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I am submitting herewith a thesis written by Bert F. Viar entitled "Influence of Location, Soil Types, and Herbicide Rates on Cotton Response to Fluometuron and Trifluralin." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Plant and Soil Science.

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INFLUENCE OF LOCATION, SOIL TYPES, AND HERBICIDE RATES ON COTTON RESPONSE TO FLUOMETURON AND TRIFLURALIN

A Thesis

Presented for the

Master of Science

Degree

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Bert F. Viar

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ABSTRACT

Weed control in cotton is achieved by using a system of mechanical cultivation and herbicide application. Over the past few years the yield per hectare of cotton has decreased throughout Tennessee. Field studies were conducted during 1977 at Ames Plantation, Jackson, and Milan to determine if the decrease in production has been due to the phytotoxic effects of herbicides currently in use.

The plots were arranged in a split-plot design with four replications at Jackson and three replications at Ames and Milan. The main treatments were trifluralin at 0 and 0.8 kg/ha applied preplant incorporated. The sub-plot treatments were fluometuron at 0, 0.8, 1.1, 1.4, 1.7, and 3.4 kg/ha applied preemergence. All plots were maintained in a weed-free condition by hand-hoeing and mechanical cultivation. Soil types were: Loring silt loam and Memphis silt loam at Ames Plantation; Grenada silt loam, Loring silt loam, and Falaya silt loam at Milan; and Memphis silt loam at Jackson. Data were obtained on cotton seedling fresh and dry weight, stand, maturity date, and yield.

Early herbicide injury, as noted by fresh and dry weight, was later expressed in delayed cotton maturity. A significant reduction in yield occurred on the Memphis silt loam at Ames and Jackson on plots treated with 3.4 kg/ha (2X) rate of fluometuron without trifluralin. Also, yield was reduced by the 3.4 kg/ha (2X) rate of fluometuron both with and without trifluralin on the Loring silt loam at Ames. No significant yield differences were observed at Milan.

Even though some early injury and delay in maturity were noted at some locations, the data from this one-year experiment showed no reduction in cotton yields when recommended rates of the herbicides were used.

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CHAPTER I

INTRODUCTION

Over the past few years the yield per hectare of cotton (Gossypium hirsutum L.) has decreased throughout Tennessee. The decrease in yield may be due to the phytotoxic effects of herbicides currently in use. According to the Tennessee Agricultural Extension Service, trifluralin (a,a,a-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine) and fluometuron [1,1-dimethyl-3-(a,a,a-trifluoro-m-tolyl) urea] are the two most widely used cotton herbicides in Tennessee.

Trifluralin is manufactured and sold as "Treflan" by Elanco Products Co. It selectively controls annual grasses and some annual broadleaf weeds before they become established. Fluometuron is sold under the name of "Cotoran" by Ciba-Geigy Corporation and "Lanex" by Nor-Am Agricultural Products, Inc. Its primary use is to control broadleaf weeds in cotton. Combinations of these two herbicides have been used advantageously by Tennessee cotton growers to control a broad spectrum of weeds.

The use of more than one herbicide in a crop may result in an interaction. Trifluralin, which inhibits lateral root development (21, 26), may affect the uptake of another herbicide on cotton or weeds. The objectives of this experiment were:

1. To evaluate the response of cotton to various rates of fluometuron applied with or without trifluralin.

2. To determine if soil properties have an influence on cotton response to combinations of fluometuron and trifluralin.
3. To determine if various environmental factors such as soil temperature and rainfall may be implicated in cotton response to fluometuron applied with and without trifluralin.

CHAPTER II

LITERATURE REVIEW

I. SOIL PROPERTIES AND ENVIRONMENTAL FACTORS INFLUENCING HERBICIDE ACTIVITY IN SOIL

The water solubility of a soil-applied herbicide greatly influences its efficacy and persistence. It is also a property used in achieving selectivity with certain herbicides. As many weed seeds germinate in the upper soil layer, a slight downward movement of the herbicide is generally desirable. Leaching of the herbicide further through the soil may decrease weed control and damage deep-rooted crops. On the other hand, a herbicide with high water solubility would be used to control deep-rooted weeds in shallow-rooted crops (2). Wiese and Davis (41) traced the movement of two substituted urea herbicides through soil columns. They found that the herbicides moved deeper into prewetted soil than into dry soil. Koren (24) found that trifluralin, which is relatively insoluble in water, did not leach more than a few centimeters in dry soil despite the use of a light soil and large amounts of herbicide. In prewetted soil, trifluralin leached more than twice as deep as in dry soil. Bailey and White (4) reported that herbicides tend to remain in solution when soil moisture is high. Herbicides may crystallize and become unavailable to plants in soils with extremely low moisture.

The intensity and amount of rainfall may influence herbicide activity by leaching herbicides into the soil. Bailey and White (5)

stated that leaching may be deeper with increasing amount and frequency of rainfall, but rains of low intensity tend to leach herbicides further than those of high intensity.

Many researchers (7, 11, 18, 22, 37) have studied the relationship between the soil reaction and herbicide phytotoxicity. In general, herbicidal activity increases as the pH increases. Frissel and Bolt (18) reported that adsorption of herbicides onto clays increased as the pH decreased.

Soil temperature may also affect the behavior of a herbicide by its effect on herbicide solubility (4). Generally, the water solubility of a herbicide increases as the temperature increases.

Extensive work has been done to determine how various soil colloids affect herbicide activity. Soil organic matter is considered to be the most important factor in herbicide adsorption (11, 19, 23, 27, 37, 38). Harris and Warren (22) reported that adsorption onto organic matter may not be a completely reversible process; thereby making a portion of the herbicide become unavailable to plants. The extent to which a herbicide will be adsorbed onto soil colloids is also affected by the cation-exchange capacity and surface area of the colloid. Montmorillonite, vermiculite clays and organic matter have high cation-exchange capacities and large surface areas. Herbicides are readily adsorbed onto these colloids. Illite, kaolinite, and chlorite clays have low cation-exchange capacities and relatively small surface areas. Therefore, they are not considered to be an important factor in herbicide adsorption.

II. TRIFLURALIN

Trifluralin (a,a,a-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine) is a member of the dinitroaniline family of herbicides. In general, they are somewhat volatile, relatively water insoluble, and strongly adsorbed by soil colloids (2). The movement of trifluralin in soil is generally restricted because of these properties. Therefore, in order to provide adequate weed control, trifluralin must be mechanically incorporated into the soil to retard vapor losses. Mechanical incorporation places the herbicides in proximity to adsorptive soil sites (1).

The herbicidal activity of trifluralin may be partly due to its volatile nature. Hegi and Funderbuck (29) found that corn (Zea mays L.) seedlings esposed to trifluralin vapors exhibited typical trifluralin vapors exhibited typical trifluralin injury symptoms. Swann and Behrens (40) also reported on the phytotoxic effects of trifluralin vapors. Foxtail millet [Setaria italica (L.) Beauv. "Empire"] and proso millet [Panicum miliaceum (L.) 'White'] seedlings were grown in containers specially designed to expose either roots or shoots to vapors arising from soil containing trifluralin. They found that shoot exposure to vapors arising from soil treated with trifluralin was lethal to seedlings of both species. Exposing roots to trifluralin vapors resulted in a suppression of root growth, but shoot growth was unaffected.

Parka and Soper (31) reviewed literature pertaining to the physiology and mode of action of the dinitroaniline herbicides. They state that a number of investigators are in agreement that the shoot of

monocots and hypocotyl of dicots are the major sites of uptake for the dinitroaniline herbicides. They also state that available data indicate that the dinitroaniline herbicides are either absorbed or adsorbed by the roots because of their proximity to the herbicide, but translocation within the plant is minimal.

Many researchers have reported that lateral or secondary root development is inhibited by the dinitroaniline herbicides (1, 2, 21, 26). It has also been shown that this inhibition is affected more by the depth of incorporation than by dosage (30). Anderson et al. (1) reported that rates as low as .28 kg/ha completely inhibited lateral root development along the portion of the taproot growing in trifluralin treated soil. Oliver and Frans (30) observed that cotton plants are able to compensate for lateral root growth inhibition. Lateral roots were found to be more abundant below the trifluralin treated layer on treated plants than on untreated plants.

Trifluralin is often used in combination with other herbicides to provide a broader spectrum of weed control. Research has been conducted to determine if an inhibition of lateral root growth could alter the effects of another herbicide. Hamilton and Arle (21) conducted experiments to compare the effects of preplant applications of diuron [3-(3,4-dichloro-phenyl)-1,1-dimethylurea] and diuron-trifluralin temporarily stunted cotton. Trifluralin reduced diuron injury to cotton in two of five years, resulting in better crop stands. Also, the trifluralin-ciuron combinations resulted in a higher average yield of cotton than with the same rates of diuron alone. They concluded that the inhibition

of lateral roots limited the uptake of diuron by the cotton plants. Ladlie et al. (26) observed an interaction between trifluralin and metribuzin [4-amino-6-tert-butyl-3-methyl thio-as-triazin-5(4H) one] and atrazine [2-chloro-4-(ethylamino)-6-isopropylamino)-S-triazine]. They reported that trifluralin protected soybeans [Glycine max (L.) Merr.] from injury by metribuzin or atrazine alone. They also concluded that the reduction in metribuzin and atrazine uptake by the soybean plants was due to the reduction in secondary root development.

The fate of trifluralin in plants and soils has been studied. Probst et al. (32) proposed a degradation pathway for the dinitroaniline herbicides involving dealyklation and reduction reactions. Metabolites of trifluralin were identified by Biswas and Hamilton (8) in peanut and sweet potato.

III. FLUOMETURON

Fluometurol [1,1-dimethyl-3-(a,a,a-trifluoro-m-tolyl) urea] is currently the most widely used cotton herbicide in Tennessee. The popularity of fluometuron is due to its effectiveness as a cotton herbicide, which has been widely reported by researchers in the Cotton Belt (6, 11, 15). This effectiveness is due to the safe margin of selectivity of fluometuron. Generally, cotton is tolerant to fluometuron at rates which effectively control most broadleaf weeds and grasses. Counselman and others (12) found that cotton was tolerant to fluometuron at rates as high as 25.8 kg/ha in certain areas. Pigweed (Amaranthus spp.), lambsquarters (Chenopodium album L.), cocklebur (Xanthium spp.), and

morningglory (Ipomea spp.) were effectively controlled at rates as low as .75 kg/ha.

Much research has been conducted to determine the mechanism of herbicidal action of fluometuron. Inhibition of the Hill reaction of photosynthesis is generally acknowledged as the primary mode of action of the substituted urea herbicides (2). Sikka and Pramer (36) studied the herbicidal properties of fluometuron on the unicellular green algae Chlorella pyrenoidosa (L.), and Euglena gracilis (L.). They reported that fluometuron reduced chlorophyll content in the algae. They suggested that the herbicides may inhibit the light-dependent biochemical reactions required for the synthesis of photosynthetic pigments and organelles. They found that the herbicide did not interfere with respiration or the light-independent reactions that occur along the pathway of chlorophyll or chloroplast biosynthesis. The light-dependent reactions of chlorophyll formation and the evolution of oxygen, or Hill reaction, were inhibited by the herbicide.

Rubin and Eshel (35) studied the absorption and translocation of fluometuron in cotton, a tolerant species, and snapbean (Phaseolus vulgaris L.), a susceptible species. They found that the uptake of fluometuron by intact cotton and snapbean plants from nutrient solution was not significantly different after 24 hours. Radioautograms showed that the herbicide translocated very rapidly in intact plants of both species in an acropetal direction with the transpiration stream. They concluded that differential absorption and translocation of root-applied fluorometuron did not appear to be important factors in the differential

phytotoxic response between species. They also reported an accumulation of fluometuron in the lysigenous glands of cotton stems and leaves. Some researchers have suggested that this accumulation may impart tolerance in cotton (33).

Fluometuron metabolism in tolerant cotton and susceptible cucumber (Cucumis sativus) was studied by Rogers and Funderbuck (33). They found that cotton tolerance may be due to degradation of fluometuron into four relatively nonphytotoxic metabolities, whereas, susceptible cucumber degraded fluometuron into only two metabolities. The major pathway of fluometuron breakdown was considered to be a stepwise demethylation process. They also found that both roots and shoots of cotton are able to demethylate fluometuron, but that the shoots are more active (34).

Although the primary site of action of fluometuron appears to be located in or near the oxygen evolving step of photosynthesis in susceptible species, differential uptake by the roots as a result of depth protection may impart partial tolerance in cotton (16). Selectivity due to depth protection is dependent on the behavior of the herbicide in soils. Bailey et al. (3) suggested that the extent of adsorption in soils is highly correlated with the degree of water solubility of the herbicide. Other researchers (15, 25, 28) have proposed a relationship between soil organic matter and urea herbicide inactivation. Wiese et al. (42) found that fluometuron injury to cotton was inversely related to soil organic matter content. Grover (20) reported that urea herbicides were readily desorbed by water from soils with low to medium organic matter, but not from soils high in organic matter.

Davidson and Santleman (13) traced the movement of fluometuron through saturated glass beads and soil. They found that fluometuron was not greatly adsorbed by soil and had a relatively high diffusion coefficient. These two properties allow fluometuron to move relatively free in soils. Fickle and Smith (17) indicated that fluometuron movement through soils is also related to rainfall. They found only 35 percent of the applied fluometuron remaining in the upper 5 cm of soil following 5.6 cm of rainfall.

Bozarth and Funderbuck (9) studied the degradation of fluometuron in soil. They concluded that degradation was a function of microbial metabolism since fluometuron was not degraded in sterile soil.

CHAPTER III

METHODS AND MATERIALS

This study was conducted on three soil types at the Milan Field Station (Milan); one at the West Tennessee Experiment Station (Jackson), and two at the Ames Plantation (Ames) near Grand Junction, Tennessee. The three soil types used at Milan were Falaya, Grenada, and Loring silt loams. Memphis silt loam was used at Jackson, and Memphis and Loring silt loam were used at Ames. All sites were suitable for cotton production. Prior to seedbed preparation, the soils of all areas were sampled and fertilizer was applied according to soil test. At Milan, all plot areas received 67 kg/ha N, 67 kg/ha P_2O_5, 67 kg/ha K_2O, and 0.6 kg/ha B. At Ames, the plots were fertilized with 448 kg/ha of 15-15-15, and at Jackson, with 336 kg/ha of 10-22-20+15. All fertilizers were applied broadcast.

The experimental design was a split-plot, with two main treatments and six sub-treatments. The main treatments consisted of no trifluralin and trifluralin applied at 0.8 kg/ha preplant incorporated. Sub-plots within each main treatment consisted of six rates of fluometuron. These rates were 0, 0.8, 1.1, 1.4, 1.7, and 3.4 kg/ha applied preemergence broadcast. This experiment was replicated four times at Jackson, with each sub-plot consisting of four rows 96 cm apart and 9 m long. At Milan and Ames, all experiments were replicated three times, with each sub-plot consisting of four 9 m rows, 102 cm apart. Replications were separated by 3 m alleys at each location.

Plots were prepared for planting by recommended tillage operations. Trifluralin was incorporated by a double disking to a depth of approximately 10 cm. This was followed by a smoothing and firming operation. The plots were maintained weed-free after planting by using a combination of handhoeing and mechanical cultivation.

Experiments at Milan were planted on May 2, at Jackson on April 26, and at Ames on May 10. "Hancock" cotton from a single seed lot was used at all locations.

Approximately four weeks after cotton emergence, the number of live plants per 3 meters of the two center rows of each plot was recorded. Twenty seedlings from the outside rows of each plot were cut off at the soil surface and placed in air-tight bags until they could be weighed. Fresh weights and oven-dry weights were recorded.

Cotton was handpicked when approximately 10 to 20 percent of the bolls in the untreated plots were open. Data were obtained from the entire 9 m of the second row of each plot at Jackson, and from the center 3 m of the second row of each plot at Milan and Ames. Later in the season, cotton was harvested twice with a spindle picker at all locations. These yield data were collected from the entire 9 m of the two middle rows of each plot.

Soil temperatures were recorded twice daily (8:00 a.m. and 4:00 p.m.) at a 5 cm depth for the first three weeks after planting at Milan and Jackson. Maximum and minimum daily temperatures at a 10 cm depth were recorded for the first three weeks after planting at Ames.

Rainfall data for each location were obtained from the weather station at each experiment station.

CHAPTER IV

RESULTS AND DISCUSSION

I. WEST TENNESSEE EXPERIMENT STATION (JACKSON)

Memphis Silt Loam

No difference in the survival rate of cotton seedlings existed between the trifluralin main treatments (Table 1). The number of live plants found when treatments were averaged across the main treatments was significantly reduced by the 1.7 and 3.4 kg/ha of fluometuron, with the 3.4 kg/ha rate causing the greatest reduction. The interaction between the fluometuron and trifluralin treatments was significant because cotton treated with 3.4 kg/ha of fluometuron alone showed more reduction in stand than that treated with 3.4 kg/ha of fluometuron with trifluralin.

Trifluralin reduced the fresh and dry weights of cotton seedling (Tables 2 and 3). When averaged across the trifluralin main treatments, the high rates of fluometuron reduced seedling fresh and dry weights. The 1.7 kg/ha rate of fluometuron reduced seedling fresh and dry weights more than the 1.4 kg/ha rate did. The 3.4 kg/ha rate of fluometuron resulted in the greatest reduction in fresh and dry weights. The trifluralin × fluometuron interaction also affected seedling weights. Cotton treated with 0, 0.8, and 1.4 kg/ha of fluometuron in combination with trifluralin showed a significant reduction in seedling fresh weight compared to cotton treated with the same rates of fluometuron alone.

Table 1. Effect of Trifluralin and Fluometuron Rates on the Survival of Cotton, Memphis Silt Loam, West Tennessee Experiment Station, Jackson, Tennessee, 1977

Fluometuron	Trifluralin kg/ha		
	0	0.8	$\bar{X}$
kg/ha	----Live Plants per 6.1 m row ------		
0.0	61 bcd*	59 cde	60 x
0.8	55 def	64 abc	59 x
1.1	68 ab	60 cd	64 x
1.4	72 a	65 abc	68 x
1.7	48 f	51 ef	50 y
3.4	24 h	38 g	31 z
	55 s	56 s	$\bar{X}$

*Values for treatments and averages followed by the same letter within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 2. Effect of Trifluralin and Fluometuron Rates on the Seedling Fresh Weight of Cotton, Memphis Silt Loam, West Tennessee Experiment Station, Jackson, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------g/20 plants----------		
0.0	108.9 bc*	79.0 ef	93.9 xy
0.8	130.8 a	79.4 ef	105.1 wx
1.1	107.3 bcd	86.7 def	97.0 wxy
1.4	125.5 ab	99.1 cde	112.3 w
1.7	90.4 cdef	73.2 fg	81.8 y
3.4	51.2 h	57.7 gh	54.4 z
	102.4 s	79.2 t	$\bar{X}$

*Values for treatments and averages followed by the same letter within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 3. Effect of Trifluralin and Fluometuron Rates on the Seedling Dry Weight of Cotton, Memphis Silt Loam, West Tennessee Experiment Station, Jackson, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------g/20 plants----------		
0.0	27.9 abc*	22.3 de	25.1 x
0.8	31.2 a	22.6 de	26.9 x
1.1	27.5 bc	23.0 de	25.2 x
1.4	29.7 ab	25.9 cd	27.8 x
1.7	23.3 de	21.6 ef	22.4 y
2.4	17.1 g	18.4 fg	17.8 z
	26.1 s	22.3 t	$\bar{X}$

*Values for treatments and averages followed by the same letter within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Trifluralin delayed cotton maturity, as determined by a handpicking on July 12 (Table 4). When yields were averaged across the main treatments, fluometuron at 3.4 kg/ha reduced yield compared to the check plot. No differences existed among other fluometuron treatments. Cotton treated with 0 and 0.8 kg/ha of fluometuron in combination with trifluralin showed a significant reduction in yield compared to the same rates of fluometuron alone. Cotton treated with 1.1, 1.4, 1.7 and 3.4 kg/ha of fluometuron alone showed no difference in maturity over the same rates of fluometuron with trifluralin.

Trifluralin did not affect the yield of the first machine picking (Table 5). The 3.4 kg/ha rate was the only rate of fluometuron to reduce yields, either with or without trifluralin. The trifluralin fluometuron-interaction affected cotton yield. The 3.4 kg/ha rate of fluometuron alone yielded significantly less than the same rate of fluometuron with trifluralin.

Trifluralin did not affect the yield obtained by the second machine picking (Table 6). The 3.4 kg/ha rate of fluometuron both with and without trifluralin resulted in the highest cotton yield. There was also a slight trifluralin × fluometuron interaction. The 0.8 kg/ha rate of fluometuron alone reduced cotton yield compared to the same rate of fluometuron with trifluralin.

Trifluralin did not affect the total yield of cotton (Table 7). The 3.4 kg/ha rate of fluometuron was the only rate to reduce yield, when averaged across main treatments. A strong trifluralin × fluometuron interaction occurred. The 3.4 kg/ha rate of fluometuron alone

Table 4. Effect of Trifluralin and Fluometuron Rates on the Yield of Handpicked Seed Cotton, Memphis Silt Loam, West Tennessee Experiment Station, Jackson, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	619 a*	216 cd	418 y
0.8	544 ab	198 cd	371 yz
1.1	425 abc	256 cd	340 yz
1.4	324 bc	347 abc	336 yz
1.7	145 cd	137 cd	141 yz
3.4	10 d	159 cd	84 z
	344 s	219 t	$\bar{X}$

*Values for treatments and averages followed by the same letter within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 5. Effect of Trifluralin and Fluometuron Rates on the Yield of Seed Cotton from the First Machine Picking, Memphis Silt Loam, West Tennessee Experiment Station, Jackson, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	2516 a*	2587 a	2552 y
0.8	2850 a	2362 ab	2606 y
1.1	2632 a	2612 a	2622 y
1.4	2702 a	2715 a	2708 y
1.7	2459 ab	2606 a	2532 y
3.4	847 c	2002 b	1425 z
	2334 s	2481 s	$\bar{X}$

*Values for treatments and averages followed by the same letter within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 6. Effect of Trifluralin and Fluometuron Rates on the Yield of Seed Cotton from the Second Machine Picking, Memphis Silt Loam, West Tennessee Experiment Station, Jackson, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	481 d*	533 bcd	507 z
0.8	456 d	719 b	588 xy
1.1	590 bcd	616 bcd	603 xy
1.4	597 bcd	514 cd	556 xy
1.7	725 b	699 bc	712 y
3.4	962 a	1020 a	991 x
	635 s	684 s	$\bar{X}$

*Values for treatments and averages followed by the same letter within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 7. Effect of Trifluralin and Fluometuron Rates on the Total Yield of Seed Cotton, Memphis Silt Loam, West Tennessee Experiment Station, Jackson, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	2617 ab*	3335 ab	3476 x
0.8	3850 a	3279 ab	3564 x
1.1	3647 ab	3486 ab	3566 x
1.4	3623 ab	3576 ab	3600 x
1.7	3329 ab	3443 ab	3386 x
3.4	1820 c	3182 b	2501 y
	3314 s	3384 s	$\bar{X}$

*Values for treatments and averages followed by the same letter within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

significantly reduced cotton yield compared to the same rate of fluometuron with trifluralin.

The recommended rates for trifluralin and fluometuron on Memphis silt loam are 0.8 and 1.7 kg/ha, respectively. This soil had the lowest percentage of organic matter (0.65 percent) of the West Tennessee soils studied and was also low in clay content (11 percent). Apparently, rainfall was sufficient to cause leaching of fluometuron into the root zone. Organic matter and clay content of this soil were high enough to prevent injury to cotton with recommended rates. Injury and yield reduction resulting from the 3.4 kg/ha rate of fluometuron may be attributed to the saturation of binding sites in the soil, making the herbicide available to the cotton plants. In general, plants treated with trifluralin showed less response to fluometuron than cotton grown in the same rates of fluometuron alone. The inhibition of lateral root development is characteristic of trifluralin. With such root inhibition, less fluometuron would be taken up by the cotton plants.

II. AMES PLANTATION

Memphis Silt Loam

Trifluralin did not reduce seedling fresh or dry weights (Tables 8 and 9). Rates of 1.7 kg/ha of fluometuron and less had no affect on seedling fresh weight. The 3.4 kg/ha rate of fluometuron reduced seedling fresh weight when compared to the check plot. The "F" value for interaction between trifluralin and fluometuron was not significant, but Duncan's Multiple Range Test showed a difference between means of

Table 8. Effect of Trifluralin and Fluometuron Rates on the Seedling Fresh Weight of Cotton, Memphis Silt Loam, Ames Plantation, Grand Junction, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------g/20 plants----------		
0.0	150.3 a*	148.7 a	149.5 x
0.8	124.9 a	134.7 a	129.8 x
1.1	112.7 a	138.2 a	125.4 x
1.4	149.6 a	138.3 a	144.0 x
1.7	143.8 a	117.0 a	130.4 xy
3.4	67.1 b	119.6 a	93.4 y
	124.7 s	132.8 s	$\bar{X}$

*Values for treatments and averages followed by the same letter within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 9. Effect of Trifluralin and Fluometuron Rates on the Seedling Dry Weight of Cotton, Memphis Silt Loam, Ames Plantation, Grand Junction, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------g/20 plants----------		
0.0	30.7 a*	30.7 a	30.7 x
0.8	28.0 a	28.8 a	28.4 xy
1.1	25.1 a	28.9 a	27.0 xy
1.4	31.0 a	29.1 a	30.0 x
1.7	29.9 a	26.0 a	28.0 xy
3.4	19.0 b	26.6 a	22.8 y
	27.3 s	28.4 s	$\bar{X}$

*Values for treatments and averages followed by the same letter within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

the fresh and dry weights for seedlings. The weight of cotton seedlings treated with 3.4 kg/ha fluometuron alone was significantly less than that of cotton seedlings treated with the same rate of fluometuron in combination with trifluralin.

Trifluralin had no affect on cotton maturity, as determined by a hand picking on September 15 (Table 10). Maturity was slightly delayed by the 3.4 kg/ha rate of fluometuron. No interaction of trifluralin and fluometuron was observed.

No differences existed in yield between the trifluralin main treatments at the time of the first machine picking (Table 11). The higher rates of fluometuron reduced yield. Again, no interaction of trifluralin and fluometuron was observed. No rate of trifluralin or fluometuron, either alone or in combination, was found to decrease cotton yield by the second machine picking (Table 12).

Total cotton yield was not affected by trifluralin (Table 13). The 1.7 kg/ha rate of fluometuron did not reduce cotton yield, while the 3.4 kg/ha rate did. No interaction of the herbicides occurred.

The recommended rates of fluometuron and trifluralin on Memphis silt loam are 1.7 and 0.8 kg/ha, respectively. No decrease in vigor, delay in maturity, or reduction in yield was observed within recommended rates. In comparison to the other soils studied, this soil had a relatively high percentage of organic matter (.97 percent) and clay content (17 percent). Seedling vigor reduction, as expressed by fresh and dry weights, caused by the high rate of fluometuron without trifluralin, was probably due to more fluometuron being taken up by the cotton plant. As the

Table 10. Effect of Trifluralin and Fluometuron Rates on the Yield of Handpicked Seed Cotton, Memphis Silt Loam, Ames Plantation, Grand Junction, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	960**	1186	1073 xy*
0.8	832	1401	1116 xy
1.1	1248	1381	1314 x
1.4	1145	698	922 xy
1.7	858	1386	1122 xy
3.4	318	575	446 y
	894 s	1104 s	$\bar{X}$

*Values for treatments and averages followed by the same letter within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

**No significant differences due to trifluralin-fluometuron interactions exist within these columns.

Table 11. Effect of Trifluralin and Fluometuron Rates on the Yield of Seed Cotton from the First Machine Picking, Memphis Silt Loam, Ames Plantation, Grand Junction, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	3364**	3518	3441 x*
0.8	3158	3629	3394 x
1.1	3398	3209	3304 xy
1.4	3124	3398	3261 xy
1.7	2662	3278	2970 xy
3.4	2379	3004	2692 y
	3014 s	3339 s	$\bar{X}$

*Values for treatments and averages followed by the same letter within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

**No significant differences due to trifluralin-fluometuron interactions exist between means in these columns.

Table 12. Effect of Trifluralin and Fluometuron Rates on the Yield of Seed Cotton from the Second Machine Picking, Memphis Silt Loam, Ames Plantation, Grand Junction, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	368*	428	398
0.8	522	496	509
1.1	496	471	484
1.4	479	471	475
1.7	539	488	514
3.4	565	479	522
	495	472	$\bar{X}$

*No significant differences exist within either columns or rows at the 5 percent level by Duncan's Multiple Range Test.

Table 13. Effect of Trifluralin and Fluometuron Rates on the Total Yield of Seed Cotton, Memphis Silt Loam, Ames Plantation, Grand Junction, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	4692**	5132**	4912 x*
0.8	4512	5527	5020 x
1.1	5142	5061	5102 x
1.4	4749	4567	4658 xy
1.7	4059	5152	4606 xy
3.4	3262	4059	3661 y
	4403 x	4916 s	$\bar{X}$

*Values for treatments and averages followed by the same letter within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

**No significant differences due to trifluralin-fluometuron interactions exist within these columns.

taproot grew out of the trifluralin-treated zone, normal root development could resume. This delay in vigor expressed by the trifluralin × fluometuron interaction was not observed as a delay in maturity or reduction in yield.

Loring Silt Loam

No rate of trifluralin or fluometuron reduced seedling fresh (Table 14) or dry weights (Table 15). The "F" value for interaction between trifluralin × fluometuron was significant, but Duncan's Multiple Range Test showed no difference between means of the fresh and dry weights for seedlings. When averaged across fluometuron rates, trifluralin did not delay cotton maturity, as determined by a handpicking on September 14 (Table 16), but significantly less cotton was handpicked from the trifluralin check than from the no herbicide-weed free check. When averaged across main treatments, the high rates of fluometuron were found to delay cotton maturity.

Trifluralin did not affect yield at the time of the first machine picking (Table 17). The 3.4 kg/ha rate of fluometuron, when averaged across main treatments, was found to reduce cotton yield. No significant difference existed due to a fluometuron × trifluralin interaction. No differences due to any treatment existed at the time of the second picking (Table 18).

Total yield was not affected by trifluralin (Table 19). Fluometuron at 3.4 kg/ha was the only treatment found to reduce cotton yield. Cotton did not respond to a trifluralin × fluometuron interaction.

Table 14. Effect of Trifluralin and Fluometuron Rates on the Seedling Fresh Weight of Cotton, Loring Silt Loam, Ames Plantation, Grand Junction, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------g/20 plants----------		
0.0	65.7*	44.8	55.2
0.8	59.5	61.8	60.6
1.1	72.1	57.7	64.9
1.4	65.2	54.6	60.0
1.7	61.2	58.9	60.0
3.4	64.5	42.9	53.7
	64.7	53.4	$\bar{X}$

*No significant differences exist within either columns or rows at the 5 percent level by Duncan's Multiple Range Test.

Table 15. Effect of Trifluralin and Fluometuron Rates on the Seedling Dry Weight of Cotton, Loring Silt Loam, Ames Plantation, Grand Junction, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------g/20 plants----------		
0.0	21.2*	17.4	19.3
0.8	19.9	20.3	20.1
1.1	21.9	19.5	20.7
1.4	20.9	18.9	19.9
1.7	20.6	19.6	20.1
3.4	22.3	17.3	19.8
	21.1	18.8	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 16. Effect of Trifluralin and Fluometuron Rates on the Yield of Handpicked Seed Cotton, Loring Silt Loam, Ames Plantation, Grand Junction, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----		------
0.0	487 a*	82 d	284 x*
0.8	370 ab	215 bcd	292 x
1.1	200 bcd	329 abc	264 x
1.4	164 cd	185 bcd	174 xy
1.7	123 d	164 cd	144 xy
3.4	20 d	108 d	64 y
	227 s*	180 s	$\bar{X}$

*Values for treatments and averages followed by the same letter within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 17. Effect of Trifluralin and Fluometuron Rates on the Yield of Seed Cotton from the First Machine Picking, Loring Silt Loam, Ames Plantation, Grand Junction, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	1626**	1412**	1519 x*
0.8	1720	1729	1724 x
1.1	1549	1558	1554 x
1.4	1420	1284	1352 x
1.7	1327	1464	1396 x
3.4	514	770	642 y
	1359 s	1369 s	$\bar{X}$

*Values for treatments and averages followed by the same letter within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

**No significant differences due to trifluralin-fluometuron interaction exist within these columns.

Table 18. Effect of Trifluralin and Fluometuron Rates on Yield of Seed Cotton from the Second Machine Picking, Loring Silt Loam, Ames Plantation, Grand Junction, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	805*	907	856
0.8	882	1034	958
1.1	959	1053	1006
1.4	1173	1138	1156
1.7	1070	1061	1066
3.4	890	984	937
	963	1030	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 19. Effect of Trifluralin and Fluometuron Rates on the Total Yield of Seed Cotton, Loring Silt Loam, Ames Plantation, Grand Junction, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	2919**	2402**	2660 x*
0.8	2972	2980	2976 x
1.1	2708	2939	2824 x
1.4	2758	2607	2672 x
1.7	2519	2689	2604 x
3.4	1424	1862	1643 y
	2550 s	2580 s	$\bar{X}$

*Values for treatments and averages followed by the same letter within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

**No significant difference due to trifluralin-fluometuron interaction exist within these columns.

Trifluralin is recommended at 0.8 kg/ha and fluometuron at 1.7 kg/ha on Loring silt loam. Cotton did not respond to herbicide treatments within recommended rates. Rainfall was sufficient to leach fluometuron into the crop root zone. This soil had an intermediate percentage of organic matter and clay compared to the other West Tennessee soils studied. Apparently, soil colloidal content was high enough to bind the trifluralin to a degree that cotton lateral root growth was not significantly affected. Thus, no trifluralin × fluometuron interaction was evident.

Loring, Grenada, and Falaya Silt Loams

No difference in any parameter measured was found between any rate of trifluralin, fluometuron, or both (Tables 20-40).

The recommended rates of trifluralin and fluometuron are 0.8 and 1.7 kg/ha, respectively. The physical characteristics of these soils were very similar to those of the other soils studied. The amount of rainfall was also similar. The soil temperatures at this location were slightly higher for the first 21 days after emergence. Cotton seedlings are very sensitive to temperature, so the slight elevation in temperature may have allowed cotton roots to grow out of the herbicide layer in the soil.

Table 41 shows the properties of all the soils studied at each location during the planting and harvesting period.

Table 20. Effect of Trifluralin and Fluometuron Rates on the Survival of Cotton, Loring Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----Live Plants per 6.1 m row-----		
0.0	36*	40	38
0.8	34	41	38
1.1	37	37	37
1.4	42	40	41
1.7	42	35	38
3.4	41	41	41
	39	39	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 21. Effect of Trifluralin and Fluometuron Rates on the Seedling Fresh Weight of Cotton, Loring Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------g/20 plants----------		
0.0	44.5*	47.7	46.1
0.8	36.8	35.5	36.2
1.1	43.9	44.9	44.4
1.4	47.5	41.0	44.2
1.7	37.3	43.9	40.6
3.4	38.5	46.0	42.2
	41.4	43.2	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 22. Effect of Trifluralin and Fluometuron Rates on the Seedling Dry Weight of Cotton, Loring Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------g/20 plants----------		
0.0	17.1*	16.7	16.9
0.8	16.3	15.1	15.7
1.1	16.3	16.5	16.4
1.4	16.9	16.2	16.6
1.7	15.3	16.6	16.0
3.4	15.6	16.9	16.2
	16.2	16.3	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 23. Effect of Trifluralin and Fluometuron Rates on the Yield of Handpicked Seed Cotton, Loring Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	570*	478	524
0.8	806	981	894
1.1	473	288	380
1.4	734	837	786
1.7	318	539	428
3.4	657	498	578
	593	604	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 24. Effect of Trifluralin and Fluometuron Rates on the Yield of Seed Cotton from the First Machine Picking, Loring Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	2003*	2482	2242
0.8	2431	2576	2504
1.1	1917	2294	2106
1.4	2225	2251	2238
1.7	2131	2268	2200
3.4	2337	2251	2294
	2174	2354	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 25. Effect of Trifluralin and Fluometuron Rates on the Yield of Seed Cotton from the Second Machine Picking, Loring Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	257*	265	261
0.8	265	197	231
1.1	377	317	347
1.4	291	299	295
1.7	274	342	308
3.4	299	316	308
	294	289	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 26. Effect of Trifluralin and Fluometuron Rates on the Total Yield of Seed Cotton, Loring Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	2830*	3225	3028
0.8	3502	3754	3628
1.1	2767	2899	2833
1.4	3250	3381	3316
1.7	2723	3149	2936
3.4	3293	3065	3179
	3060	3246	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 27. Effect of Trifluralin and Fluometuron Rates on the Survival of Cotton, Grenada Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	-----Live plants per 6.1 m row----		
0.0	42*	31	36
0.8	35	34	34
1.1	40	35	38
1.4	36	40	38
1.7	36	41	38
3.4	32	40	36
	37	37	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 28. Effect of Trifluralin and Fluometuron Rates on the Seedling Fresh Weight of Cotton, Grenada Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------g/20 plants----------		
0.0	33.6*	37.8	35.7
0.8	28.8	28.5	28.6
1.1	29.9	33.8	31.8
1.4	28.0	25.5	26.8
1.7	26.5	32.6	29.6
3.4	29.3	30.4	29.8
	29.4	31.4	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 29. Effect of Trifluralin and Fluometuron Rates on the Seedling Dry Weight of Cotton, Grenada Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------g/20 plants----------		
0.0	14.4*	15.3	14.8
0.8	13.8	13.7	13.8
1.1	14.1	14.4	14.2
1.4	13.3	13.8	13.6
1.7	13.7	14.3	14.0
3.4	14.6	13.7	14.2
	14.0	14.2	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 30. Effect of Trifluralin and Fluometuron Rates on the Yield of Handpicked Seed Cotton, Grenada Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	503*	724	614
0.8	375	210	292
1.1	447	472	460
1.4	365	411	388
1.7	154	421	288
3.4	154	431	292
	333	445	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 31. Effect of Trifluralin and Fluometuron Rates on the Yield of Seed Cotton from the First Machine Picking, Grenada Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	2405*	2474	2440
0.8	2114	1849	1982
1.1	2542	2302	2422
1.4	2285	2131	2208
1.7	1695	2183	1939
3.4	1738	2234	1986
	2130	2196	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 32. Effect of Trifluralin and Fluometuron Rates on the Yield of Seed Cotton from the Second Machine Picking, Grenada Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	436*	454	445
0.8	573	530	552
1.1	531	488	510
1.4	479	556	518
1.7	471	368	420
3.4	471	514	492
	494	485	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 33. Effect of Trifluralin and Fluometuron Rates on the Total Yield of Seed Cotton, Grenada Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	3344*	3652	3498
0.8	3062	2589	2826
1.1	3520	3262	3391
1.4	3129	3098	3114
1.7	2320	2972	2646
3.4	2363	3179	2771
	2956	3125	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 34. Effect of Trifluralin and Fluometuron Rates on the Survival of Cotton, Falaya Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	-----Live Plants per 6.1 m row-----		
0.0	43*	40	42
0.8	35	36	35
1.1	29	32	30
1.4	34	42	38
1.7	30	37	34
3.4	35	34	34
	34	37	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 35. Effect of Trifluralin and Fluometuron Rates on the Seedling Fresh Weight of Cotton, Falaya Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------g/20 plants----------		
0.0	49.0*	42.4	45.7
0.8	41.5	46.9	44.2
1.1	48.4	32.3	40.4
1.4	45.9	44.0	45.0
1.7	53.4	42.0	47.7
3.4	43.3	36.8	40.0
	46.9	40.8	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 36. Effect of Trifluralin and Fluometuron Rates on the Seedling Dry Weight of Cotton, Falaya Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------g/20 plants----------		
0.0	16.8*	16.0	16.4
0.8	15.4	16.4	15.9
1.1	16.9	15.4	16.2
1.4	16.4	16.6	16.5
1.7	17.3	15.7	16.5
3.4	16.2	15.3	15.8
	16.5	15.9	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 37. Effect of Trifluralin and Fluometuron Rates on the Yield of Handpicked Seed Cotton, Falaya Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	1001*	600	800
0.8	1263	611	937
1.1	570	308	439
1.4	770	688	729
1.7	991	580	786
3.4	991	626	808
			$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 38. Effect of Trifluralin and Fluometuron Rates on the Yield of Seed Cotton from the First Machine Picking, Falaya Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	2542*	2551	2546
0.8	2277	2191	2234
1.1	2388	2285	2336
1.4	2260	2183	2222
1.7	2559	2191	2375
3.4	2414	2431	2422
	2407	2305	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 39. Effect of Trifluralin and Fluometuron Rates on the Yield of Seed Cotton from the Second Machine Picking, Falaya Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	779*	830	804
0.8	830	838	834
1.1	710	959	834
1.4	907	736	822
1.7	685	710	698
3.4	642	864	753
	759	822	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 40. Effect of Trifluralin and Fluometuron Rates on the Total Yield of Seed Cotton, Falaya Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Fluometuron	Trifluralin kg/ha 0	0.8	$\bar{X}$
kg/ha	----------Yield, kg/ha----------		
0.0	4322*	3981	4152
0.8	4370	3640	4005
1.1	3668	3552	3610
1.4	3937	3607	3772
1.7	4235	3481	3858
3.4	4047	3921	3984
	4096	3697	$\bar{X}$

*Values for treatments and averages within either columns or rows are not significantly different at the 5 percent level by Duncan's Multiple Range Test.

Table 41. Analysis of Selected West Tennessee Soils

Item	Soil Properties					
	Jackson	Ames		Milan		
	Memphis Silt Loam	Loring Silt Loam	Memphis Silt Loam	Grenada Silt Loam	Loring Silt Loam	Falaya Silt Loam
pH	5.9	5.9	5.9	6.0	5.9	5.8
% OM	.65	.75	.97	.87	.74	1.09
Texture						
% sand	29.0	24.8	17.5	8.5	34.3	21.0
% silt	60.0	60.2	65.5	66.0	56.2	67.0
% clay	11.0	15.0	17.0	25.5	9.5	12.0

CHAPTER V

SUMMARY AND CONCLUSIONS

This research was carried on to:

1. Evaluate the response of cotton to various rates of fluometuron applied with or without trifluralin.
2. Determine if soil properties have an influence on cotton response to combinations of fluometuron and trifluralin.
3. Determine if various environmental factors such as soil temperature and rainfall may be implicated in cotton response to fluometuron applied with and without trifluralin.

The research was conducted in the summer of 1977 at the West Tennessee Experiment Station, Jackson, Tennessee; at the Ames Plantation, Grand Junction, Tennessee; and at the Milan Field Station, Milan, Tennessee. Soil types were: Memphis silt loam at Jackson; Loring silt loam and Memphis silt loam at Ames Plantation; Grenada silt loam, Loring silt loam, and Falaya silt loam at Milan. Trifluralin was applied at two rates as a preplant incorporated treatment, and fluometuron was applied at six rates as a preemergence surface application.

Indications of cotton response to the various herbicide treatments were obtained by recording data on various crop parameters such as seedling fresh and dry weights, stand, maturity date, and yield.

At Jackson and Ames, data generally indicated that cotton response to fluometuron alone was significantly greater than the same rates of fluometuron in combination with trifluralin. Inhibition of secondary

root development in the trifluralin-treated layer of soil probably decreased the amount of fluometuron taken up by the cotton plants.

At Milan, cotton did not respond to any herbicide treatment. This was probably because of a more favorable environmental condition for vigorous seedling growth.

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APPENDIX

Table A-1. Rainfall Data for April-August of 1977, West Tennessee Experiment Station, Jackson, Tennessee

Date	Month				
	April	May	June	July	August
	inches				
1					
2	.05				
3	.90	.85	.10		
4	1.25	.43			
5	.50				
6	.01				
7					
8					
9				1.38	
10				.63	
11				.89	
12					
13					
14			.30		.11
15					.65
16					.70
17					.20
18			.04		.26
19					
20			.93	.20	
21	.10		.05		
22	.52			.10	
23	.14		.52	.02	
24	.67				
25	.14	.07		.05	
26	*	.05	.23	T	
27			1.37		
28					
29	.37			.13	.15
30	.02	.04			
31		1.10			
Monthly Total	4.67	2.54	3.54	3.40	2.89

*cotton planted

Table A-2. Rainfall Data for April-August of 1977, Milan Field Station, Milan, Tennessee

Date	Month				
	April	May	June	July	August
	----------inches----------				
1					
2		*	.44		
3		1.15			
4		.70			
5					
6					
7					.96
8					
9				.64	
10				.67	
11				.58	
12					
13					1.30
14					1.05
15					.50
16					.80
17			.20		.55
18					
19					
20					
21					
22	.50		.12	.86	
23	.50				
24	1.45		1.05		
25	.13		1.50	.20	
26			.94		
27			T		
28	.48				
29					.17
30					
31		.26		.46	
Monthly Total	3.06	2.11	4.25	3.41	5.33

*cotton planted

Table A-3. Rainfall Data for April-August of 1977, Ames Plantation, Grand Junction, Tennessee

Date	Month				
	April	May	June	July	August
	inches				
1					
2	.06				
3	.72	.75	T		
4	1.39	.69			
5	.19				
6			.06		
7					
8					
9					
10		*			
11				.22	
12				.03	
13					
14			.52		
15			.42	1.34	
16			.02		
17			.07		
18					
19	T			T	
20	.16			.23	
21	.03		T		
22	.53				
23					
24	1.70			.12	
25	.20	.55		.08	
26		.24	.24	.22	
27			.64		
28			T		
29	T			.40	
30		T			
31					
Monthly Total	4.98	2.23	2.14	2.64	

*cotton planted

Table A-4. Soil Temperatures for First Twenty-One Days Following Cotton Planting at Jackson, Milan, and Ames, 1977

Days After Planting	Soil Temperature, °F					
	Jackson*		Milan*		Ames**	
	8:00	4:00	8:00	4:00	Max.	Min.
1	64	67	66	76	74	41
2	60	76	68	83	70	42
3	62	78	71	85	75	47
4	63	75	70	84	79	51
5	64	76	74	86	82	55
6	64	76	70	84	91	59
7	66	76	74	78	87	61
8	69	80	52	78	90	60
9	69	85	55	84	87	58
10	68	79	58	88	87	58
11	59	80	61	91	88	61
12	54	82	62	92	90	62
13	55	86	67	94	88	61
14	58	91	70	90	87	61
15	62	95	72	92	87	58
16	65	93	71	95	85	60
17	68	96	72	94	82	62
18	70	94	72	94	82	64
19	72	91	73	92	86	60
20	71	91	71	94	92	67
21	72	92				
Average	64.0	83.7	67.7	87.2	84.6	56.7

*Soil temperature, 8:00 a.m. and 4:00 p.m., 2 inch depth.

**Soil temperature, maximum and minimum, 4 inch depth.

Table A-5. Analysis of Variance for Survival, Seedling Fresh Weight, Seedling Dry Weight, Yield of Handpicked Seed Cotton, Yield of Seed Cotton from the First Machine Picking, Yield of Seed Cotton from the Second Machine Picking, and Total Yield of Seed Cotton Affected by Trifluralin and Fluometuron, Memphis Silt Loam, West Tennessee Experiment Station, Jackson, Tennessee, 1977

Source of Variation	Degrees of Freedom	Mean Squares	F Values
	Live Plants per 6.1 meter row		
Replications	3	7.56	0.32
Trifluralin treatments (MT)	1	21.33	0.92
Error 1	3	23.22	
Fluometuron treatments (ST)	5	1,488.63	49.42*
MT * ST	5	164.63	5.46*
Error 2	30	30.12	
Total	47		
	Seedling Fresh Weight		
Replications	3	35.16	0.07
Trifluralin treatments (MT)	1	6,446.59	13.06*
Error 1	3	493.39	
Fluometuron treatments (ST)	5	3,389.85	26.92*
MT * ST	5	710.98	5.65*
Error 2	30	125.89	
Total	47		
	Seedling Dry Weight		
Replications	3	0.76	0.05
Trifluralin treatments (MT)	1	171.31	11.38*
Error 1	3	15.06	
Fluometuron treatments (ST)	5	107.31	32.34*
MT * ST	5	22.28	6.72*
Error 2	30	3.31	
Total	47		
	Yield of Handpicked Seed Cotton		
Replications	3	92,400.72	15.60*
Trifluralin treatments (MT)	1	189,320.98	31.97*
Error 1	3	5,921.35	
Fluometuron treatments (ST)	5	145,979.17	3.69*
Error 2	30	39,602.93	2.41*
Total	47		

Table A-5. (continued)

Source of Variation	Degrees Freedom	Mean Squares	F Value
	Yield of Seed Cotton from the First Machine Picking		
Replications	3	460,591.58	1.98
Trifluralin treatments (MT)	1	257,811.32	1.11
Error 1	3	233,013.23	
Fluometuron treatments (ST)	5	1,884,870.15	26.31*
MT * ST	5	588,629.59	8.22*
Error 2	30	71,642.49	
Total	47		
	Yield of Seed Cotton from the Second Machine Picking		
Replications	3	30,819.05	1.51
Trifluralin treatments (MT)	1	27,815.44	1.36
Error 1	3	20,379.67	
Fluometuron treatments (ST)	5	249,053.24	19.49*
MT * ST	5	27,848.40	2.18*
Error 2	30	12,775.41	
Total	47		
	Total Yield of Seed Cotton		
Replications	3	530,180.63	2.77
Trifluralin treatments (MT)	1	57,322.20	0.29
Error 1	3	191,412.62	
Fluometuron treatments (ST)	5	1,427,372.47	14.11*
MT * ST	5	909,535.10	8.99*
Error 2	30	101,146.13	
Total	47		

Table A-6. Analysis of Variance for Seedling Fresh Weight, Seedling Dry Weight, Yield of Handpicked Seed Cotton, Yield of Seed Cotton from the First Machine Picking, Yield of Seed Cotton from the Second Machine Picking, and Total Yield of Seed Cotton Affected by Trifluralin and Fluometuron, Memphis Silt Loam, Ames Plantation, Grand Junction, Tennessee, 1977

Source of Variation	Degrees of Freedom	Mean Squares	F Values
	Seedling Fresh Weight		
Replications	2	3,173.05	6.83
Trifluralin treatments (MT)	1	576.16	1.24
Error 1	2	464.68	
Fluometuron treatments (ST)	5	2,315.99	3.69*
MT *ST	5	1,189.43	1.88
Error 2	20	626.81	
Total	35		
	Seedling Dry Weight		
Replications	2	61.27	7.56
Trifluralin treatments (MT)	1	9.81	1.21
Error 1	2	8.11	
Fluometuron treatments (ST)	5	47.55	3.56*
MT * ST	5	25.19	1.88
Error 2	20	13.36	
Total	35		
	Yield of Handpicked Seed Cotton		
Replications	2	640,521.54	1.25
Trifluralin treatments (MT)	1	402,252.04	0.78
Error 1	2	512,980.30	
Fluometuron treatments (ST)	5	534,176.52	2.79*
MT * ST	5	201,303.38	1.05
Error 2	20	191,587.46	
Total	35		
	Yield of Seed Cotton from the First Machine Picking		
Replications	2	1,220,106.39	5.86
Trifluralin treatments (MT)	1	952,070.89	4.58
Error 1	2	208,073.20	
Fluometuron treatments (ST)	5	501,470.89	3.84*
MT * ST	5	147,381.98	1.13
Error 2	20	130,495.84	
Total	35		

Table A-6. (continued)

Source of Variance	Degrees of Freedom	Mean Squares	F Value
	Yield of Seed Cotton from the Second Machine Picking		
Replications	2	41,262.99	45.98*
Trifluralin treatments (MT)	1	4,688.56	5.22
Error 1	2	897.42	
Fluometuron treatments (ST)	5	12,527.25	1.19
MT * ST	5	3,545.72	0.34
Error 2	20	10,552.92	
Total	35		
	Total Yield of Seed Cotton		
Replications	2	2,771,845.83	2.09
Trifluralin treatments (MT)	1	2,376,227.06	1.79
Error 1	2	1,320,194.46	
Fluometuron treatments (ST)	5	1,668,033.58	4.49*
MT * ST	5	452,818.62	1.22
Error 2	20	370,684.02	
Total	35		

Table A-7. Analysis of Variance for Seedling Fresh Weight, Seedling Dry Weight, Yield of Handpicked Seed Cotton, Yield of Seed Cotton from the First Machine Picking, Yield of Seed Cotton from the Second Machine Picking, and Total Yield of Seed Cotton Affected by Trifluralin and Fluometuron, Loring Silt Loam, Ames Plantation, Grand Junction, Tennessee, 1977

Source of Variation	Degrees of Freedom	Mean Squares	F Values
	Seedling Fresh Weight		
Replications	2	156.56	0.11
Trifluralin treatments (MT)	1	1,135.91	0.78
Error 1	2	1,460.80	
Fluometuron treatments (ST)	5	98.10	2.02
MT * ST	5	142.98	2.94*
Error 2	20	48.65	
Total	35		
	Seedling Dry Weight		
Replications	2	14.61	0.23
Trifluralin treatments (MT)	1	47.22	0.75
Error 1	2	62.98	
Fluometuron treatments (ST)	5	1.25	0.61
MT * ST	5	5.35	2.68*
Error 2	20	2.06	
Total	35		
	Yield of Handpicked Seed Cotton		
Replications	2	494.49	0.06
Trifluralin treatments (MT)	1	19,944.80	2.47
Error 1	2	8,076.82	
Fluometuron treatments (ST)	5	50,553.64	4.39*
MT * ST	5	60,375.06	5.24*
Error 2	20	11,509.30	
Total	35		
	Yield of Seed Cotton from the First Machine Picking		
Replications	2	380,890.63	1.26
Trifluralin treatments (MT)	1	897.42	
Error 1	2	300,892.06	
Fluometuron treatments (ST)	5	855,079.95	10.69*
MT * ST	5	44,632.90	0.56
Error 2	20	79,972.93	
Total	35		

Table A-7. (continued)

Source of Variation	Degrees of Freedom	Mean Squares	F Value
	Yield of Seed Cotton from the Second Machine Picking		
Replications	2	268,200.33	2.34
Trifluralin treatments (MT)	1	40,457.15	0.35
Error 1	2	114,356.93	
Fluometuron treatments (ST)	5	65,819.34	2.49
MT * ST	5	7,886.31	0.29
Error 2	20	26,468.39	
Total	35		
	Total Yield of Seed Cotton		
Replications	2	118,620.95	7.85
Trifluralin treatments (MT)	1	8,076.71	0.05
Error 1	2	151,041.43	
Fluometuron treatments (ST)	5	1,331,615.87	10.35*
MT * ST	5	167,643.87	1.30
Error 2	20	128,592.24	
Total	35		

Table A-8. Analysis of Variance for Survival, Seedling Fresh Weight, Seedling Dry Weight, Yield of Handpicked Seed Cotton, Yield of Seed Cotton from the First Machine Picking, Yield of Seed Cotton from the Second Machine Picking, and Total Yield of Seed Cotton Affected by Trifluralin and Fluometuron, Loring Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Source of Variation	Degrees of Freedom	Mean Squares	F Values
	Live Plants per 6.1 meter row		
Replications	2	27.58	0.38
Trifluralin treatments (MT)	1	0.03	0.01
Error 1	2	73.53	
Fluometuron treatments (ST)	5	21.38	0.38
MT * ST	5	35.03	0.63
Error 2	20	55.52	
Total	35		
	Seedling Fresh Weight		
Replications	2	333.63	1.82
Trifluralin treatments (MT)	1	28.34	0.16
Error 1	2	182.72	
Fluometuron treatments (ST)	5	76.22	0.84
MT * ST	5	41.18	0.46
Error 2	20	90.31	
Total	35		
	Seedling Dry Weight		
Replications	2	8.32	2.89
Trifluralin treatments (MT)	1	0.04	0.01
Error 1	2	2.88	
Fluometuron treatments (ST)	5	1.15	0.43
MT * ST	5	1.65	0.62
Error 2	20	2.67	
Total	35		
	Yield of Handpicked Seed Cotton		
Replications	2	760,163.98	0.97
Trifluralin treatments (MT)	1	949.44	0.01
Error 1	2	783,622.58	
Fluometuron treatments (ST)	5	245,588.09	2.25
MT * ST	5	47,171.27	0.43
Error 2	20	109,134.00	
Total	35		

Table A-8. (continued)

Source of Variation	Degrees of Freedom	Mean Squares	F Values
	Yield of Seed Cotton from the First Machine Picking		
Replications	2	1,337,283.78	1.05
Trifluralin treatments (MT)	1	290,764.03	0.23
Error 1	2	1,268,054.25	
Fluometuron treatments (ST)	5	106,371.72	0.62
MT * ST	5	67,691.10	0.30
Error 2	20	171,920.00	
Total	35		
	Yield of Seed Cotton from the Second Machine Picking		
Replications	2	12,600.51	0.63
Trifluralin treatments (MT)	1	164.83	0.01
Error 1	2	19,999.64	
Fluometuron treatments (ST)	5	9,820.33	1.33
MT * ST	5	3,988.94	0.54
Error 2	20	7,399.14	
Total	35		
	Total Yield of Seed Cotton		
Replications	2	3,668,948.14	1.08
Trifluralin treatments (MT)	1	310,471.46	0.09
Error 1	2	3,403,630.90	
Fluometuron treatments (ST)	5	503,606.70	1.31
MT * ST	5	84,706.80	
Error 2	20	385,075.88	
Total	35		

Table A-9. Analysis of Variance for Survival, Seedling Fresh Weight, Seedling Dry Weight, Yield of Handpicked Seed Cotton, Yield of Seed Cotton from the First Machine Picking, Yield of Seed Cotton from the Second Machine Picking, and Total Yield of Seed Cotton Affected by Trifluralin and Fluometuron, Grenada Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Source of Variation	Degrees of Freedom	Mean Squares	F Values
	Live Plants per 6.1 meter row		
Replications	2	58.22	0.54
Trifluralin treatments (MT)	1	30.69	0.28
Error 1	2	108.70	
Fluometuron treatments (ST)	5	52.54	1.08
MT * ST	5	31.23	0.64
Error 2	20	48.60	
Total	35		
	Seedling Fresh Weight		
Replications	2	257.42	7.14
Trifluralin treatments (MT)	1	38.61	1.07
Error 1	2	36.03	
Fluometuron treatments (ST)	5	57.02	1.43
MT * ST	5	15.61	0.39
Error 2	20	39.99	
Total	35		
	Seedling Dry Weight		
Replications	2	5.80	7.95
Trifluralin treatments (MT)	1	0.55	0.75
Error 1	2	0.73	
Fluometuron treatments (ST)	5	1.27	1.25
MT * ST	5	0.58	0.57
Error 2	20	1.02	
Total	35		
	Yield of Handpicked Seed Cotton		
Replications	2	367,432.70	4.38
Trifluralin treatments (MT)	1	113,148.02	1.35
Error 1	2	83,893.44	
Fluometuron treatments (ST)	5	101,158.72	1.24
MT * ST	5	45,405.58	0.56
Error 2	20	81,720.28	
Total	35		

Table A-9. (continued)

Source of Variation	Degrees of Freedom	Mean Squares	F Values
	Yield of Seed Cotton from the First Machine Picking		
Replications	2	357,264.67	0.47
Trifluralin treatments (MT)	1	40,457.15	0.05
Error 1	2	766,268.35	
Fluometuron treatments (ST)	5	311,441.32	0.62
MT * ST	5	182,740.32	0.36
Error 2	20	503,457.77	
Total	35		
	Yield of Seed Cotton from the Second Machine Picking		
Replications	2	76,390.58	3.17
Trifluralin treatments (MT)	1	659.33	0.03
Error 1	2	24,120.45	
Fluometuron treatments (ST)	5	14,402.67	1.84
MT * ST	5	6,549.33	0.84
Error 2	20	7,816.71	
Total	35		
	Total Yield of Seed Cotton		
Replications	2	1,098,999.32	1.26
Trifluralin treatments (MT)	1	261,977.16	0.30
Error 1	2	872,337.77	
Fluometuron treatments (ST)	5	734,164.32	0.94
MT * ST	5	387,013.81	0.49
Error 2	20	781,194.88	
Total	35		

Table A-10. Analysis of Variance for Survival, Seedling Fresh Weight, Seedling Dry Weight, Yield of Handpicked Seed Cotton, Yield of Seed Cotton from the First Machine Picking, Yield of Seed Cotton from the Second Machine Picking, and Total Yield of Seed Cotton Affected by Trifluralin and Fluometuron, Falaya Silt Loam, Milan Field Station, Milan, Tennessee, 1977

Source of Variation	Degrees of Freedom	Mean Squares	F Values
	Live Plants per 6.1 meter row		
Replications	2	88.86	0.62
Trifluralin treatments (MT)	1	61.36	0.43
Error 1	2	143.86	
Fluometuron treatments (ST)	5	83.69	1.99
MT * ST	5	27.43	0.65
Error 2	20	42.09	
Total	35		
	Seedling Fresh Weight		
Replications	2	77.49	0.65
Trifluralin treatments (MT)	1	230.83	1.93
Error 1	2	119.31	
Fluometuron treatments (ST)	5	39.26	1.08
MT * ST	5	55.68	1.53
Error 2	20	36.37	
Total	35		
	Seedling Dry Weight		
Replications	2	2.91	0.71
Trifluralin treatments (MT)	1	3.59	0.95
Error 1	2	3.79	
Fluometuron treatments (ST)	5	0.53	0.63
MT * ST	5	1.51	1.78
Error 2	20	0.85	
Total	35		
	Yield of Handpicked Seed Cotton		
Replications	2	610,357.09	0.99
Trifluralin treatments (MT)	1	1,213,441.75	1.98
Error 1	2	612,941.67	
Fluometuron treatments (ST)	5	166,870.41	1.52
MT * ST	5	47,990.16	0.44
Error 2	20	109,902.78	
Total	35		

Table A-10. (continued)

Source of Variation	Degrees of Freedom	Mean Squares	F Values
	Yield of Seed Cotton from the First Machine Picking		
Replications	2	190,344.58	5.02*
Trifluralin treatments (MT)	1	89,741.98	2.37
Error 1	2	37,929.72	
Fluometuron treatments (ST)	5	89,566.16	0.98
MT * ST	5	29,435.37	0.32
Error 2	20	91,192.51	
Total	35		
	Yield of Seed Cotton from the Second Machine Picking		
Replications	2	281,551.74	8.09
Trifluralin treatments (MT)	1	37,087.25	1.07
Error 1	2	34,779.59	
Fluometuron treatments (ST)	5	18,083.93	0.44
MT * ST	5	35,724.64	0.86
Error 2	20	41,530.39	
Total	35		
	Total Yield of Seed Cotton		
Replications	2	664,440.35	0.99
Trifluralin treatments (MT)	1	1,460,599.11	2.19
Error 1	2	665,530.51	
Fluometuron treatments (ST)	5	219,173.44	0.94
MT * ST	5	119,739.04	0.51
Error 2	20	234,125.46	
Total	35		

VITA

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