CONTROL OF JOHNSONGRASS BY HERBICIDES APPLIED TO MOWED AND UNMOWED JOHNSONGRASS FOLLOWING MOWING AT WEEKLY INTERVALS.

by

JOHN WILLIAM WESELOH

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INTRODUCTION

Johnsongrass (Sorghum halepense (L.) Pers.) has become a serious weed problem in Kansas that is second only to field bindweed (Convolvulus arvensis). It is now widely distributed in the southeastern counties and in the western irrigated sections of the state. Johnsongrass has been declared a noxious weed by 80 counties under provisions of the Kansas Weed Law.

Since its introduction, johnsongrass has spread through all of the southern states, the eastern seaboard states, north to Missouri, Kansas, Iowa, Michigan, and west into New Mexico, Arizona, and California.

Even though johnsongrass is the major weed in cultivated fields of both sugarcane and cotton, it may also be a valuable forage for hay and pasture. Hay made from johnsongrass cut in the boot stage is of good quality when cured properly. Hay cut in this stage does not usually contain mature seed that might result in spreading the grass to areas where it is not established.

The objectives of this study were two-fold: (1) to obtain basic information concerning the effects of desiccation on johnsongrass rhizomes and (2) to determine the effects of dalapon (2,2 dichloroproponiate) and garlon, (Diethylene glycol bis dichloroproponiate / 2, (2,4,5, Trichlorophenoxy) propionic acid, propylene glycol) a new formulation, applied to unmowed johnsongrass and to johnsongrass regrowth following mowing at weekly intervals.

LITERATURE REVIEW

According to a description by Vinall and Crosby (19), johnsongrass is a stout, erect perennial grass with rather broad leaves in which the middle vein is thickened and white. The panicle is large and open when in bloom. Besides the fibrous roots customarily associated with grasses, johnsongrass produces numerous rhizomes, which send up shoots from the nodes, thus producing new plants. It resembles and is closely related botanically to sudangrass, the chief difference between the two grasses being the presence of rhizomes on the former. These rhizomes are most abundant at a depth of 6 to 8 inches, but in cultivated fields they often penetrate 18 to 24 inches beneath the surface of the soil. Johnsongrass stems vary in height from 3 to 10 feet, according to the moisture and the fertility of the soil.

Cates and Spillman (4) classified johnsongrass rhizomes as primary, secondary, and tertiary. Primary rhizomes include all the rhizomes alive in the ground at the beginning of the growing season in the spring. Secondary rhizomes are those which are produced from the primaries, come to the soil surface, and there form crowns, thus producing new plants. Tertiary rhizomes are those starting later in the season, about flowering time, from the base of the crown of a new plant. These tertiary rhizomes will, under favorable condition, grow to a large diameter and penetrate to a depth of 4 feet, but normally from 15 to 30 inches. In the spring, secondary and tertiary rhizomes become primary rhizomes and in turn send out secondary shoots to

reach the surface, and the cycle is repeated.

Many studies have been made in the past in an attempt to find methods of controlling johnsongrass. In 1917, Heard (9) concluded that the quickest way to eradicate johnsongrass was to irrigate it frequently during the growing season and to overgraze it with sheep. Overpeck (10) recommended heavy grazing followed by intensive cultivation with crops such as corn or cotton. Perkins (12) found that growing alfalfa in johnsongrass infested areas caused johnsongrass to all but disappear after the third year. Zahnley et al. (22) listed four general control methods applicable to varying conditions: (1) close grazing or frequent cutting followed by late fall plowing, (2) intensive cultivation, (3) intensive cultivation in combination with growing small grain, and (4) use of chemicals for small infestations.

Fletchall et al. (6) and Overpeck (10) reported that shallow plowing in late summer followed by a long period of dry, hot weather was effective in killing johnsongrass rhizomes by desiccation.

Oyer et al. (11) concluded that under Indiana conditions seedlings should be controlled some time before rhizomes are formed, i.e. before the seven-leaf stage. It apparently is not sufficient merely to cover the crowns of seedlings plants with soil during cultivation, as new crowns may be formed. Very young plants may be controlled by cultivation, as is the case with other young annuals of similar size.

Once the rhizomes have been formed, according to Oyer, the

problem of control is multiplied many times over, as each auxiliary bud is capable to giving rise to a new plant. Also, if a chemical is to be useful as a systemic herbicide for johnsongrass control, it must be translocated into all of the rhizome buds and must inhibit further growth of these buds.

Robbins et al. (14) found that Trichloroacetic acid (TCA) applied at rates of 50 to 120 pounds per acre either in the spring or fall gave satisfactory control.

Soil sterilants such as sodium chlorate, boron, CMU, boron-chlorate mixtures, and boron-CMU mixtures give excellent control of johnsongrass. Even though soil sterilants are effective, they render crop land unproductive for two or more years. Sodium chlorate applied at a rate of 4 pounds per square rod in the spring or 3 pounds per square rod in the fall, boron compounds and mixtures of borates and sodium chlorate applied at rates of 10 to 11 pounds boron trioxide (B_2O_3) equivalent per square rod, and erbon (2,2,4,5 trichlorophenoxy) ethyl 2,2 dichloropropionate) applied at 1 pint per square rod are all effective in controlling johnsongrass. Retreatment is generally necessary with all soil sterilants.

Hexachloroacetone (HCA) mixed in kerosene at rates of 90 to 180 ml. per gallon is successful for spot treatment of johnsongrass in cotton and other field crops.

Dalapon is a newer herbicide that has been effective as a johnsongrass killer. Investigators (1,7,8,15,18,20,21) have found that applications of from 20 to 40 pounds of dalapon per acre gave excellent control when applied to the folage during

early growth stages.

Watson (20) found that 20 pounds of dalapon per acre in early summer followed by minimum tillage to control seedlings gave good results in controlling johnsongrass in the Mississippi Delta. Hanson (7) concluded that rates up to 5 pounds of dalapon per acre are effective in controlling annual grasses in sugarcane. It was also found that if dalapon is applied 1/2 hour prior to a rain optimum effectiveness should result.

Santelmann and Meade (15) reported better control of johnsongrass with two applications of low rates of dalapon (7 to 15 pounds per acre) than with a single high rate (20 to 30 pounds per acre). Where single treatments were used, the degree of control decreased after the plants were 30 to 36 inches tall.

Watson (21) found dalapon to be effective for spot treatment of johnsongrass in cotton. Optimum concentration was 1/5 pound of 85% dalapon per gallon of water applied on the plants until thoroughly wetted. Cotton wet by the spray was generally killed, but stand reduction from spot treatments was no greater than it would have been from continuous hoeing.

Anderson (1) found that dalapon and 2,2,3, trichloropropionate at 20 and 40 pounds per acre gave excellent control of johnsongrass in Kansas. It was found that dalapon applied at the six-inch stage as a single 20-pound-per-acre or in two 10-pound-per-acre applications gave excellent control. Although 2,2,3 trichloropropionate gave satisfactory control at 20 pounds per acre, it was not so effective as dalapon.

Results in Alabama (18) showed that dalapon and TCA were

the most practical and economical chemicals for killing johnsongrass and bermudagrass. The Alabama workers preferred dalapon to TCA for these reasons: (1) cheaper per acre, (2) more predictable as a chemical to control the grasses, (3) less damaging to metals, (4) less harmful to the skin, (5) will not stay in the soil as long as TCA, and (6) safer to use near shrubbery and trees.

According to recommendations under provisions of the Kansas State Weed Law, dalapon should be applied when the johnsongrass is from 6 to 18 inches tall. After johnsongrass has reached a height of more than 24 inches, dalapon applications are less effective.

Buchholtz and Peterson (3) found dalapon applied as fall and spring preplanting treatments to be effective for controlling quackgrass (Agropyron repens).

Spring applications of dalapon appeared to be more effective than fall application but presented a greater hazard to certain early spring-sown crops.

Barrons (2) found that dosages of 12 to 15 pounds of dalapon per acre gave good control of quackgrass when applied in September, October, and November. He also found that following dalapon treatments some quackgrass recovered, although in a weakened condition. Spring plowing after fall application weakened the quackgrass and subsequent crop competition and cultivation further retarded recovery.

Santelmann and Willard (16) found dalapon at 20 and 40 pounds per acre gave good control of quackgrass when applied in the fall

without plowing. Spring treatments were less effective.

Scholl and Staniforth (17) found that when weedy grasses were controlled with dalapon at rates of 3 to 4 pounds per acre, successful stands of birdsfoot trefoil were established. An additional herbicide was needed to control the broad-leaved weeds.

Peters and Kerkin (13) reported that dalapon has given excellent control of foxtail (Setaria spp.) and crabgrass (Digitaria spp.) in early post-emergence applications on newly seeded alfalfa and birdsfoot trefoil.

Harrison (8) concluded that annual spring treatments with dalapon in apple orchards were effective in controlling perennial grasses without any evidence of phytotoxicity to the trees.

Thus dalapon promises to be a valuable new tool in controlling annual and perennial grasses under a great variety of conditions.

MATERIALS AND METHODS

To insure clarity, the materials and methods for the two parts of this study will be given separately.

The study of the effects of desiccation upon johnsongrass rhizomes was conducted in the greenhouse in the spring and summer of 1959. Rhizomes for this study were obtained from a johnsongrass-infested area adjacent to the campus of Kansas State University, Manhattan, Kansas. After the rhizomes were dug, they were washed, drip-dried, and sorted into groups of

three according to diameter, length, and weight. Three replications of three rhizomes each were placed on a piece of cardboard 3 x 4 feet on a greenhouse bench to dry to 75, 50, 45, 40, 35, 30, 25, 20, and 15 percent of their original weight. When the rhizomes had reached the desired desiccation level they were placed in metal flats of moist vermiculite to determine viability as expressed by shoot growth.

A bottom-land area heavily infested with johnsongrass near Ogden, Kansas, was leased for the purpose of studying the effects of dalapon and garlon on johnsongrass regrowth following mowing at weekly intervals. Garlon is a new formulation used for the first time in Kansas to control johnsongrass.

The experimental design was one of randomized blocks replicated three times. Plot size was one square rod. The treatments were as follows:

Control - neither sprayed nor mowed.

Mowing - regrowth sprayed with dalapon at 20 pounds per acre.

Original growth - sprayed with dalapon at 20 pounds per acre.

Mowing - regrowth sprayed with garlon at 20 pounds per acre.

Original growth - sprayed with garlon at 20 pounds per acre.

Each week for an 11-week period six plots were mowed and the top growth removed. Each of the chemicals was applied to the three mowed and unmowed plots when the regrowth had reached a height of 12 to 15 inches each week. A sticker (household detergent) was used with both chemicals.

At each date of spraying, soil samples were taken from sprayed plots at the 12th inch depth. The soil samples were

oven dried, and total soil moisture determined on a dry-weight basis.

Evaluation of the treatments was made by digging rhizomes from an area 24 x 24 inches to a depth of 18 inches. The rhizomes were washed and dried, and their weight recorded in grams.

The chemicals were furnished by The Dow Chemical Company, Midland, Michigan.

Table 1. Dates which plots were mowed and sprayed.

Plot-Mowing Dates	Plot-Spraying Dates
6-15	6-29
6-23	7-7
6-29	7-23
7-7	8-3
7-12	8-4
7-23	8-10
7-27	8-17
8-3	8-24
8-10	8-31
8-17	9-8
8-24	9-14

EXPERIMENTAL RESULTS

Results of the rhizome desiccation study are shown in Table 2.

From the data in Table 2 it was found that as long as 40 percent and above of the original weight remained following desiccation, all rhizomes produced shoots.

Only a few rhizomes produced shoots when desiccated to 35 percent of their original weight. Desiccation to the 20 percent

level required 67 days. Desiccation below 20 percent of original weight by air drying was not possible.

Table 2. Viability of johnsongrass rhizomes at various desiccation levels.

Percent weight of rhizomes remaining after desiccation	Percent of rhizomes which produced shoots
75	100
50	100
45	100
40	100
35	22
30	33
25	11
20*	0

*67 days of drying were required to obtain this percentage.

An analysis of variance indicated that the original weights of the surviving groups of rhizomes were no different from the original weights of rhizomes that did not survive desiccation (Table 3).

Table 3. Analysis of variance among original rhizome weights of survival groups.

Source	d.f.	Sum of Squares	Mean Square	F
Survival groups	1	9.67	9.67	.195 ns
Within groups	22	1092.33	49.65	
Total	23	1102.00		

ns = nonsignificant

Table 4 gives the percent control of johnsongrass for dalapon and garlon in mowed and unmowed plots for the 11-week period. The results are based upon the mean rhizome weight of four replications for each treatment effect and upon the mean rhizome weight of all control plots.

EXPLANATION OF PLATE 1

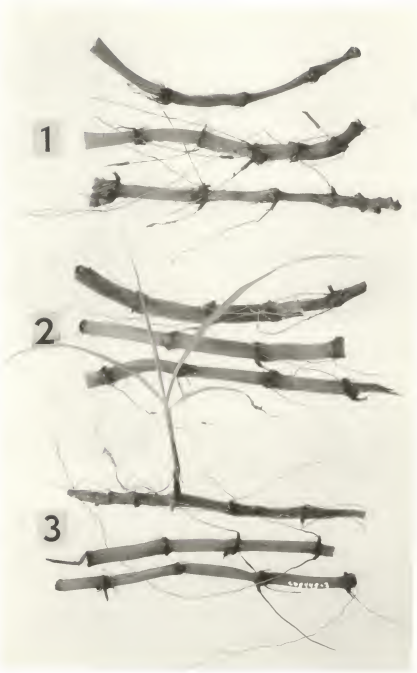
Johnsongrass rhizomes which have never been dried.

PLATE 1

EXPLANATION OF PLATE 11

Johnsongrass rhizomes desiccated to
25 percent of their original weight.

PLATE 11



EXPLANATION OF PLATE 111

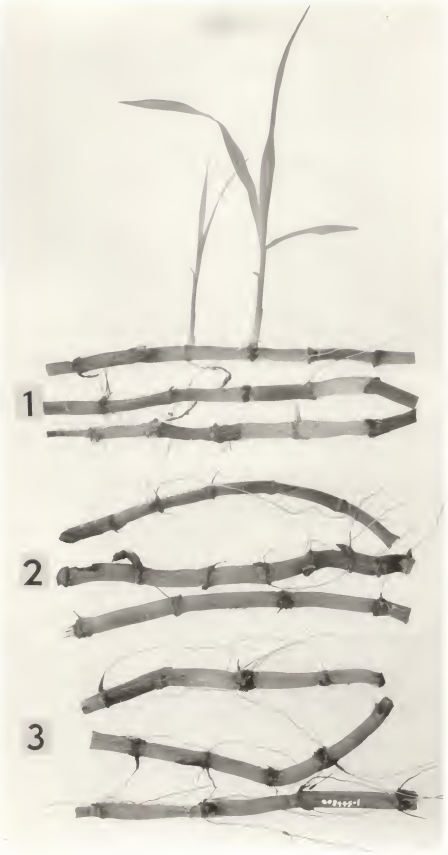
Johnsongrass rhizomes desiccated to 30 percent of their original weight.

Plate III

EXPLANATION OF PLATE IV

Johnsongrass rhizomes desiccated to 35 percent of their original weight.

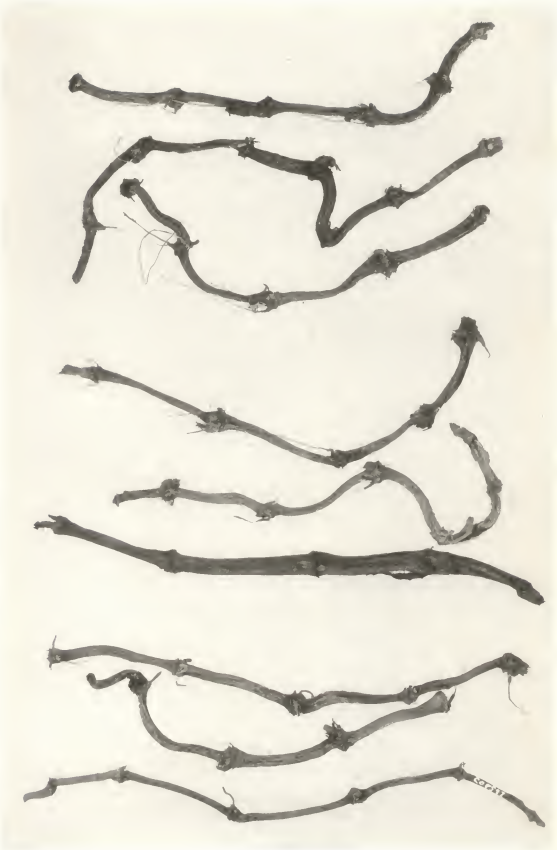
Plate IV



EXPLANATION OF PLATE V

Johnsongrass rhizomes desiccated to 20 percent of their original weight.

Plate V



EXPLANATION OF PLATE VI

Regrowth one week after mowing. Notice the nonmowed plots in the background.

PLATE VI

Table 4. Percent control of johnsongrass on mowed and unmowed plots following applications of dalapon and garlon.

Date of Mowing	Spray dates (Mowed and unmowed)	%Control of Dalapon		%Control for Garlon	
		Mowed	Unmowed	Mowed	Unmowed
June 15	June 29	78.6	37.1	99.5	98.4
June 23	July 7	100.0	67.1	91.2	96.0
June 29	July 23	99.0	76.9	97.0	98.3
July 7	August 3	92.8	58.1	97.3	76.7
July 13	August 4	97.8	64.9	92.6	26.2
July 22	August 10	87.7	52.2	75.4	64.3
July 27	August 17	60.1	34.0	66.1	39.3
Aug. 3	August 24	67.2	43.8	64.6	47.7
Aug. 10	August 31	68.5	44.8	53.9	48.6
Aug. 17	Sept. 8	60.1	32.8	39.3	9.7

Information in Table 5 indicates that the effect of both dalapon and garlon was dependent upon mowing and date of application.

Table 5. Analysis of variance showing interaction of mowing, date of application and chemical effect.

Source	d.f.	Sum of Squares	Mean Square	F
Chemical X date	10	846368.35	84636.84	2.085*
Mowing X date	10	1905246.74	190524.67	4.694**
Chemical X Mowing X Date	10	1025100.03	103510.00	2.536*
Remainder	86	3490284.45	40584.71	

* p.05
**p.01

In Tables 6 and 7, Duncan's New Multiple Range Test (5) was used to test for significant differences among mean rhizome weights. No significant differences were found among those treatments which are included above the same line. All treatments not included above the same line are significantly different from each other.

Table 6. Ranked mean weight of rhizomes in grams for dates of application of dalapon to mowed and unmowed plots.

Dalapon mowed.

Dates of dalapon application.	7-7	7-23	8-4	8-3	8-10	6-29	8-31	8-24	8-17	9-14	8-10
Ranked Means.	0	12.33	26.67	84.33	111	250	376.7	382.7	431.7	467	733.7

Dalapon not mowed.

Dates of dalapon application.	7-23	7-7	8-4	8-3	8-10	8-31	8-24	9-8	6-29	8-17	9-14
Ranked Means	270	329.3	409.7	489.7	558.7	645.3	656.7	730.7	735.7	771.0	784.7

Table 7. Ranked mean weights of rhizomes in grams for dates of application of garlon to mowed and unmowed plots.

Garlon mowed.

Dates of garlon application	7-23	8-3	6-29	8-4	7-7	8-10	8-17	8-24	9-8	8-31	9-14
Ranked Means	34.7	51.0	61.3	96.3	103.3	287.7	397.0	413.0	482.7	538.7	708.7

Garlon not mowed.

Dates of garlon application	7-7	6-29	7-23	8-3	8-10	8-31	8-24	8-17	8-4	9-14	9-10
Ranked Means	46.7	182.0	201.7	272.7	417.0	600.7	611.7	708.7	744.7	1054.7	1149.3

Degree of johnsongrass control by various treatments is presented in Table 8. The degree of control is expressed as the mean weight of rhizomes recovered from an area 24x24x18 inches from each replication. Dalapon applied on johnsongrass regrowth following mowing significantly reduced rhizome weight from that of dalapon applied on nonmowed johnsongrass. This was true for all dates studied except July 23, August 31, September 8, and September 14. Generally, garlon applied to nonmowed johnsongrass was as effective as garlon sprayed on johnsongrass regrowth for the period studied.

Table 8. A comparison of mowing vs. nonmowing in combination with dalapon and with garlon for the 11-week period.

	Rhizome weights in grams per quadrat					
Date	Dalapon mowed		Dalapon not mowed	Garlon mowed		Garlon not mowed
June 29	250.3	*	735.7	61.3	ns	182.0
July 7	0.0	*	329.3	103.3	ns	46.7
July 23	12.3	ns	270.0	34.7	ns	201.7
Aug. 3	84.3	*	489.7	51.0	ns	272.7
Aug. 4	25.7	*	509.7	96.3	*	744.7
Aug. 10	111.0	*	558.7	287.7	ns	417.0
Aug. 17	431.7	*	771.0	397.0	ns	707.7
Aug. 24	382.7	*	656.7	413.0	ns	611.3
Aug. 31	376.7	ns	645.7	538.7	ns	600.7
Sept. 8	733.7	ns	730.7	438.7	*	1149.3
Sept.14	467.0	ns	784.7	707.7	*	1054.7

ns = nonsignificant.
* = least significant range $_{.05}$ = 329 grams.

The data in Table 9 compares the result of dalapon applied on johnsongrass regrowth and dalapon applied on nonmowed johnsongrass with control for the 11-week period. Dalapon applied to johnsongrass regrowth significantly reduced rhizome weight for all

dates studied except for September 8. Dalapon applied to nonmowed johnsongrass significantly reduced rhizome weights for the dates studied, excepting June 29, August 10, and September 8. The nonsignificant control for the June 29th application can be accounted for by the heavy shower immediately after the dalapon application by washing the material from the plants. Lack of control for the later date cannot be accounted for.

Table 9. Comparison between dalapon applied to johnsongrass regrowth and dalapon applied to nonmowed johnsongrass vs. control for the 11-week period.

	Rhizome weights in grams per quadrat				
Dates	: Dalapon : mowed	:	Control	:	Dalapon not : mowed
June 29	250.3	*	850	ns	735.7
July 17	0.0	*	825	*	329.3
July 23	12.3	*	1130	*	270.0
Aug. 3	84.3	*	1010	*	489.7
Aug. 4	26.7	*	1116	*	409.7
Aug. 10	111.0	*	813	ns	558.7
Aug. 17	431.7	*	1200	*	771.0
Aug. 24	382.7	*	1946	*	656.7
Aug. 31	376.7	*	1580	*	648.7
Sept. 8	733.7	ns	1045	ns	730.7
Sept.14	467.0	*	1328	*	784.7

* = least significant range $_{.05}$ = 329 grams.
ns = nonsignificant.

The data in Table 10 compares the result between garlon applied to johnsongrass regrowth and garlon applied to unmowed johnsongrass vs. control for each week. Garlon applied to johnsongrass regrowth following mowing significantly reduced rhizome weight for all dates studied. Garlon applied to nonmowed johnsongrass significantly reduced rhizome weight for all

weeks until the week of September 8.

Table 10. Comparison between garlon applied to johnsongrass regrowth and garlon applied to unmowed johnsongrass vs. control for the 11-week period.

	Rhizome weights in grams per quadrat				
Dates	Garlon mowed		Control		Garlon not mowed
June 29	61.3	*	850	*	182.0
July 7	103.3	*	825	*	46.7
July 23	34.7	*	1130	*	201.7
Aug. 3	51.0	*	1010	*	272.7
Aug. 4	96.3	*	1116	*	744.7
Aug. 10	287.7	*	813	*	417.0
Aug. 17	397.0	*	1200	*	708.7
Aug. 24	413.0	*	1946	*	611.3
Aug. 31	538.7	*	1580	*	600.7
Sept. 8	428.7	*	1045	ns	1149.3
Sept.14	708.7	*	1328	ns	1054.7

ns = nonsignificant.
* = least significant range $_{.05}$ = 329 grams.

A comparison of dalapon vs. garlon on mowed plots and dalapon vs. garlon on unmowed plots is shown in Table 11. Dalapon and garlon are equally effective in controlling johnsongrass regrowth following mowing for all dates studied. Except for June 29, August 4, and September 8, dalapon and garlon are equally effective on unmowed johnsongrass. The June 29th date of application was followed by a heavy shower which may have washed the dalapon off the plants and may account for the difference between the responses of dalapon and garlon on that date. The differences observed on the other two dates cannot be accounted for.

Table 11. Comparison between dalapon vs. garlon on mowed plots and dalapon vs. garlon on unmowed plots for the 11-week period.

	Rhizome weights in grams per quadrat					
	Mowed			Not mowed		
Dates	Dalapon		Garlon	Dalapon		Garlon
June 29	250.3	ns	61.3	735.7	*	183.0
July 7	0.0	ns	103.3	329.3	ns	46.7
July 23	12.3	ns	34.7	270.0	ns	201.7
Aug. 3	84.3	ns	51.0	489.7	ns	272.7
Aug. 4	26.7	ns	96.3	409.7	*	744.7
Aug. 10	111.0	ns	287.7	588.7	ns	417.0
Aug. 17	431.7	ns	397.0	771.0	ns	708.7
Aug. 24	382.7	ns	413.0	656.7	ns	611.3
Aug. 31	376.7	ns	538.7	645.7	ns	600.7
Sept. 8	733.7	ns	428.7	730.7	*	1149.3
Sept.14	467.0	ns	708.7	784.7	ns	1054.7

* = least significant range .05 = 329 grams.
ns = nonsignificant.

A regression coefficient was calculated between total soil moisture and rhizome weight. A "t" test was calculated and "b" was found to be nonsignificant. The results are shown in Table 12.

Table 12. Mean percent of total soil moisture for mowed and unmowed plots at the 12-inch depth taken on the dates of spraying.

Date Sprayed	Percent Total Soil Moisture	
	mowed	unmowed
June 29	9.6	10.0
July 7	7.9	6.9
July 23	13.2	13.4
Aug. 3	9.9	9.5
Aug. 4	10.6	8.3
Aug. 10	9.9	8.1
Aug. 17	6.9	5.2
Aug. 24	7.9	7.0
Aug. 31	12.4	13.6
Sept. 8	12.1	11.6
Sept.14	9.8	8.8

DISCUSSION

Results of the rhizome desiccation study led to the conclusion that a critical value, reflected by viability, was reached at approximately 35 percent desiccation of the original weights. All rhizomes remained viable above 35 percent desiccation of original weight. Only a few rhizomes were able to produce shoots when desiccated from 25 to 35 percent of their original weight. No shoots were produced when rhizomes were desiccated to 20 percent. Desiccation of rhizomes below 20 percent of their original weight could not be obtained by air drying. On the basis of this information, it does not appear practical to control johnsongrass by surface drying of rhizomes. It may also be noted that if rhizomes are dried to 25 to 35 percent of their original weight, 100 percent control is not probable.

The effectiveness of garlon and dalapon was found to be dependent upon mowing and date of application. Using Duncan's New Multiple Range test, it was found that the period of effective control of johnsongrass could be extended approximately 5 weeks by spraying dalapon on johnsongrass regrowth following mowing.

Garlon was equally as effective on nonmowed johnsongrass as it was on johnsongrass regrowth for the first 3-week period. Following the third week, garlon was more effective for the control of johnsongrass regrowth than it was on nonmowed johnsongrass. It was also found that both garlon and dalapon are equally effective in controlling johnsongrass regrowth for the

same period of time.

Dalapon applied to unmowed johnsongrass significantly reduced rhizome weights for all dates of application except for June 29, August 10, and September 8. In general, the degree of control unmowed plots was not as effective as that obtained by dalapon applied to regrowth.

Garlon applied to regrowth, when compared with the control, reduced rhizome weight significantly for all weeks. When compared to the control, garlon applied to unmowed plots significantly reduced rhizome weight for all dates until the week of September 8.

Dalapon and garlon were equally effective for control of johnsongrass regrowth for all weeks. With the exception of those dates, they were equally effective for control of nonmowed johnsongrass plots.

It was found that no relationship existed between rhizome, which reflected johnsongrass control, weight, and total soil moisture at the 12th-inch depth.

Under the condition of this experiment, it was found that the period during which johnsongrass could effectively be controlled was extended approximately 5 weeks by spraying the regrowth with dalapon or garlon. This is important since it will extend the period during which county weed supervisors and farmers can apply dalapon or garlon to johnsongrass regrowth with reasonable assurance that established stands of johnsongrass will be controlled.

SUMMARY

Based on experimental results, it was found that:

1. Rhizomes dried to 40 percent of their original weight retained viability. Drying rhizomes to between 25 to 35 percent of their original weight reduced subsequent shoot growth by approximately 84 percent.

2. The period of effective control of johnsongrass was extended approximately 5 weeks by mowing and spraying the regrowth with dalapon or garlon.

3. Dalapon and garlon were equally effective in controlling johnsongrass regrowth through the summer.

4. There was no relationship between the degree of johnsongrass control and total soil moisture taken at the 12th-inch depth.

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CONTROL OF JOHNSONGRASS BY HERBICIDES APPLIED TO MOWED AND UNMOWED JOHNSONGRASS FOLLOWING MOWING AT WEEKLY INTERVALS.

by

JOHN WILLIAM WESELOH

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Johnsongrass (Sorghum halepense (L.) Pers.) has become a serious weed problem in Kansas, second only to field bindweed (Convolvulus arvensis). It has been declared a noxious weed in 80 counties in Kansas. The objectives of this study were two-fold: (1) to find basic information concerning the effects of desiccation on johnsongrass rhizomes and (2) to determine the effects of dalapon (2,2 dichloropropoponiate) and garlon, (diethylene glycol bis dichloropropionate plus 2,(2,4,5 trichlorophenoxy) proponic acid propylene glycol), on johnsongrass regrowth following mowing at weekly intervals.

In the rhizome desiccation study, rhizomes were dug, washed and dried, to 75, 50, 45, 40, 35, 30, 25, and 20 percent of their original weight. It was found that a critical value was reached at approximately 35 percent desiccation of original weight. Above 35 percent desiccation, all rhizomes remained viable. Only a few rhizomes were able to produce shoots when desiccated from 25 to 35 percent of their original weight. Desiccation below the 20 percent level could not be obtained. Therefore, it does not appear practical to control johnsongrass by drying rhizomes to 20 percent of their original weight. Where 35 to 25 percent desiccation of original weight does occur, 100 percent control is not probable.

The following treatments were given to mowed and unmowed plots of johnsongrass when the regrowth had reached a height of 12 to 15 inches:

Control-neither mowed nor sprayed.

Mowing-in combination with dalapon at 20 pounds per acre.

Original growth-in combination with dalapon at 20 pounds pounds per acre.

Mowing-in combination with garlon at 20 pounds per acre.

Original growth-in combination with garlon at 20 pounds per acre.

A sticker (household detergent) was used in applying each chemical.

It was found that the effectiveness of garlon and dalapon was dependent upon mowing and date of application. It was concluded that dalapon in combination with mowing extended for approximately 5 weeks the period during which johnsongrass could be controlled. The response of garlon to mowing differed from dalapon in that it was as effective in controlling johnsongrass on nonmowed plots as on mowed plots for the first three-week period. Following the third week, garlon was more effective for the control of johnsongrass regrowth than it was on nonmowed johnsongrass. Garlon and dalapon were equally effective for control of johnsongrass regrowth for the period studied.

Except for the weeks of June 29, August 4, and September 8, garlon and dalapon were equally effective for control of original growth, but the degree of control was not so effective as the control obtained when in combination with mowing for the first 5-week period.

At each date of spraying, soil samples were taken from each plot at the 12-inch depth, oven dried, and total soil

moisture determined. It was concluded that there was no relationship between total soil moisture at the 12-inch depth and degree of johnsongrass control.