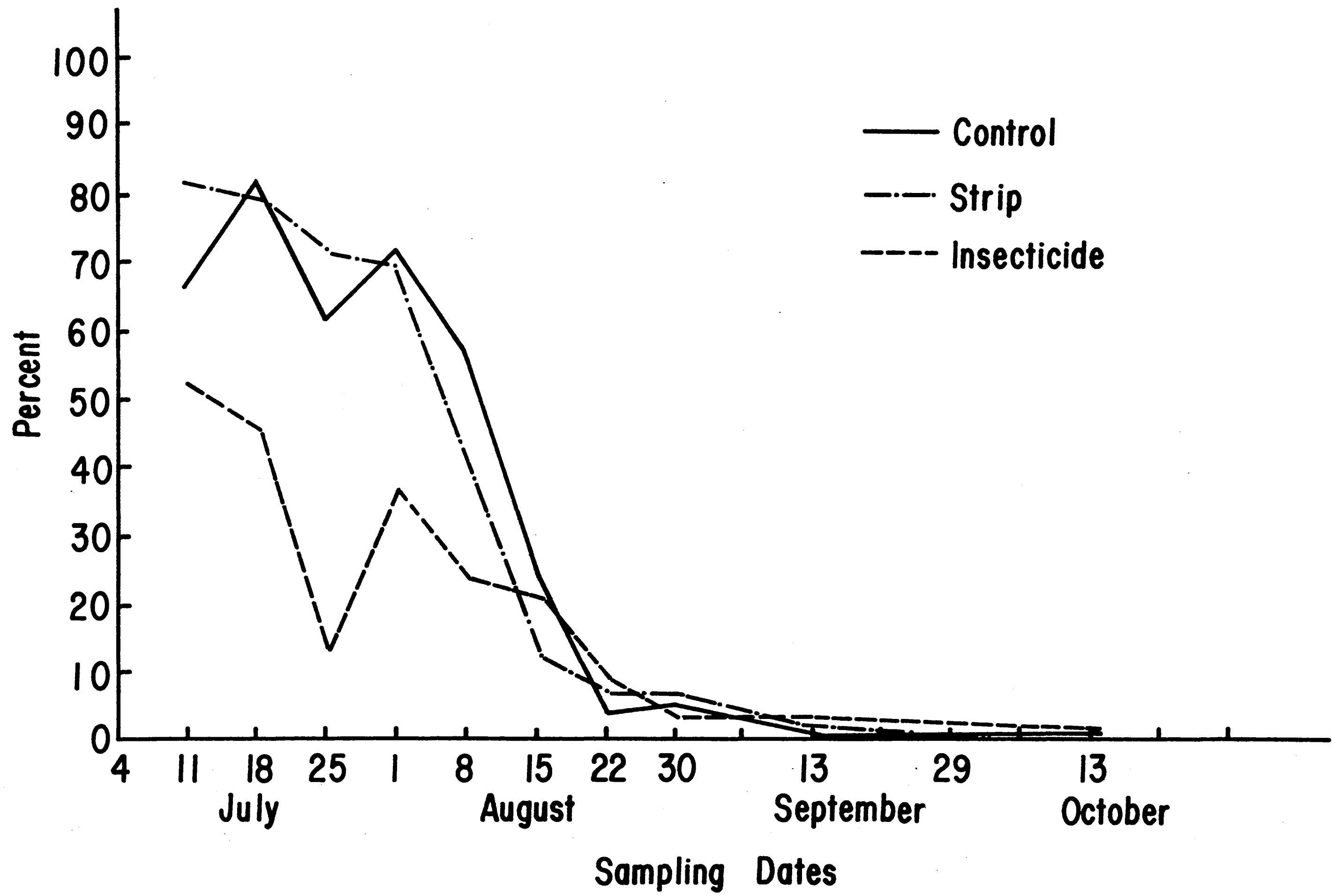

Figure 12. Average Percent Fleahopper Damaged Squares per Total Lost Fruit per Acre of Westburn 70 Cotton by Treatment and Date, Altus, Oklahoma, 1973

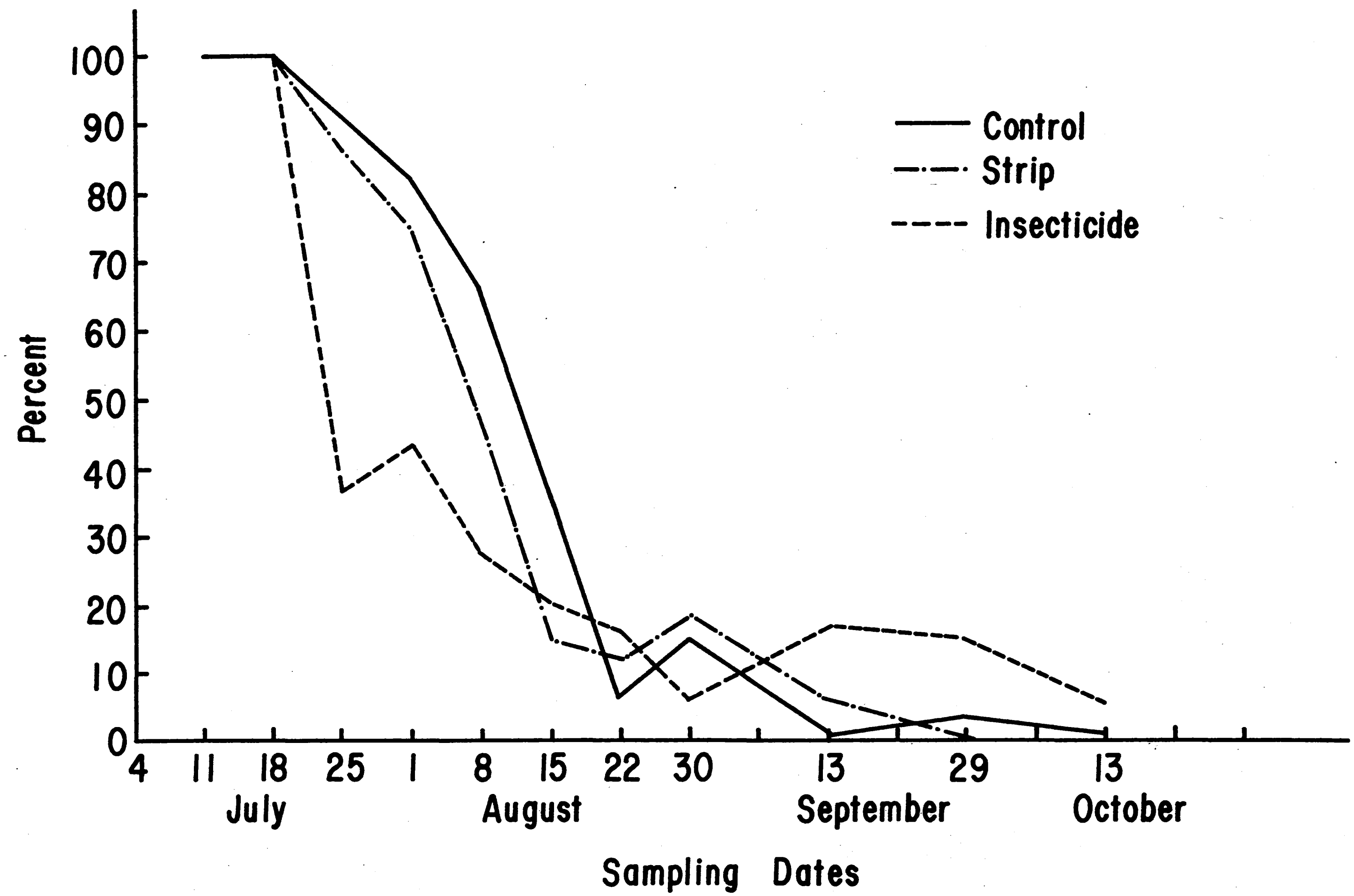

Figure 13. Average Percent Fleahopper Damaged Squares per Total Insect Damaged Fruit per Acre of Westburn 70 Cotton by Treatment and Date, Altus, Oklahoma, 1973

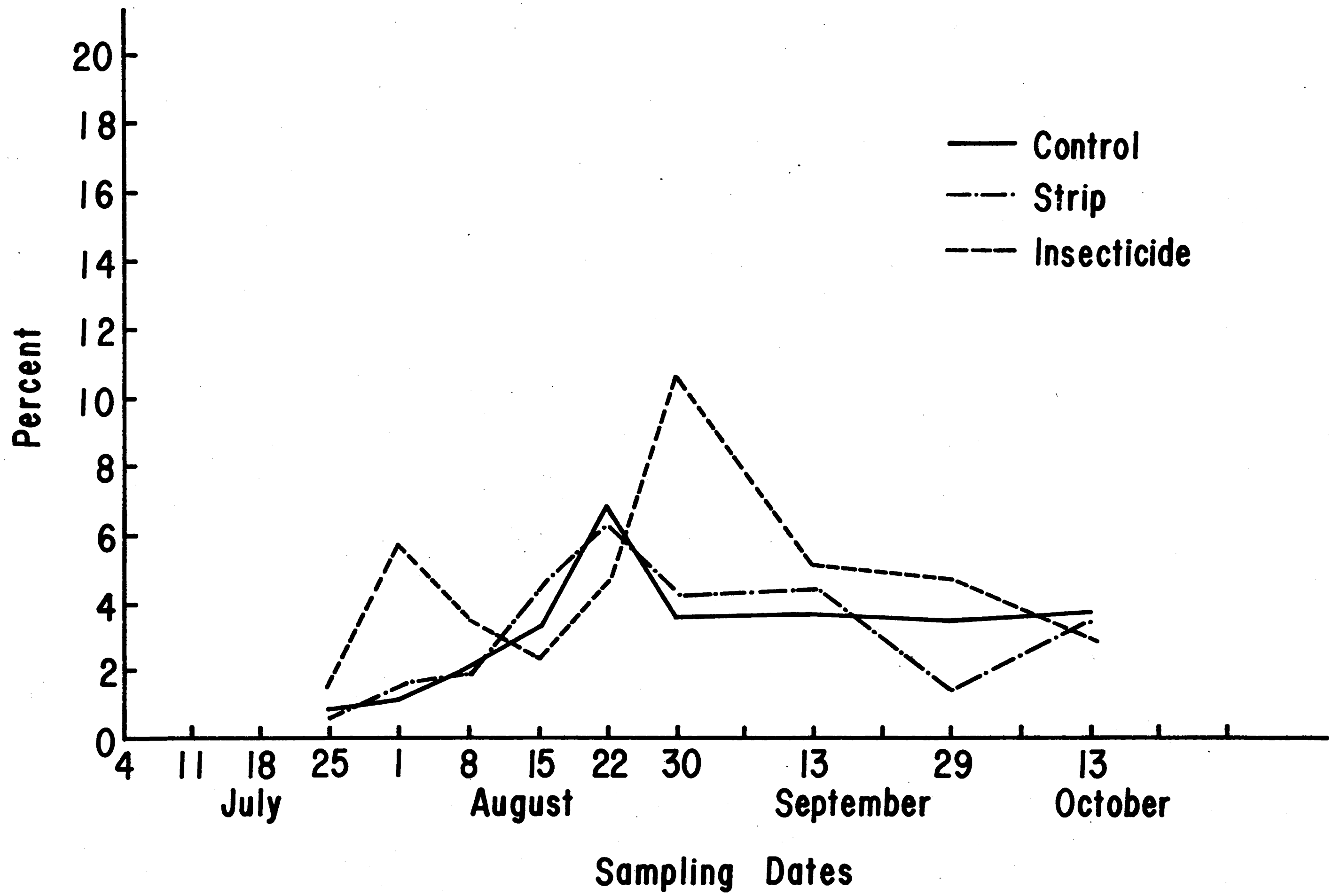

Figure 14. Average Percent Bollworm Damaged Fruit per Total Fruit per Acre of Westburn 70 Cotton by Treatment and Date, Altus, Oklahoma, 1973

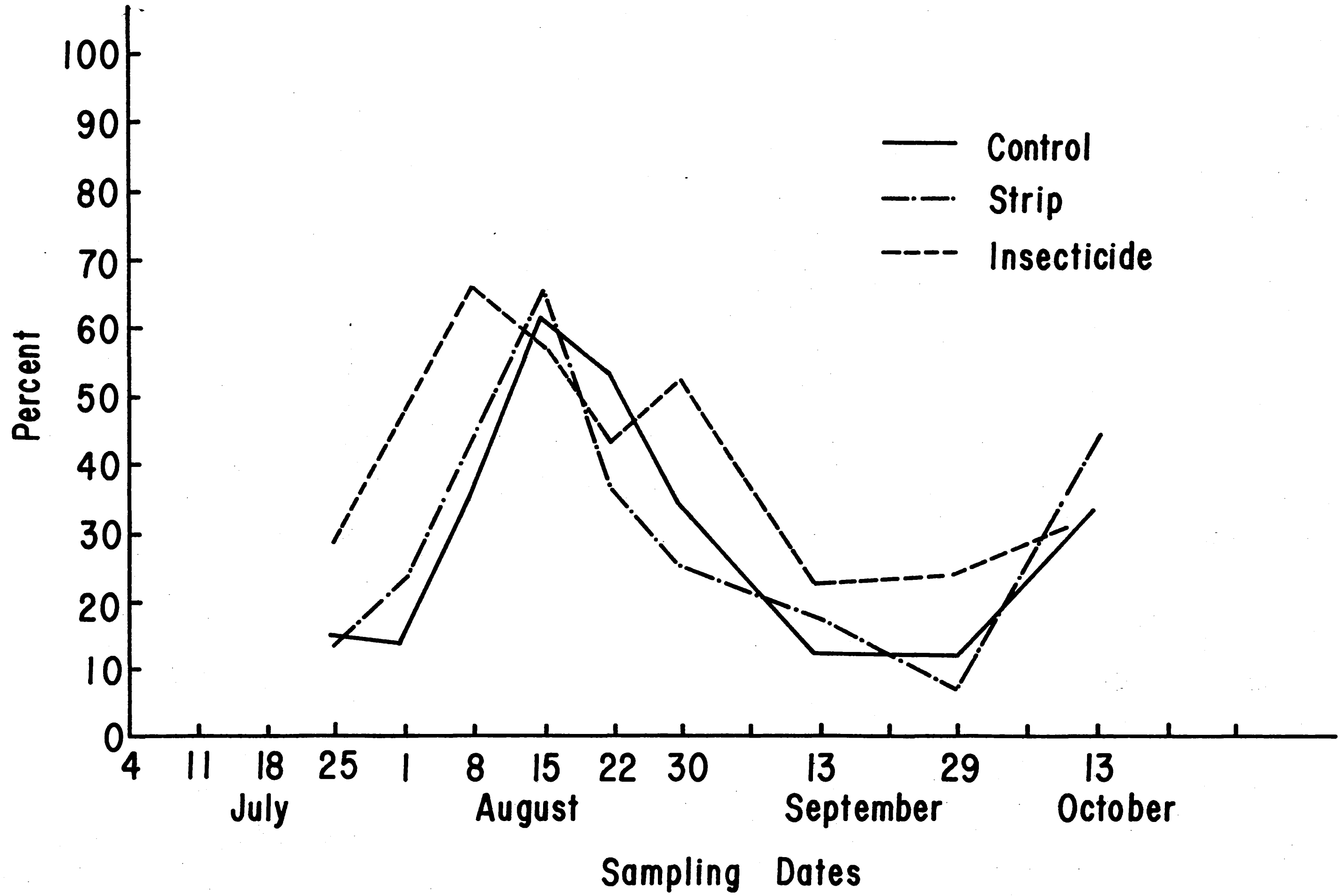

Figure 15. Average Percent Bollworm Damaged Fruit per Total Lost Fruit per Acre of Westburn 70 Cotton by Treatment and Date, Altus, Oklahoma, 1973

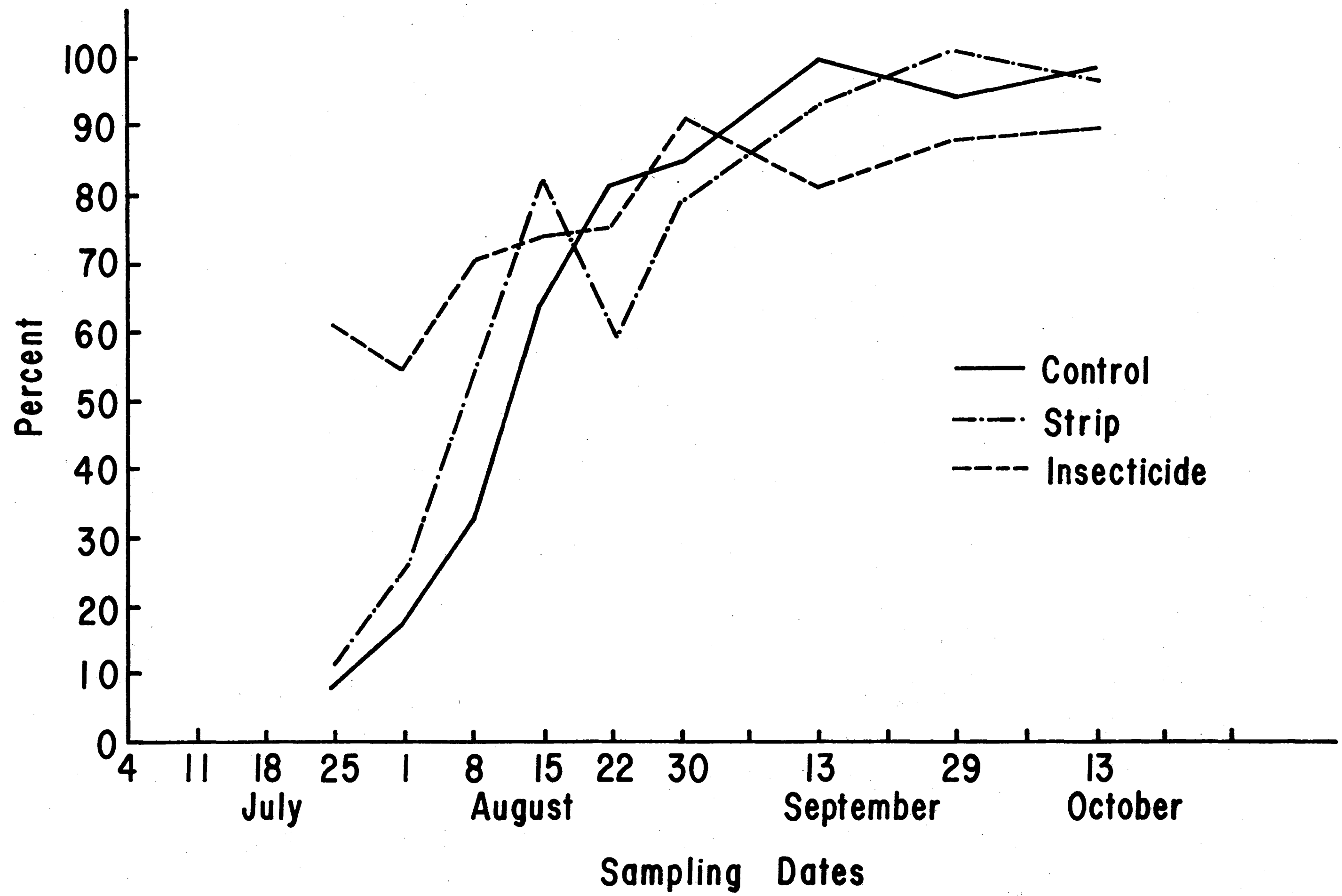

Figure 16. Average Percent Bollworm Damaged Fruit per Total Insect Damaged Fruit per Acre of Westburn 70 Cotton by Treatment and Date, Altus, Oklahoma, 1973

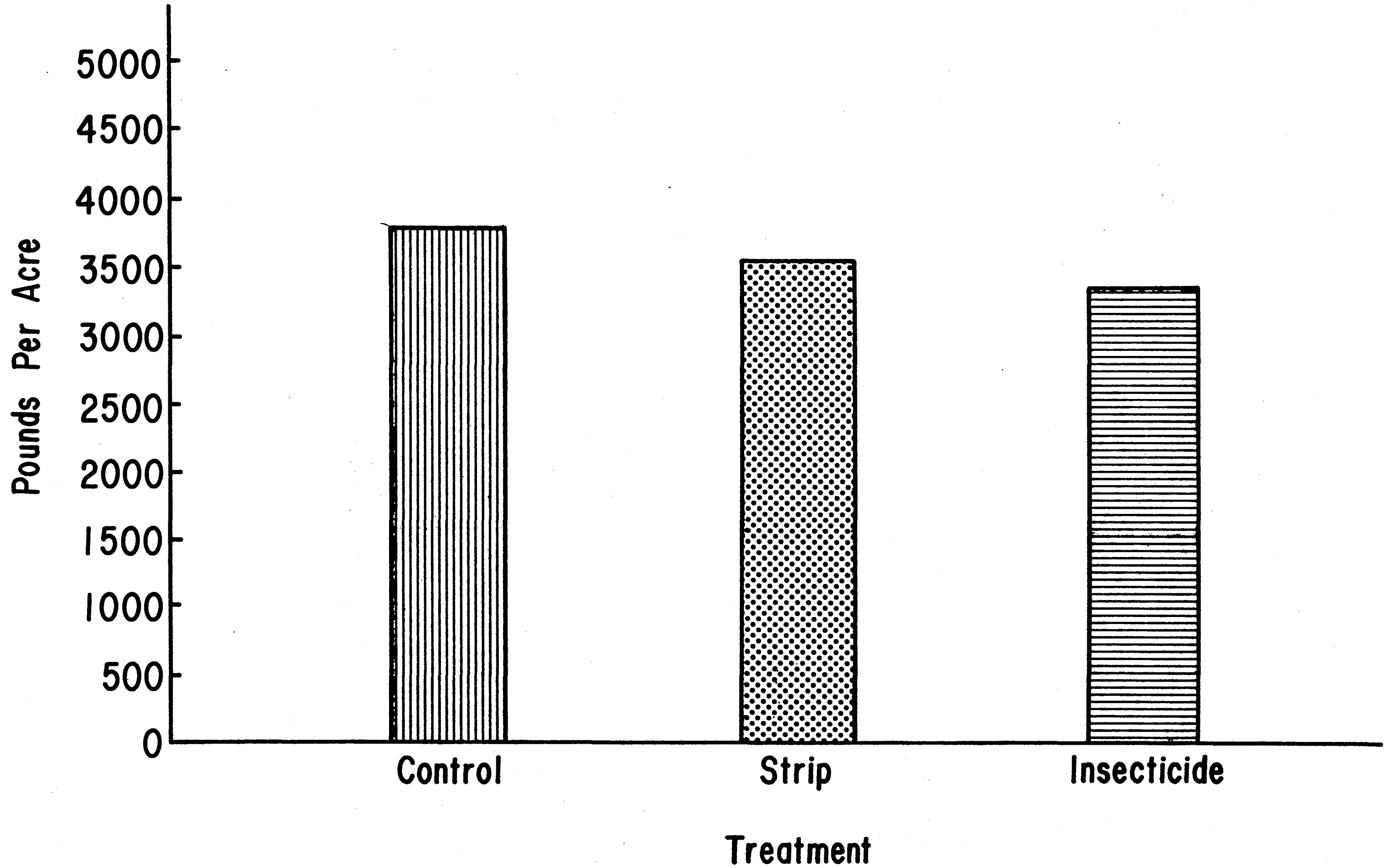

Figure 17. Total Yield of Stripper Cotton in Pounds per Acre of Westburn 70 Cotton by Treatment, Altus, Oklahoma, 1973

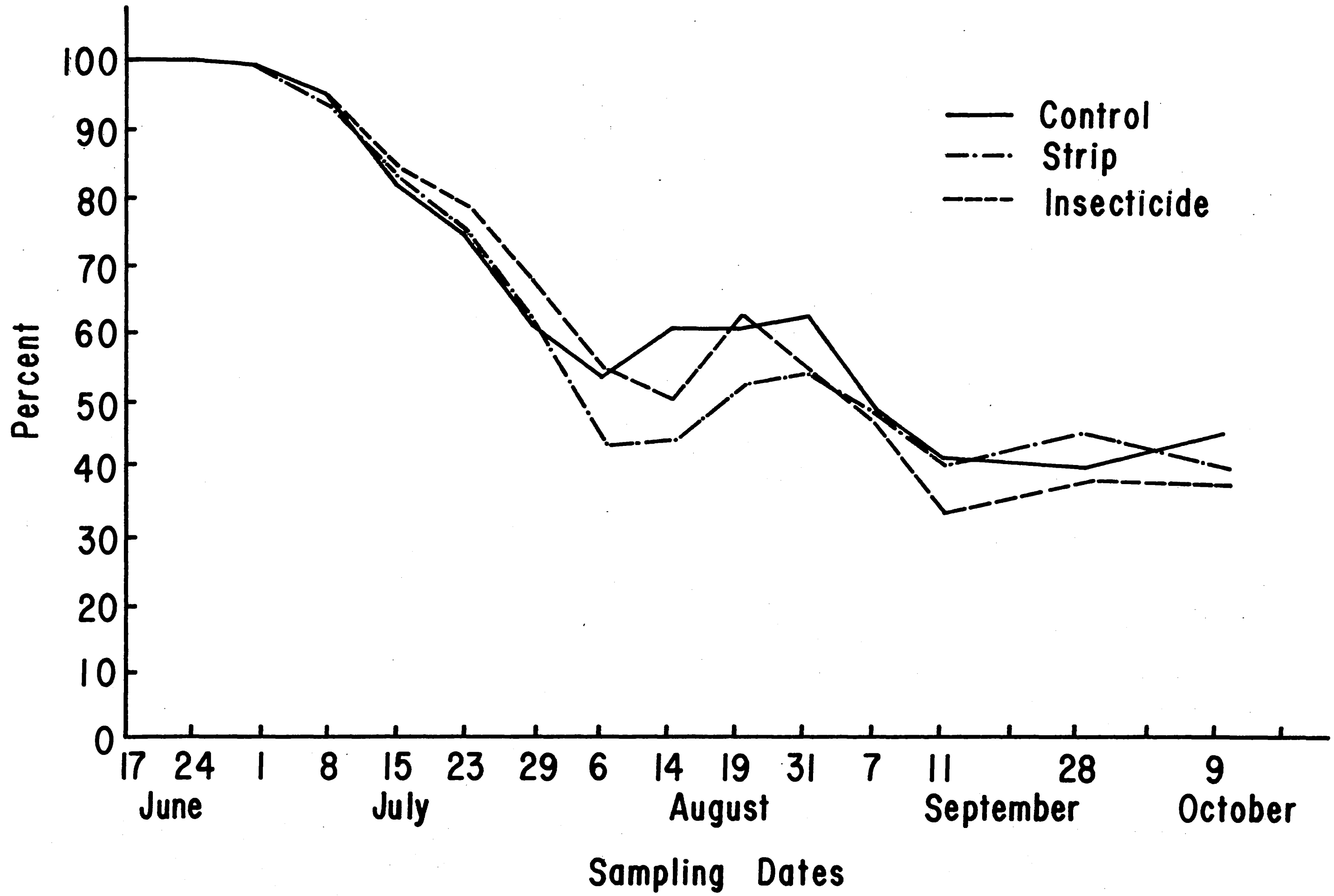

Figure 18. Average Percent Total Squares per Total Fruit of Thorpe Cotton by Treatment and Date, Tipton, Oklahoma, 1974.

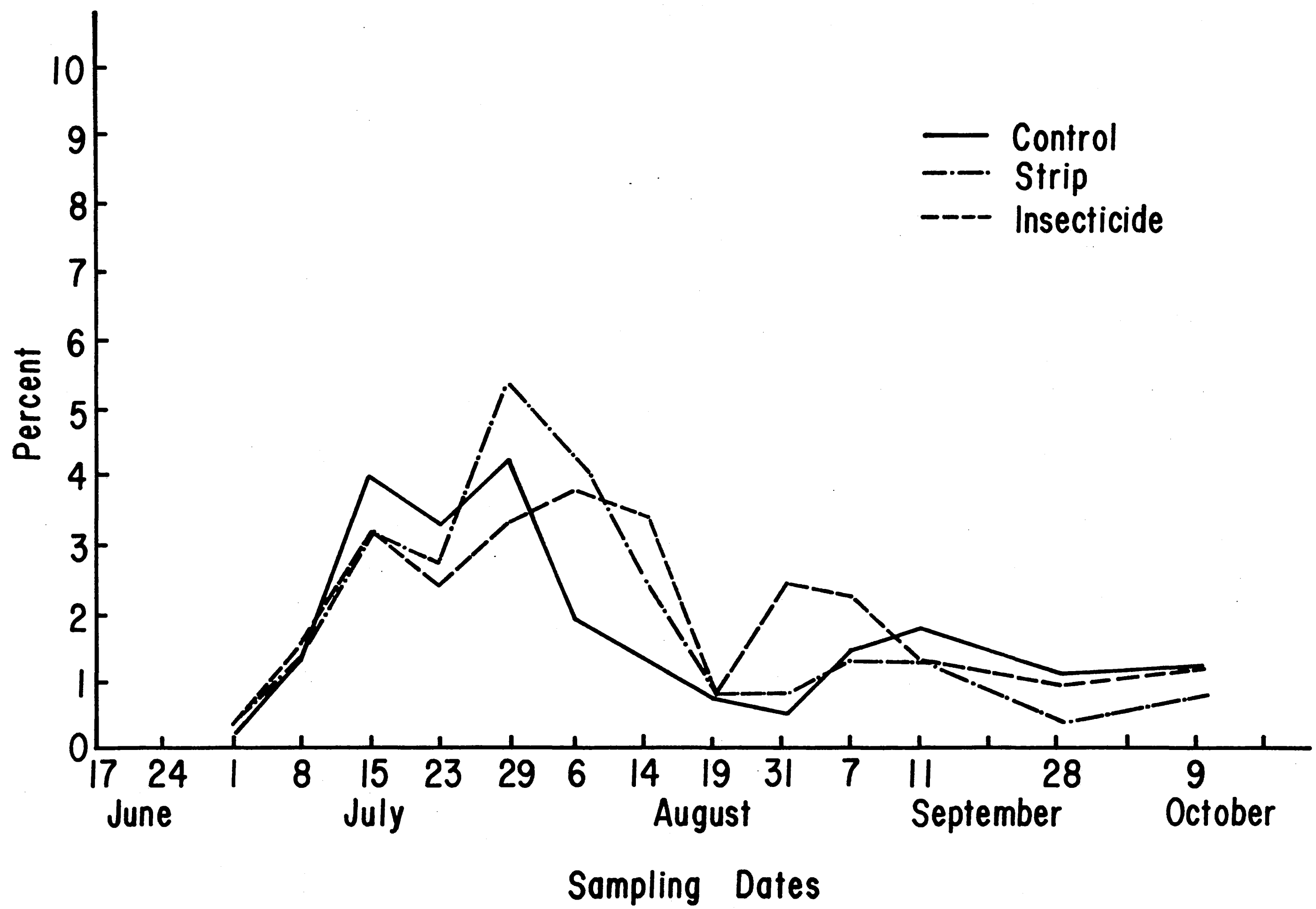

Figure 19. Average Percent Total Blooms per Total Fruit of Thorpe Cotton by Treatment and Date, Tipton, Oklahoma, 1974

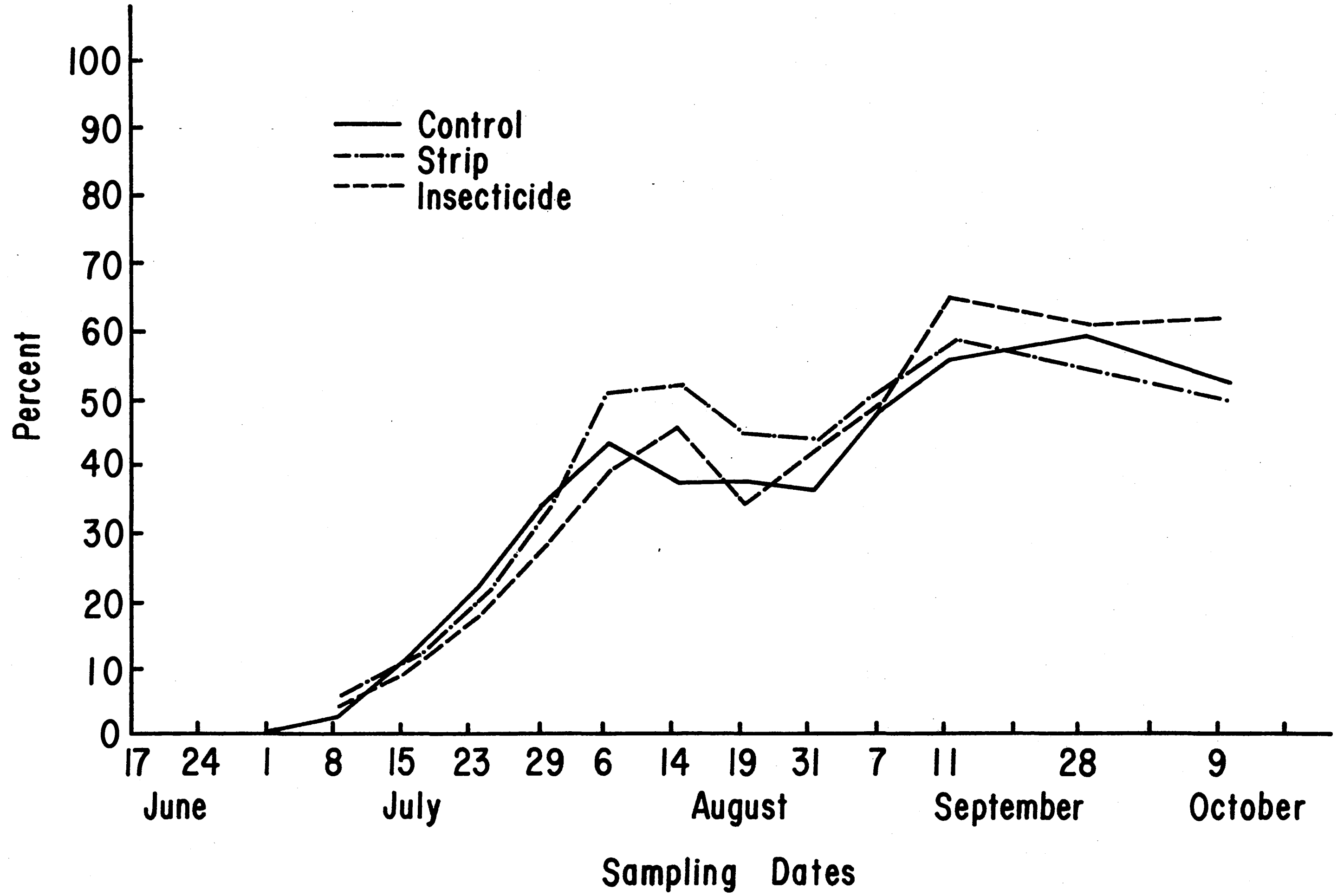

Figure 20. Average Percent Total Bolls per Total Fruit of Thorpe Cotton by Treatment and Date, Tipton, Oklahoma, 1974

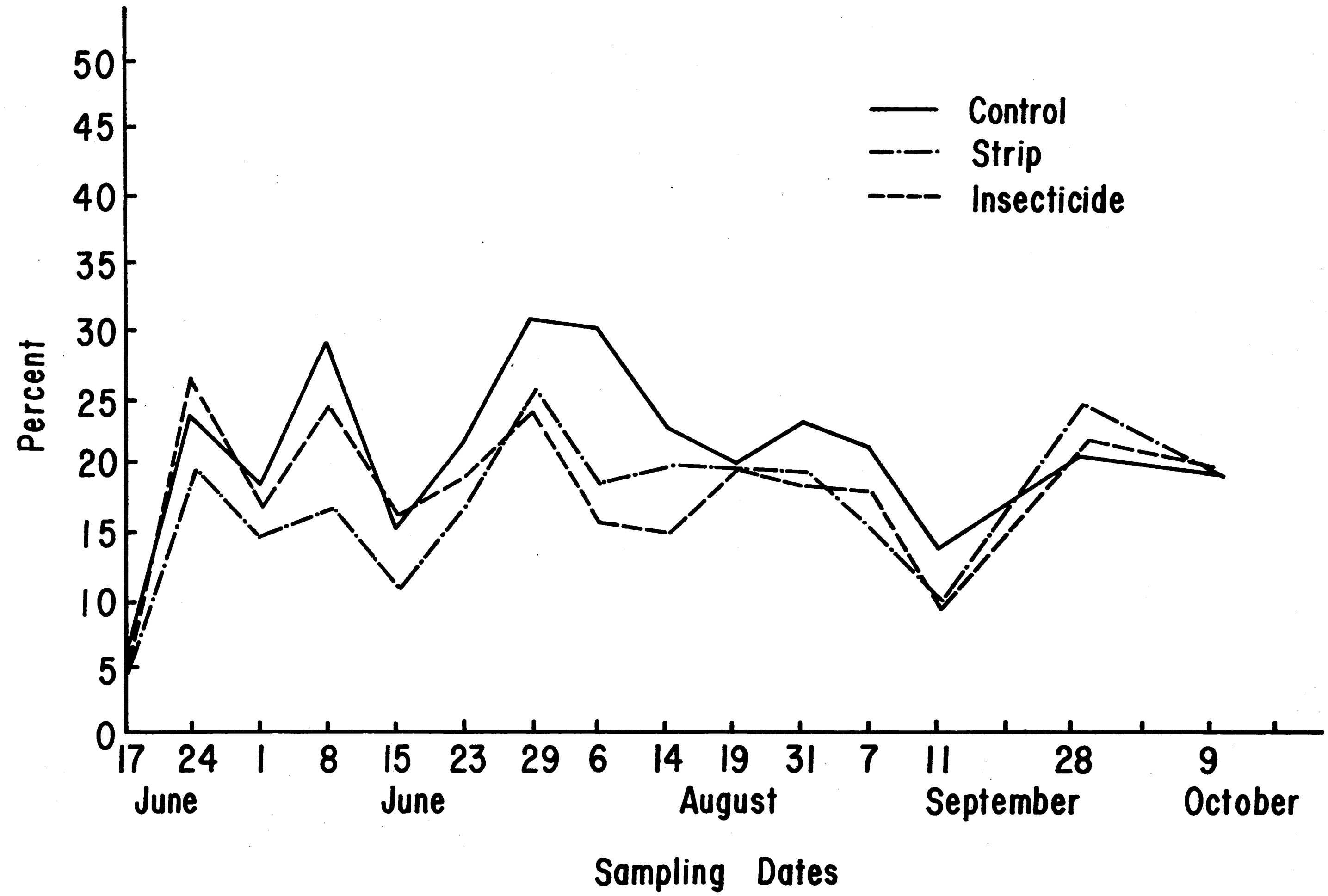

Figure 21. Average Percent Total Lost Fruit per Total Fruit of Thorpe Cotton by Treatment and Date, Tipton, Oklahoma, 1974

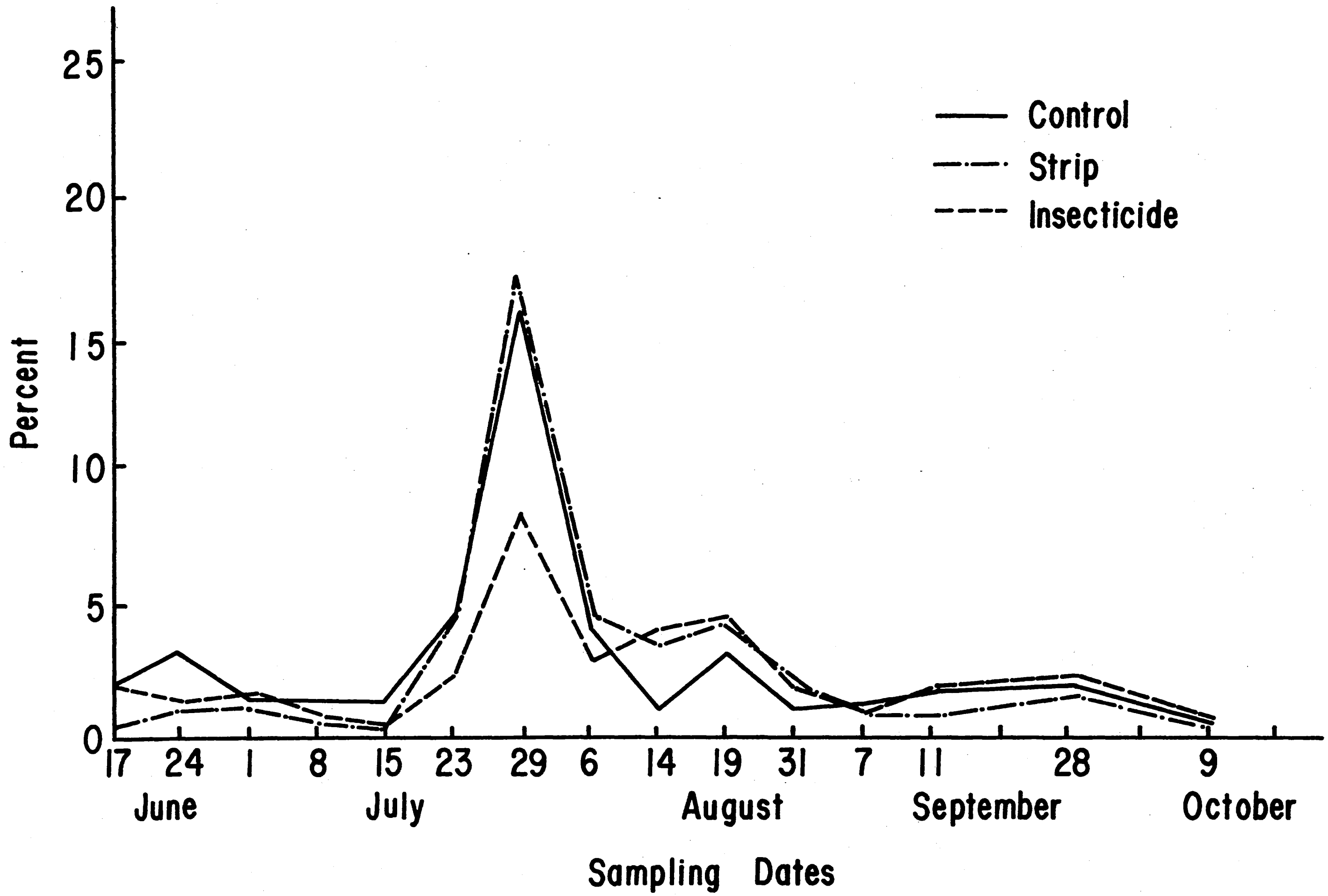

Figure 22. Average Percent Physiological Shed Fruit per Total Fruit of Thorpe Cotton by Treatment and Date, Tipton, Oklahoma, 1974

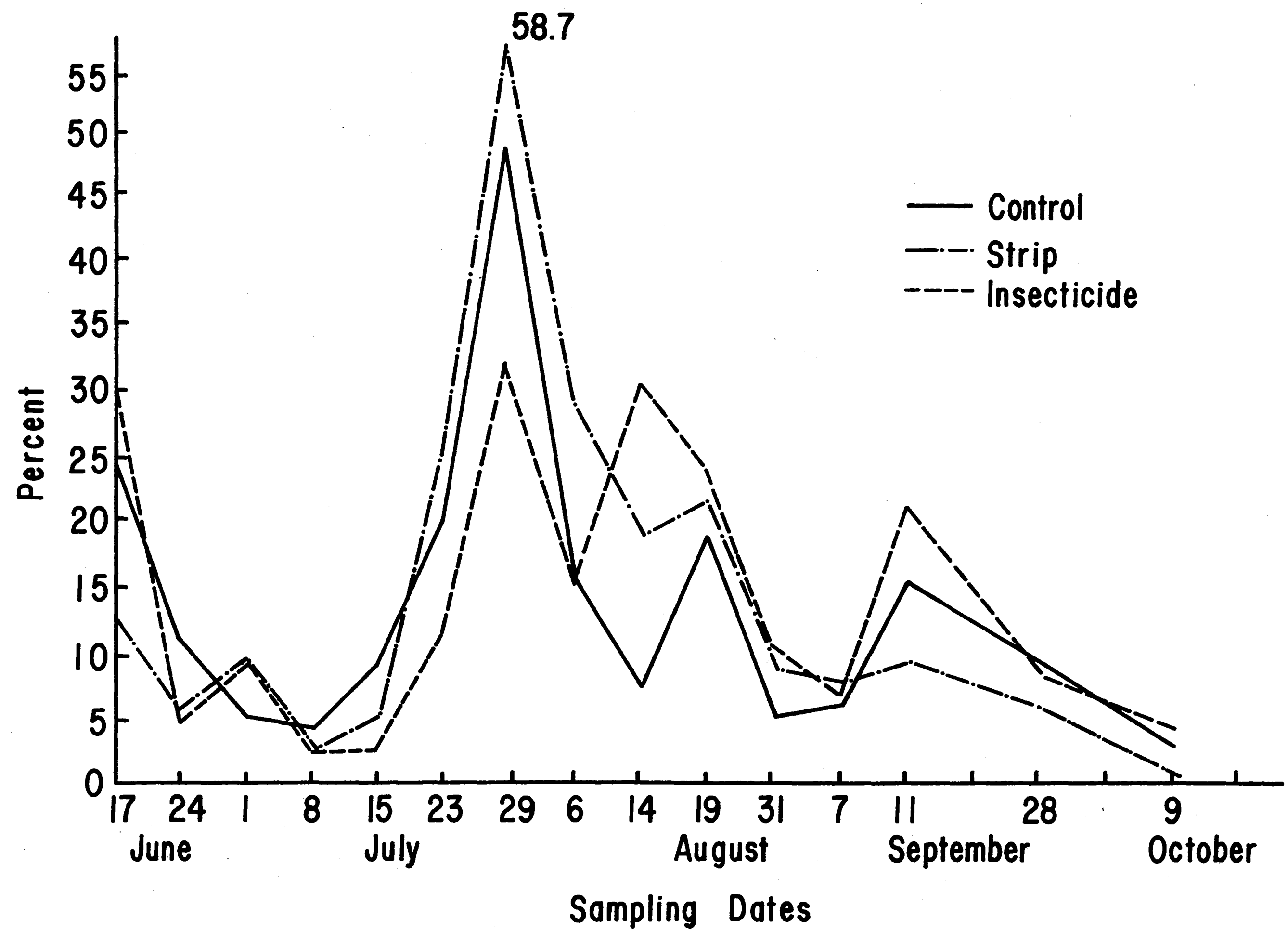

Figure 23. Average Percent Physiological Shed Fruit per Total Lost Fruit of Thorpe Cotton by Treatment and Date, Tipton, Oklahoma, 1974

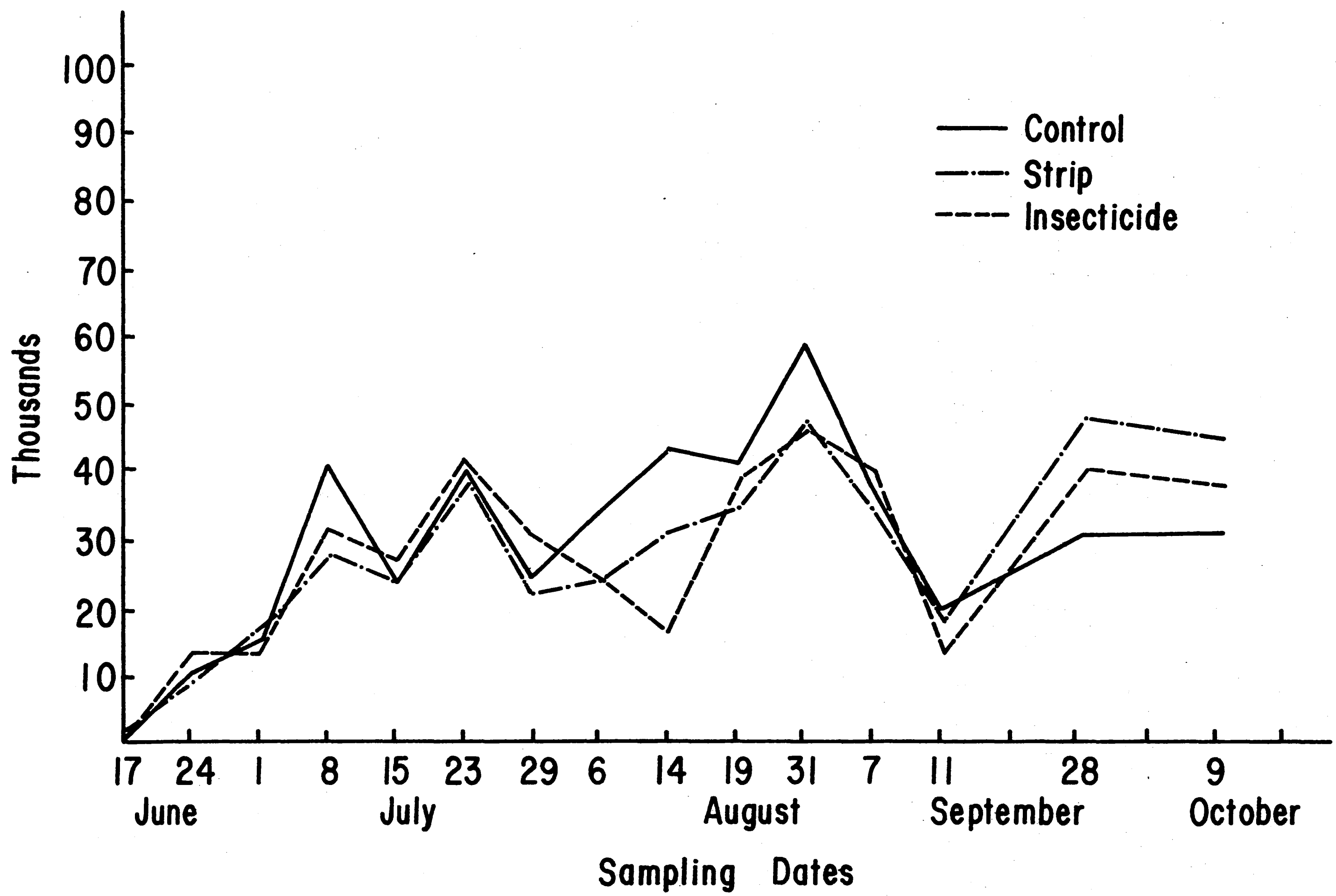

Figure 24. Average Number of Total Insect Damaged Fruit per Acre of Thorpe Cotton by Treatment and Date, Tipton, Oklahoma, 1974

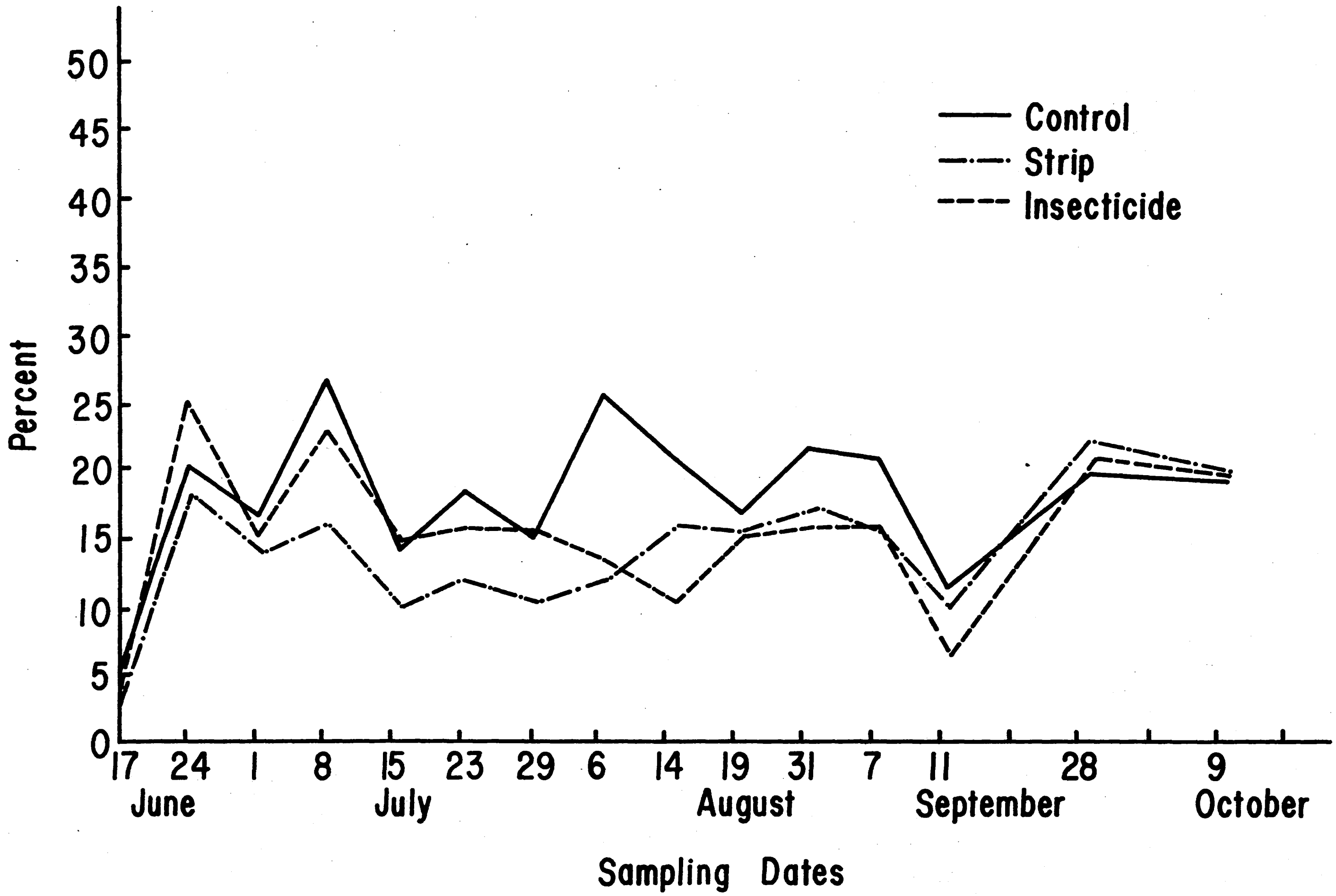

Figure 25. Average Percent Insect Damaged Fruit per Total Fruit of Thorpe Cotton by Treatment and Date, Tipton, Oklahoma, 1974

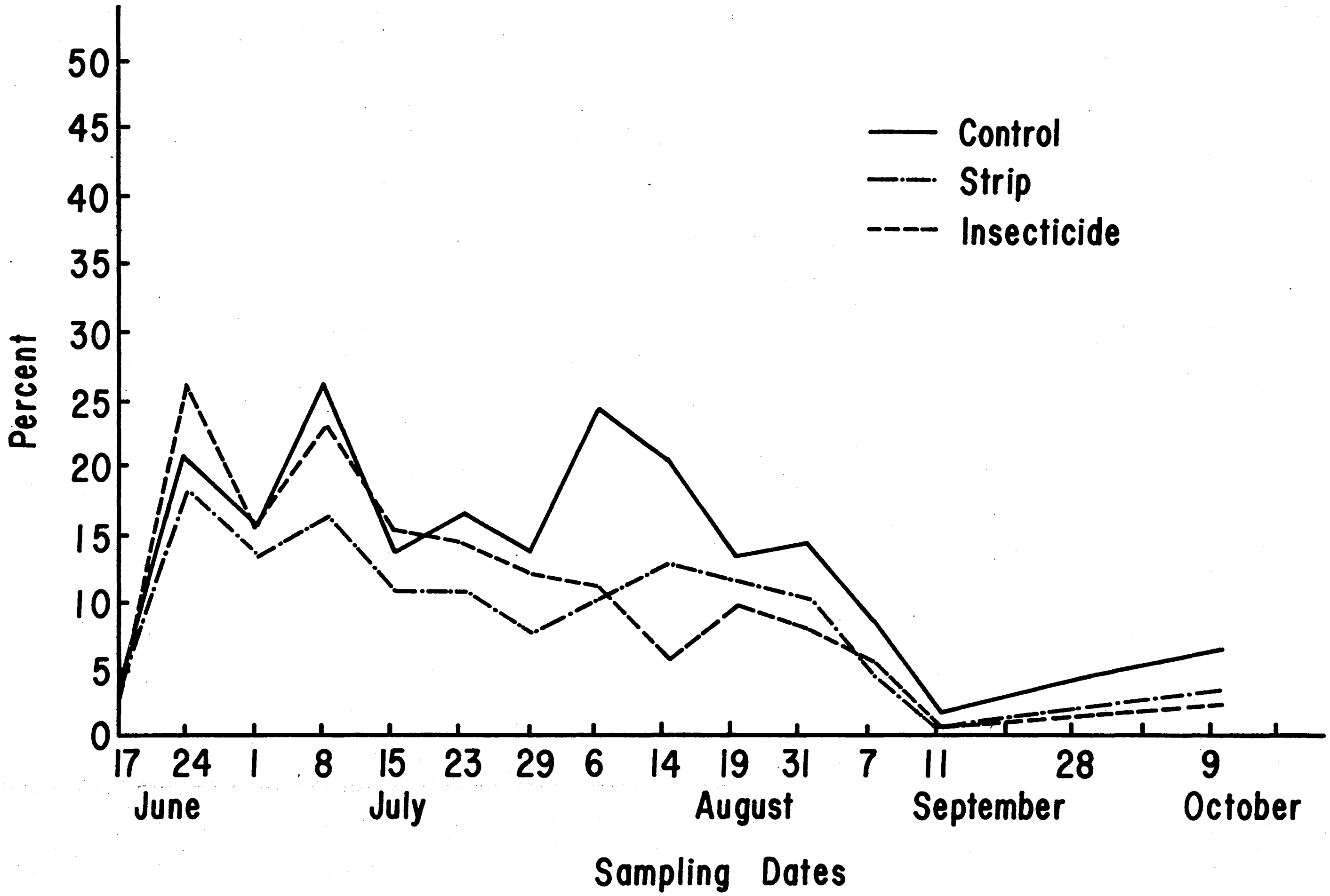

Figure 26. Average Percent Fleahopper Damaged Squares per Total Fruit of Thorpe Cotton by Treatment and Date, Tipton, Oklahoma, 1974

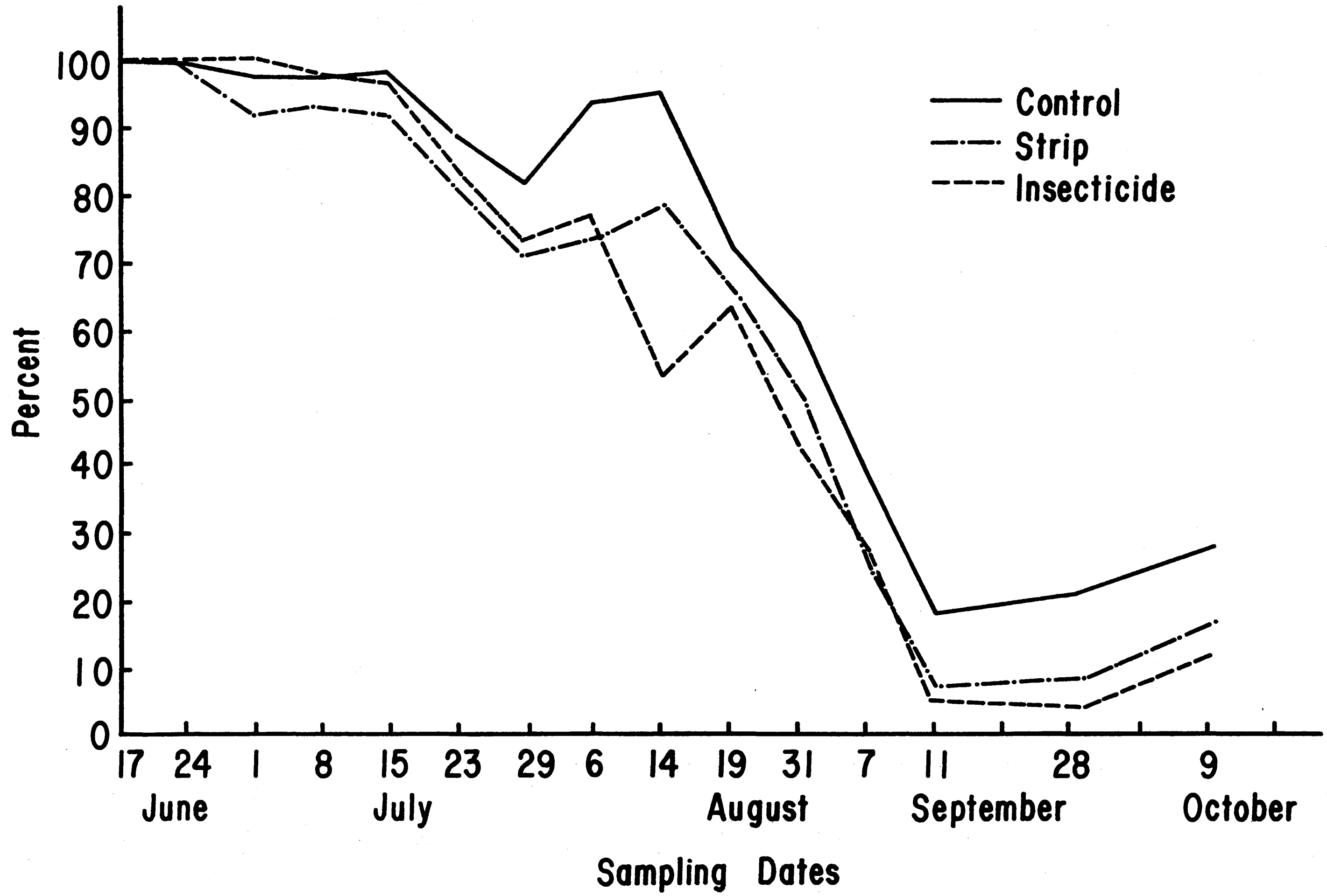

Figure 27. Average Percent Fleahopper Damaged Squares per Insect Damaged Fruit of Thorpe Cotton by Treatment and Date, Tipton, Oklahoma, 1974

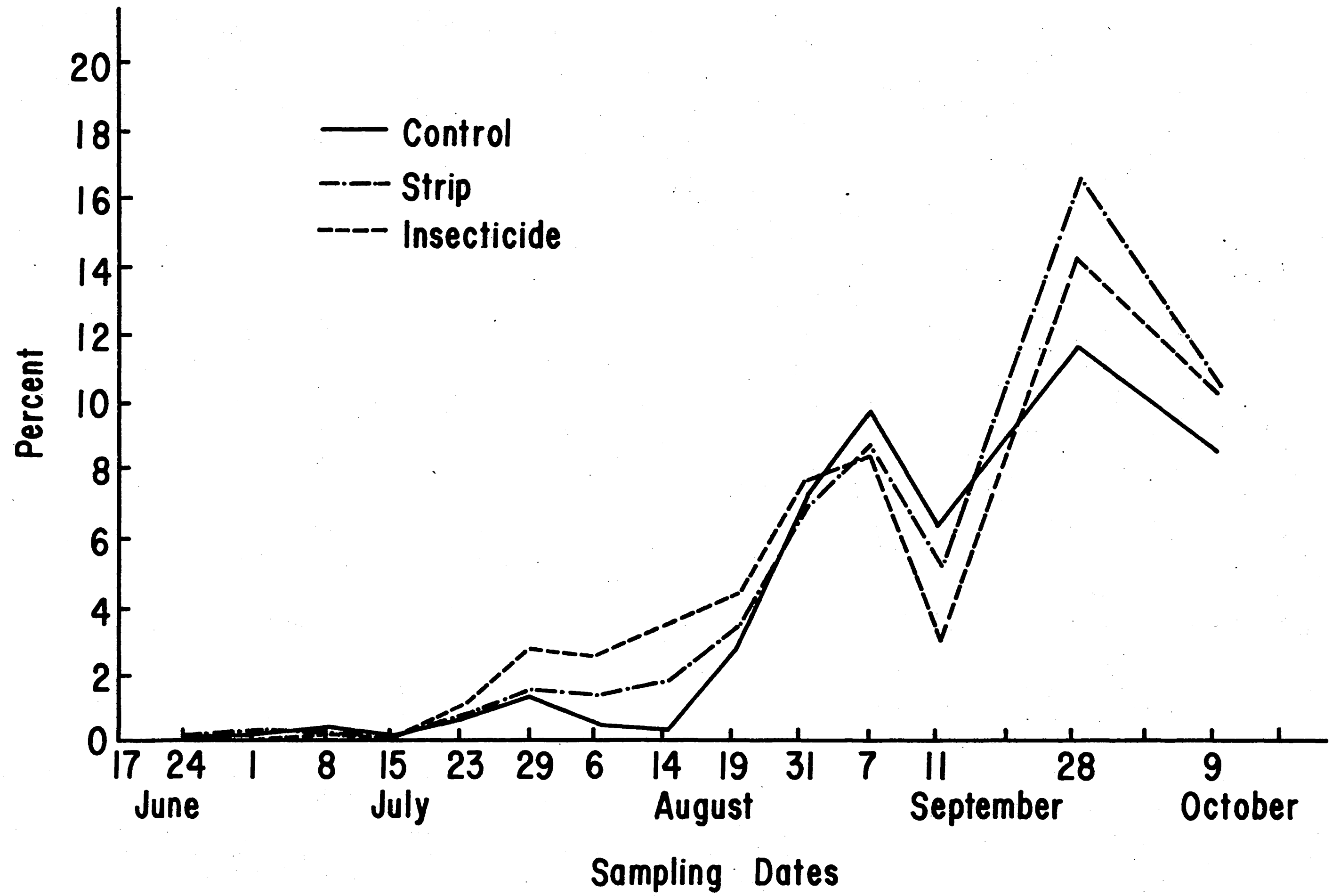

Figure 28. Average Percent Boll Weevil Damaged Fruit per Total Fruit of Thorpe Cotton by Treatment and Date, Tipton, Oklahoma, 1974

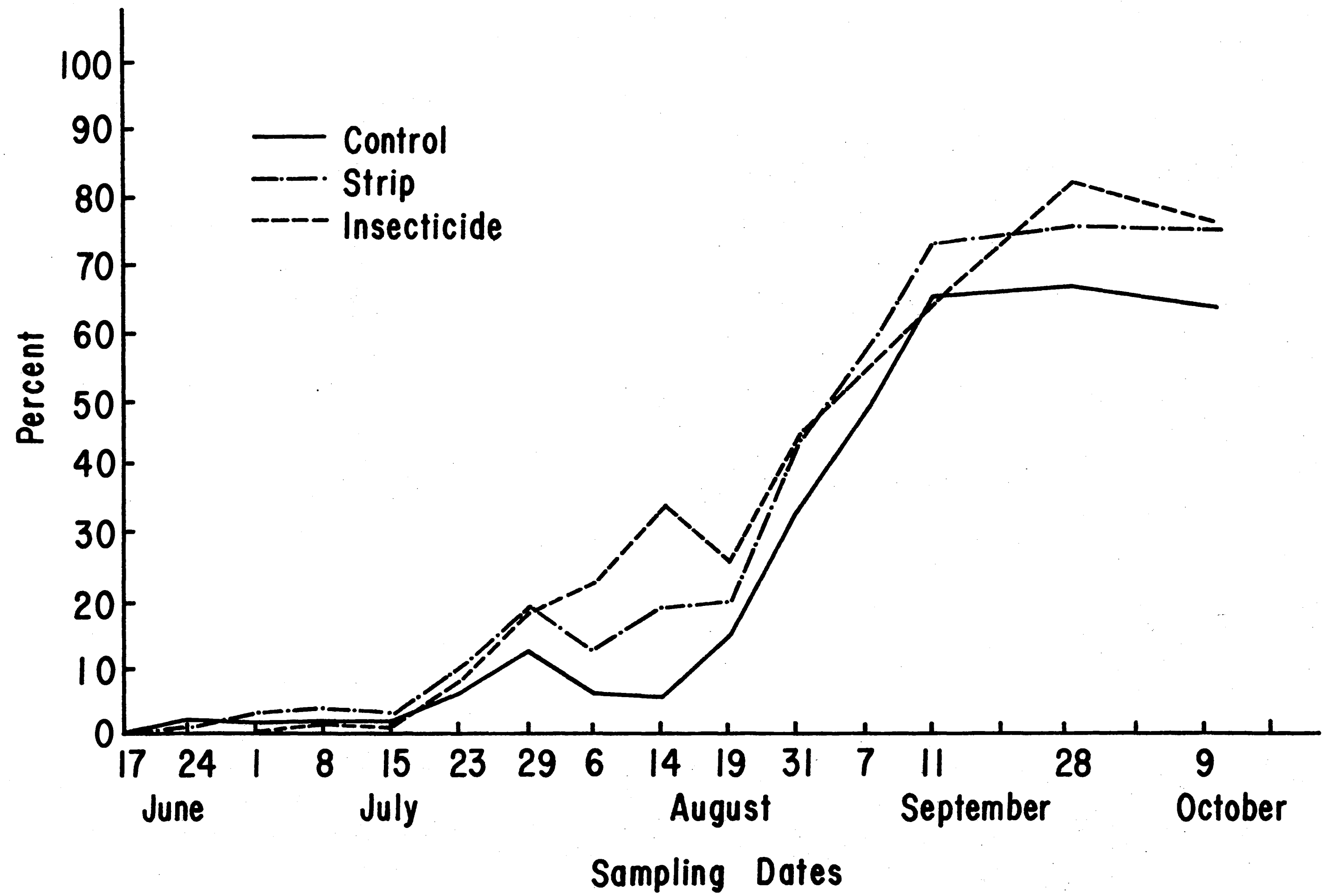

Figure 29. Average Percent Boll Weevil Damaged Fruit per Total Insect Damaged Fruit of Thorpe Cotton by Treatment and Date, Tipton, Oklahoma, 1974

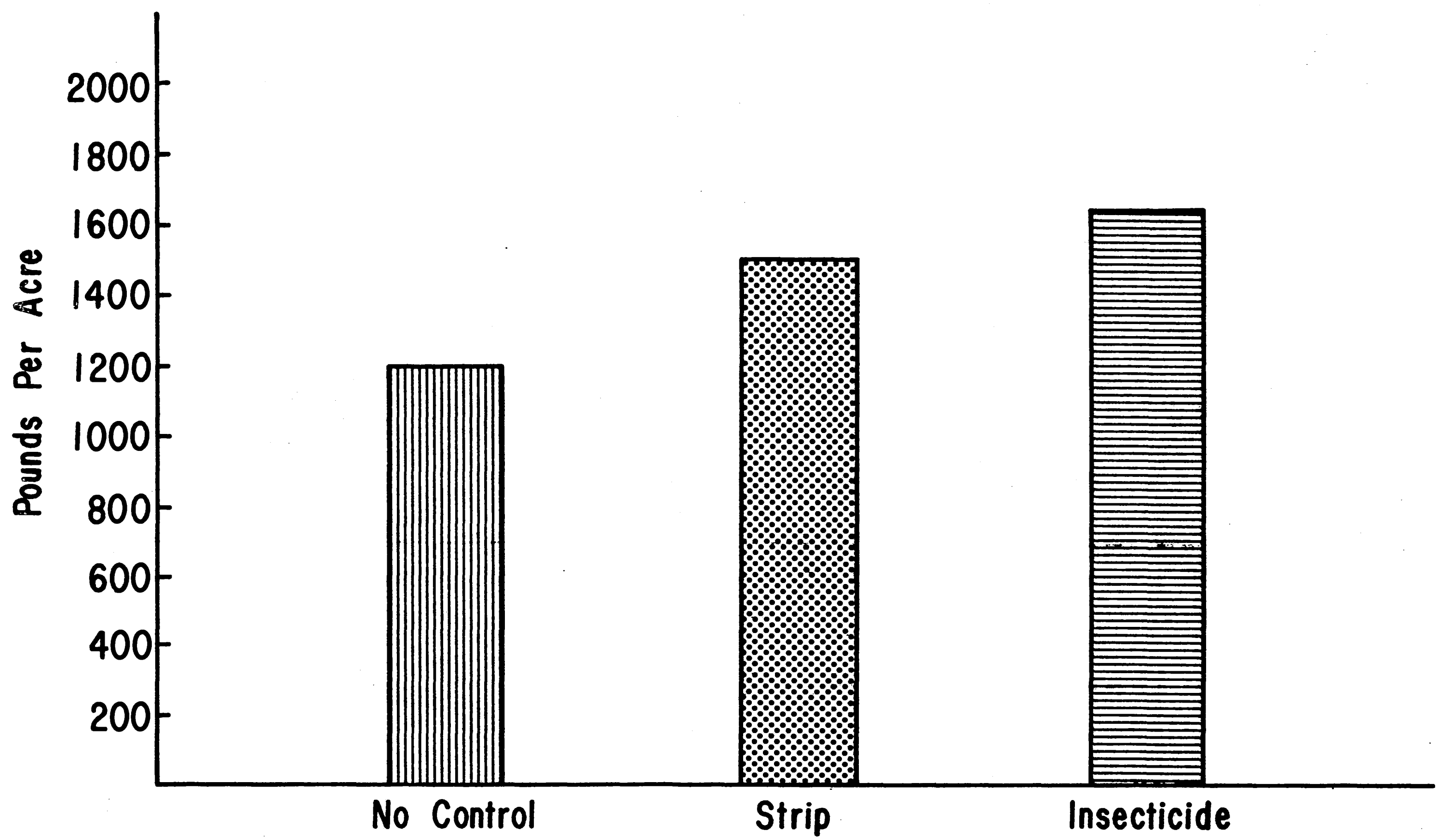

Figure 30. Total Yield of Stripper Cotton in Pounds per Acre of Thorpe Cotton by Treatment, Tipton, Oklahoma, 1974

2

VITA

Donald Ray Molnar

Candidate for the Degree of

Doctor of Philosophy

Thesis: COMPARISON OF THREE METHODS OF TREATMENT ON FRUITING CHARACTERISTICS, PHYSIOLOGICAL SHED, INSECT DAMAGE, YIELD AND QUALITY OF COTTON

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