

JOHNSON GRASS CONTROL

A Farm and County Program

KY. AGR. EXP. STA. PROGRESS REPORT 78

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PREPARED BY
AGRICULTURAL EXPERIMENT STATION
OF THE UNIVERSITY OF KENTUCKY
LEXINGTON
and
DEPARTMENT OF ECONOMIC DEVELOPMENT
COMMONWEALTH OF KENTUCKY
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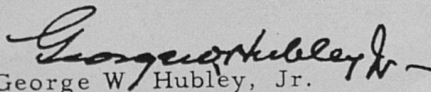
The eradication of Johnson grass is a matter of concern for farmers throughout Kentucky. In cooperation with the University of Kentucky Experiment Station, the Department of Economic Development has published this study to emphasize the practices followed on experimental plots in Franklin County to destroy this noxious weed. Much infested land throughout the Commonwealth can be returned to useful production, resulting in added income for our farmers.

To assist in creating expanded industrial markets for Kentucky farm products, an Agricultural Development Division was created within the Department of Economic Development by Executive Order in March, 1956. The Division works cooperatively with Kentucky's many agricultural organizations on projects to expand and diversify farm production and to encourage the development of agriculture-based processing and distributing facilities in the state. That the program is achieving results is attested by relatively stable and continued high levels of Kentucky farm income during the past five years, despite constantly dwindling marketings of burley tobacco, a principal cash crop.

Many other publications have been issued by the Division to encourage these objectives. Among them are brochures relating to truck crop production and marketing opportunities, a report on opportunities for broiler production, information on tobacco research, studies pointing up the promising field for production of wooden pallets and charcoal. Others deal with installation of a food testing laboratory, a study emphasizing increased opportunities and advantages of dairy farming in the Jackson Purchase area of the state, economic possibilities in production and marketing of edible nuts. Publication of a timber buyer's guide for the state filled a critical need.

Policy for the Division is formulated by an Agricultural Development Board appointed by the Governor. Directives from the Board are carried out by the Division Director, Wm. Frank Lebus, Jr., Cornell University graduate in the field of agricultural economics, and his assistant, William L. Wiesman, University of Kentucky graduate in animal husbandry and agricultural economics.

Sincerely,


George W. Hubley, Jr.
Commissioner

Johnson Grass Control: A Farm and County Program

Introduction

Until recently, Kentucky farmers faced the prospect of a never-ending war—and slight chance of victory—against a noxious weed pest that inexorably choked out acre after acre of fertile farm land.

Like a plague of yore, Johnson grass continued unchecked its ravaging advance. At best the fight to control its spread was an individual holding action, waged with largely ineffective weapons.

Thousands of infested acres, especially rich bottomland along river-beds and streams, were abandoned to the enemy. When dug or pulled out of fields, the scourge crept along the edges of highways, along railroad tracks, outflanking and engulfing the land anew.

But now the tide has been turned. Armed with determination, newly-developed herbicides and patiently acquired know-how, a group of Franklin county citizens pooled their resources and launched a coordinated assault that has achieved spectacular success, raising hopes that effective control measures are within reach and that overrun land can be reclaimed.

It was in the spring of 1957 that the people of Franklin county recognized the time had come to take a united stand. A committee representing concerned agricultural groups was formed and a control program outlined.

But the committee realized that it lacked the



At the time this project was started, Johnson grass was taking over some of Franklin county's most fertile bottomland and spreading into other areas.

answers to many vital questions: Which of the new herbicides were most effective? Would landowners cooperate? What would be the cost?

From fighting their rear-guard action, farmers themselves had learned some valuable lessons and the University of Kentucky Agricultural Experiment Station had compiled pertinent technical information. The need for additional research and trained personnel to give technical advice to farmers and spray operators soon became apparent, however. Financial assistance obviously was needed.

The Kentucky Department of Economic Development, which allocates funds appropriated by the Kentucky Legislature for research programs designed to improve agricultural productivity, came to the rescue with grants totaling \$13,000 that made

possible an all-out experimental program. And the State Agricultural Stabilization and Conservation Committee agreed to permit the use of ACP funds for county cost-sharing under the project.

This, then, is the story of what Franklin county has done to rid itself of a blight on the land—a report of the progress achieved in a two-year research operation. The job is by no means finished—won't be for many years.

But Franklin county farmers are demonstrating that Johnson grass can be controlled through cooperative effort. Already 7 other counties have embarked on similar campaigns, and indications are another 15 to 20 counties will avail themselves of ACP cost-sharing aid for this purpose in 1959.

It is hoped that still others will join in the fight.

Part I — Root of the Problem

What is Johnson Grass?

Johnson grass is a perennial sorghum closely resembling Sudan grass. It reproduces by seeds and extensive underground rootstocks. Since its entry into the United States, it has spread to all parts of the southern clime, and as far west as California, as far east as Maryland and Massachusetts and as far north as Michigan.

Once it was thought to be a southern-type grass, a notion now largely dispelled since it survives winters in northern Ohio, Indiana, Illinois and southern Michigan.

How to Recognize It

The average height of mature plants is around 6 feet. Stems are about the size of a lead pencil, and the broad-bladed leaves are one-half to three-quarters of an inch wide with a light green midrib. The plant usually grows in bunches with several stems arising from each root crown.

Seed heads formed at the top of the stem are branched and become reddish when nearing maturity. The seeds are oblong, red or dark brown in color. Established plants have large, fleshy rootstocks, often as much as a half-inch in diameter, which live over winter. By its rootstock, Johnson grass is easily distinguished from Sudan grass.

Why Control It?

The spread of Johnson grass has been relatively continuous during the 128 years of its existence on

this continent even though extensive and concentrated efforts have been made to eradicate it. Each year it further encroaches on upland soils. Heavily infested fields are practically worthless for the growing of row crops. Left alone, it easily can choke out a cornfield, for example.

Although the grass can be used for hay or pasture, its disadvantages as a crop menace greatly outweigh its advantages.

How To Avoid Spreading It

Johnson grass often shows up first on a farm as a single plant or in small patches. Such small infestations can be destroyed readily by digging up the plants or spot-treating them with chemicals, thus preventing the spread of the grass into nearby cultivated fields.

The weed spreads by underground rootstocks as well as by seed. Seed on established plants usually matures in July, but on plants starting from seed or from regrowth of clipped plants, it matures later in the summer. Plants should never be allowed to develop mature seed because birds, livestock, wind, and drainage waters can spread it to infest adjacent fields.

Usually three close cuttings a year, each time as the plants develop seed heads, will prevent seed production. Cutting as described should be done on road and ditch banks, fence rows, and waste lands, as well as in fields and pastures, until the grass can be destroyed.



(Left) The yardstick beside the plant helps to show the size of this freshly dug Johnson grass plant. A portion of the fleshy rootstocks is shown.

(Above) This drawing of parts of Johnson grass shows the two means of reproduction—A. The underground, creeping rootstocks which live over winter and B. The seed (sorghum-like) borne in open panicles at the top of the maturing plant.

To avoid spreading the rootstock pieces from infested spots in cultivated fields, raise the breaking plow or cultivating tool while passing through such spots. New plants can start from the nodes or joints of any rootstocks that are moved and dropped in clean soil. Disk harrows can be used without much danger of spreading the rootstocks, but spike-tooth harrows and drags are likely to move the pieces and encourage rapid spread.

Crop seeds sown should be free from Johnson grass. Straw and hay from infested fields should not be brought to the farm or moved to clean fields. Combines, corn harvesters, and other farm machin-

ery in which seeds might lodge should be cleaned before being moved from infested fields to clean fields.

Franklin County Gears for Action

More than 20 years ago Johnson grass was added to the list of seeds considered noxious in the Kentucky Pure Seed Law. Since the law applied only to crop seeds that were sold commercially, it had little effect on control of the grass.

A legislative bill that required the State Department of Highways to control the pest on all state rights-of-way was passed in 1956. Meanwhile, be-



Johnson grass producing seed on highway and railroad rights-of-way furnishes a constant source of infestation to adjacent farm lands. Both highway and railroad employees have used control measures in Franklin county.



The Franklin county plot experiments in Johnson grass control at the time of the 1958 field day conducted for farm leaders.

leaguered Franklin county farmers faced the necessity of doing something on their own.

In 1956, representatives of the Franklin County Farm Bureau made a survey to determine the extent of infestation in Franklin county. Startled, they found more than 1,200 acres of crop land under attack or already devastated. In November of that year the first meeting of interested groups was called to consider county-wide control measures.

Organizations represented were the Franklin County Farm Bureau, Franklin County Cooperative Extension Service, Kentucky State Department of Agriculture, Agricultural Committee of the Kentucky Chamber of Commerce, State Department of Highways, Vocational Agriculture Teachers and the Kentucky Agricultural Experiment Station.

Other meetings followed, with representatives of the County ASC Committee and the Kentucky Department of Economic Development added to the earlier group. An action program emerged under which all agencies pledged cooperation to establish Franklin county as a test area for the control of Johnson grass.

In response to the need for funds to finance the study, the Department of Economic Development made grants totaling \$13,000 available to the Ken-

tucky Agricultural Experiment Station, and the State ASC office added Johnson grass control to its cost-sharing program, which subsequently was broadened to include other counties anxious to be rid of the weed.

The Battle is Joined

Franklin county's research program was initiated in August, 1957. In the following two-month period, 47 of the county's 60 farms known to have Johnson grass were visited, records of infested areas were kept and control steps recommended. Experimental plots were laid out on one infested field to supplement information obtained in the weed control project at the Kentucky Agricultural Experiment Station and that from other states' experiment stations and the U.S. Department of Agriculture.

Treatments consisted of various rates and methods of application of different herbicides along with cultural practices which had shown promise of giving effective control.

When the farms were revisited in 1958, all but five of the operators were using, or planned to use, some recommended system of control. Approximately 40 percent were counting on a relatively

long control program of mowing and/or grazing to weaken plants and prevent production of seed before undertaking final eradication.

Four were using summer fallow methods. On seven of the 19 farms which used chemicals in 1957 there was no apparent need for retreatment in 1958. Twenty-one farmers are known to have used chemical treatments in 1958. Eleven Franklin county farmers received ASC cost-sharing payments under the Johnson grass control practice in 1957, and 14 applied for the same in 1958.

The Franklin County Highway Department launched a campaign to spray county-maintained road rights-of-way in 1958. An excessive amount of rainfall delayed its operations, and some of the grass was sprayed too late for maximum control. County highway departments in some of the other counties attempted to reduce the spread of Johnson grass seed by either mowing or spraying.

Johnson grass on most of the Kentucky Highway Department rights-of-way was cut but not sprayed in 1958 because of a wet season and public sentiment against highway spraying. The F&C and the L&N railroads sprayed their roadbeds in Franklin county with good results.

In 1958, seven additional counties organized Johnson grass control programs and received approval to include Johnson grass control practices in their county ACP cost-sharing program. Data shown in Table 1 were prepared by the state ASC office.

As a result of experimental work in Franklin county in 1957 and 1958, and the necessity of obtaining additional information, the Kentucky De-

partment of Economic Development made available to the Kentucky Agricultural Experiment Station additional funds as part of its total \$13,000 grant for the fiscal year ending June 30, 1959. The State Agricultural Stabilization and Conservation Committee approved the use of county ACP funds for 1959.

Information from the State Agricultural Stabilization and Conservation office indicates there probably will be from 15 to 20 counties participating in the ACP cost-sharing program in 1959.

Cost-Sharing Procedure Formalized

In order that Johnson grass control as a cost-sharing practice can be approved for inclusion in a county program, the procedure suggested by the Kentucky Agricultural Stabilization and Conservation Committee is as follows:

1. Under the sponsorship of the County Extension Agent, or County Farm Bureau, a survey will be made of farms in the county to determine the extent of infestation. This survey will give the number of farms involved, as well as the approximate number of acres solidly infested and the number partially infested.
2. Obtain letters from county organizations such as Extension Service, Soil Conservation District Supervisor, Fiscal Court, Vocational Agricultural teachers, etc., volunteering cooperation in the program.
3. Establishing Johnson grass control committees under the sponsorship of the Farm Bureau or other farm organizations to spearhead and coordinate work of the various agencies.

Table 1. Report of Johnson Grass Control—1958 A.C.P.—Period Ending November 28, 1958

County	No. Farms Making Requests	No. Farms Qualifying for Cost-sharing	Total Acres Treated	Solidly Infested	Partially Infested	Summer Fallow Method	Lb. Sodium Chlorate	Lb. TCA Used	Lb. Dalapon Used	For Use of Chemicals	By Summer Fallow
Caldwell	13	11	244	100	144	76	100	515	350	\$296.00	\$354.48
Fayette	24	5	44	28	16	0	0	0	90	27.80
Franklin	14	6	53	9	44	8	85	25	85	106.98	48.00
Fleming	5	1	7	7	0	7	0	0	102	52.50	40.80
Henderson	32	28	704	375	329	493	1,583	0	1,190	775.13	2,958.00
Livingston	20	20	52	47	5	0	3,010	2,060	270	768.98
Simpson	41	31	887	188	699	2	5,609	109	3,885	2,197.57	14.00
Union	51	40	306	113	193	174	11,097	0	1,705	1,765.89	1,198.00
TOTALS	200	142	2,297	867	1,430	760	21,484	2,709	7,677	5,990.85	4,613.28

The operation of this program requires:

1. Agreement by the farmer in a signed statement, that measures to prevent seed production will be carried out on areas not treated. Forms ACP-201 should be prepared, which will include:

(a) acres infested, and (b) agreement to carry out complete control measures.

2. Prior inspection of the area to be treated by a representative of the county ASC committee and a report from him to the county on the forms designated for the purpose.

Part II — Research and Results

Field research in Franklin county was designed to study the control of Johnson grass in solidly infested fields during a period of three to five years—the time considered necessary for effective control.

Initial control measures were employed to destroy the greater part of the perennial rootstock population. Follow-up treatments were used to kill rootstocks that escaped initial treatment and to destroy volunteer plants starting from seed before they began to produce new rootstocks (about 7-leaf stage). Seed in the soil will continue to produce new plants for three or more years even if new seeds are prevented from infesting the land.

Partial or temporary control measures in cornfields were tested. Various soil preparation methods, pre-planting treatments with herbicides and row treatments with herbicides were compared on corn land not previously treated for rootstock con-

trol. Herbicidal treatments in corn rows also were used on land where a combination of herbicidal and cultural treatments the preceding year had practically eradicated rootstocks.

Control of Rootstock Plants

All of the herbicides applied to heavily infested plots in late August and September 1957 had significantly reduced the number of plants propagated by rootstocks by July 1958. These treatments and the results are shown in Fig. 1. Sodium dalapon applied as foliage sprays on short-regrowth Johnson grass resulted on the average in a 94 percent reduction. Repeated light applications at 7-day intervals resulted in the greatest reduction of rootstock plants, and the single application at double rate resulted in least reduction, but the difference between them was not significant.

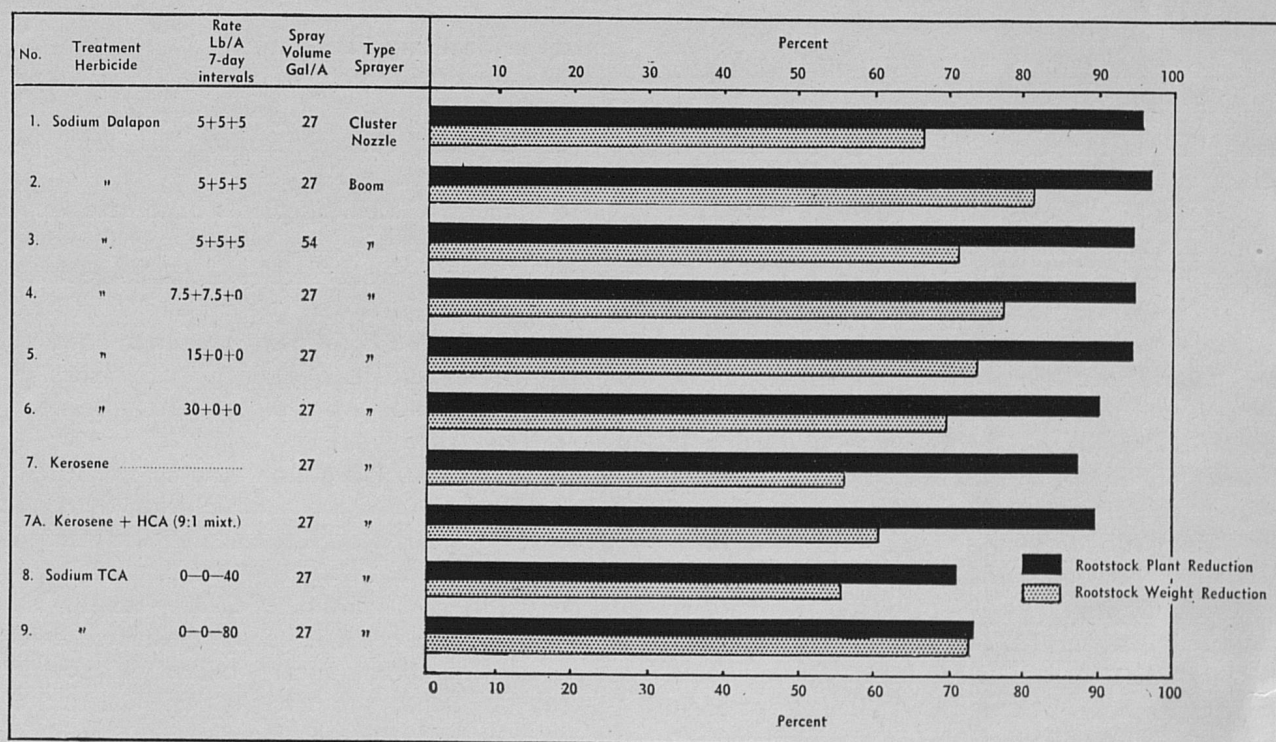


Fig. 1.—The percent reduction of Johnson grass from rootstocks in 1958 which resulted from the use of various herbicidal treatments in 1957. (The percentages are based on the check plot which received no treatment.)



Johnson grass growing uncontrolled on untreated land.

Spray mixtures of kerosene and HCA (Hexachloroacetone) for single foliage treatments reduced stands less than did the sodium dalapon sprays, but the differences were not significant. The TCA sprays on heavily-disked Johnson grass land resulted in more than 70 percent reduction of rootstock plants, significantly less than obtained by other treatments. The reduction in weight of live rootstocks as determined from soil samplings was used as a measure of effectiveness of herbicidal-cultural treatments. The weight was considerably less on a comparative basis than the reduction in number of rootstock plants (Fig. 1).

Summer fallow—early summer plowing followed by disking of the land at 2- to 3-week intervals throughout the season—was used to control rootstocks during 1958. Its effectiveness cannot be measured until the 1959 season. However, the use of this method at the Experiment Station farm, Lexington, has resulted in excellent control of rootstocks, especially during hot, dry summers. It has been much less effective in wet seasons, however.

Control of Seedling Plants

Seriousness of the problem of controlling volunteer plants developing from Johnson grass seed in soil where good rootstock control has been obtained is illustrated in Fig. 2.

The number of seedling plants in sample areas was determined during early July 1958, at the same time the rootstock plants were counted. Large numbers of seedling plants were present on plots where 1957 treatments had effectively controlled rootstock plants; whereas few seedlings developed in the untreated plot where vigorously growing rootstock plants were dense.

Two methods were used to destroy the seedlings and the escaped rootstock plants during the summer of 1958. Each plot treated in 1957 was divided lengthwise. Half was disked at 2- to 3-week intervals from June 25 until time of seeding small grain in the fall. The other half was sprayed three times at one-month intervals, using sodium dalapon at rate of 7.5 pounds per acre on June 24, and 5 pounds at each of the other application dates.

Disking was more effective than spraying in controlling both types of plants and was less expensive.

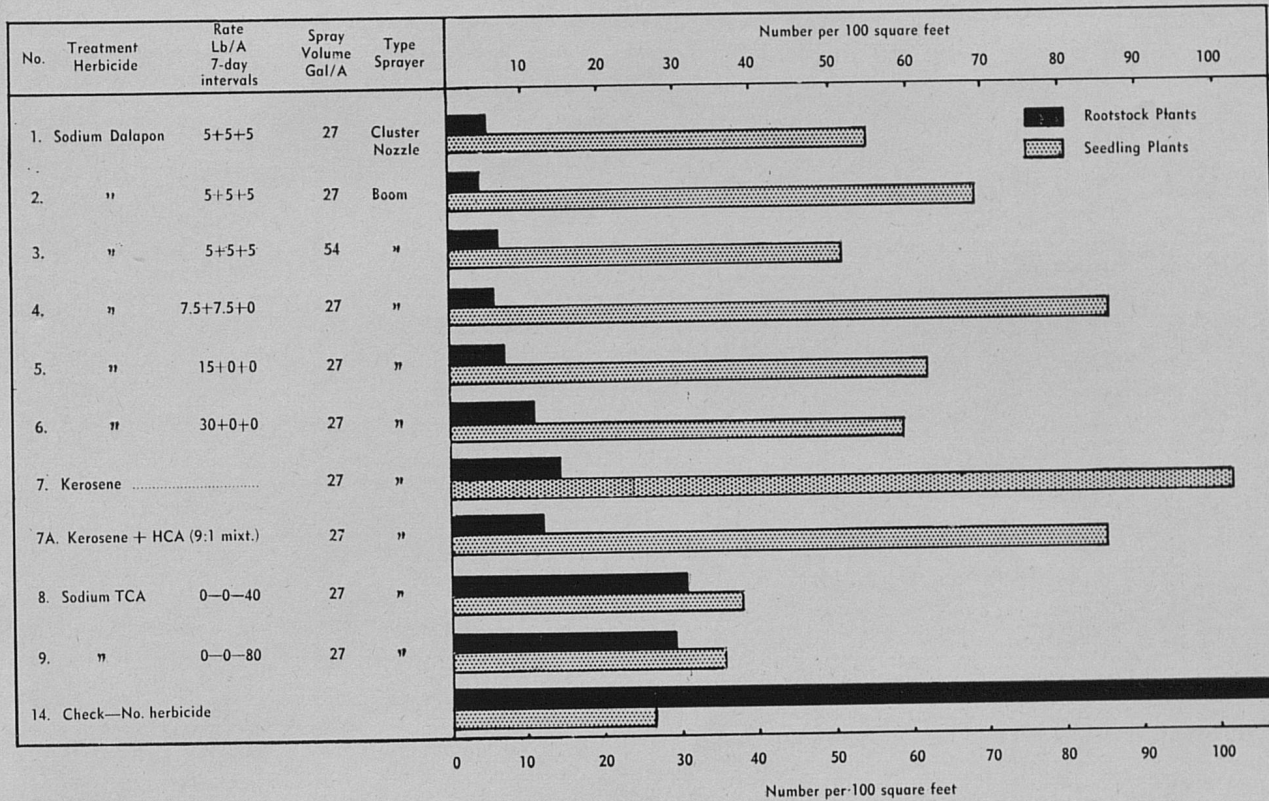
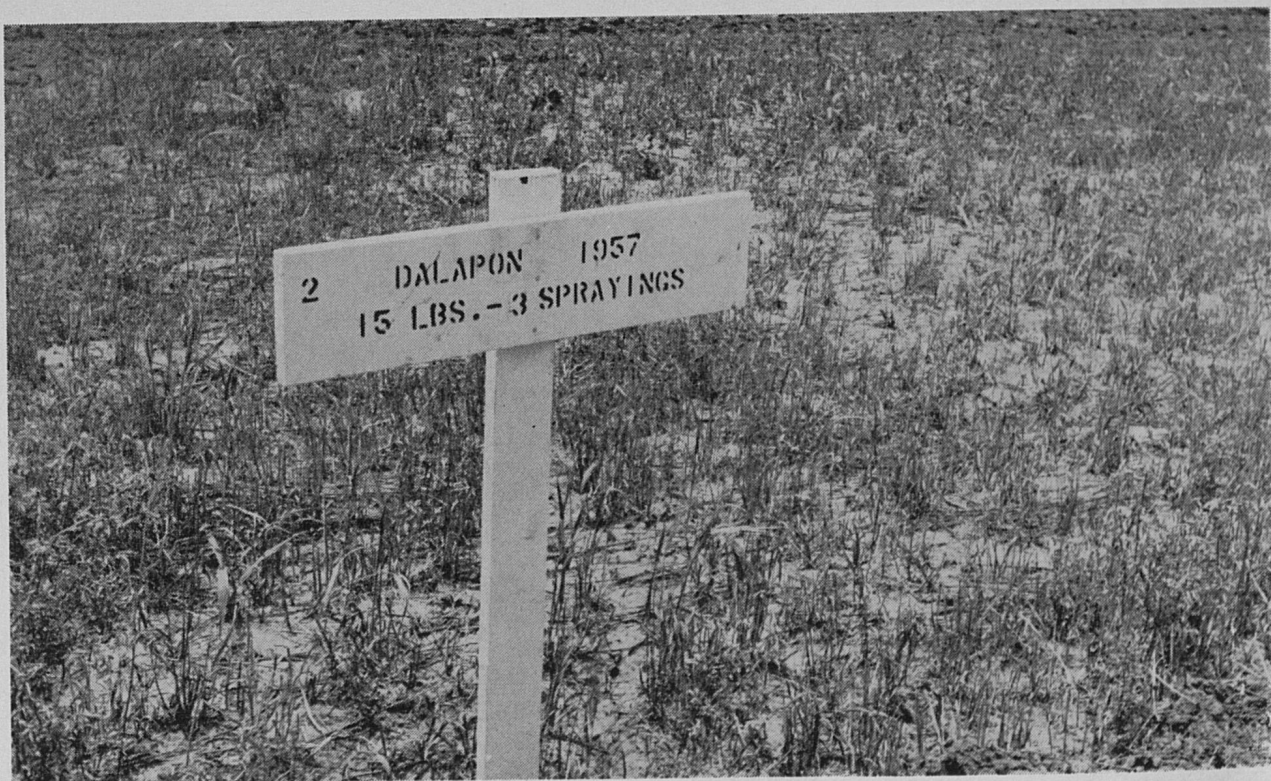


Fig. 2.— The stand (number per 100 square feet) of Johnson grass plants resulting from rootstocks and seed after various control treatments.



Repeated light spraying of Johnson grass with dalapon in 1957, followed by cultivation and a winter small grain crop, resulted in good control of root stock plants in 1958.



Mowing Johnson grass at boot stage prevents seed production and weakens rootstocks. Rootstocks may be controlled by spraying the foliage of the regrowth when 9 to 15 inches high, a week before plowing, and then clean-cultivating each month until the small grain is seeded.

Partial Control in Cornfields by Soil-Preparation Methods

Effectiveness of two methods of land preparation for reducing the stands of Johnson grass in heavily infested fields being planted to corn was tested in comparison to the usual preparation method. These methods are described in Table 2. Cultivation was used to destroy sprouting Johnson grass between the rows. Grass stems in the corn rows of each treatment were counted July 17 in a 12-inch band, 100 feet long, with results as follows:

Methods 1 and 2 resulted in about 60 and 93 percent reduction in number of Johnson grass stems, respectively, in comparison with the number for Method 3. The use of the dalapon spray on new Johnson grass foliage one week before breaking the land evidently destroyed many rootstocks and inhibited growth of plants from them; while the disking ahead of planting, nearly 3 weeks later, greatly

reduced the number of seedling-plants. Only 16 percent of the 41 stems per 100 feet of row were seedling plants.

The dalapon treatment at rate used and time-interval between spraying and planting resulted in

Table 2.— The Effect of Preplanting Treatments in Reducing Stands of Johnson Grass in Corn, 1958

Methods of preparation	No. Johnson grass stems per 100 feet of row
1. Plowed 4/30; disked 5/24; replowed 6/6; fitted and planted corn 6/7	225
2. Sprayed Johnson grass with sodium dalapon 15 lb/A, 5/31; plowed 6/6; fitted and planted corn 6/25	41
3. Plowed Johnson grass 6/6; fitted and planted corn 6/7	570



Clean cultivation every two weeks during summer after breaking Johnson grass land is a good method of controlling rootstocks in dry summers. A field cultivator equipped with overlapping flat sweeps is best for such cultivations, but a disk harrow is satisfactory.



Spraying short Johnson grass with dalapon solution. Boom-type sprayers give a desired uniform coverage of the plants.

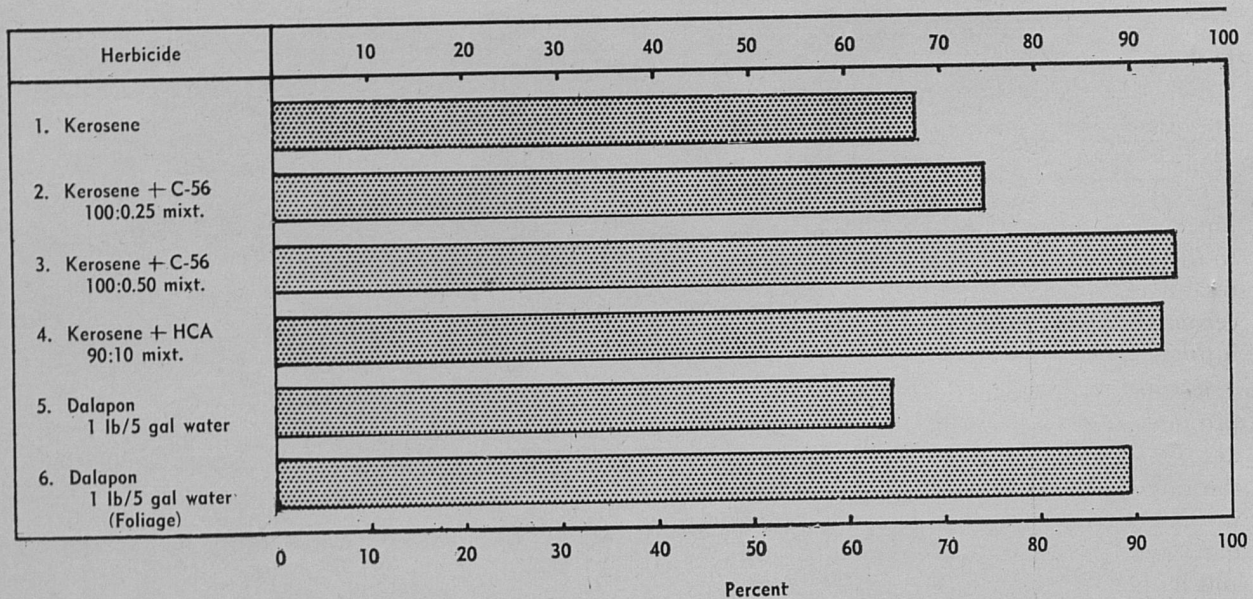


Fig. 3.— The percentage reduction¹ in number of Johnson grass stems in corn rows resulting from repeated spot treatments² with various chemicals.

¹ An average of 208 plant stems per 100 feet of corn row were present before treatment.

² Three repeat treatments were given at 9-day intervals (July 19, 28 and August 6). The spray was directed to the lower 5-6 inches of the Johnson grass plants except for treatment 6 in which the spray was applied to the foliage.

no apparent harm to stand and growth of the corn crop. The extremely late planting date which such a method entails usually is associated with lower yields of corn in years with dry summers. But late planting in 1958 with favorable moisture conditions did not greatly hamper production. Yield for this treatment was 86 bushels of corn per acre.

Follow-up Corn Control

One of the best methods of restricting growth of escaped rootstock plants and new seedling-plants

in cornfields where rootstocks have been largely eliminated is to check-plant the corn and cross-cultivate frequently with flat sweeps. Occasional Johnson grass coming up in the corn hill is destroyed by spot treating with chemicals. Unfortunately, check-planting was not included in this experiment in 1958. However, various chemicals were used in repeated spot treatments to destroy Johnson grass growing in the row of drilled corn. These treatments and the results obtained are shown in Fig. 3.



These experimental plots show the value of preplanting treatment with EPTC herbicide in checking Johnson grass seedlings in corn. (Right) A 99-percent control resulted from the use of 3 pounds EPTC per acre, incorporated into the soil, after sowing Johnson grass in rows before the corn was planted.

These spray treatments were applied by hand with a special gravity-flow knapsack sprayer having a diaphragm pump in the handle which permits the application of a small quantity of solution to individual plants.

Corn plants were shielded from the basal sprays but not from the foliage applications. Little injury to the corn was noted as a result of the basal spray treatments, but ears and stalks of corn which received the foliage sprays containing dalapon were injured.

Results of preliminary tests with EPTC, a new pre-emergence herbicide, appear very promising for destroying viability of soil-borne seed. EPTC, at the rates of 3 and 6 pounds per acre, applied and worked into the prepared soil just ahead of planting corn reduced seedling Johnson grass plants 92 and 96 percent, respectively.



Single plants or small patches of Johnson grass can be destroyed best by spot-treating the soil with soil-sterilizing chemicals, such as dry sodium chlorate broadcast in the stubble after removing the tall Johnson grass.



Using a boomless or cluster-nozzle sprayer. Double spraying with a half-swath overlap provides uniform coverage of the plants.

Part III — Summary

Based on the Franklin county experiments, recommended measures for controlling Johnson grass are summarized here:

A. Solidly Infested Fields

First year:

- (1) Spray Johnson grass with sodium dalapon, 7½ lb per acre in 20 gallons of water at each of two applications, 7 to 10 days apart, beginning when growth is 9-15 inches tall either as the first growth or as regrowth after first or second mowing at boot stage.
- (2) Break land 1 to 3 weeks after second spray application.
- (3) Clean cultivate the land with disk or field cultivator until time to sow small grain.
- (4) Sow small grain as winter cover or for harvest.

Succeeding years:

- (1) Break or disk land heavily after small grain and not later than boot stage of escaped rootstock plants or 7-leaf stage of seedlings.
- (2) Clean cultivate once every 2 or 3 weeks until time to sow small grain.

Note: Early reinfestation of the land is likely to occur if corn or other summer crop is grown before all escaped plants and most of the Johnson grass seed in the soil have been destroyed by summer cultivations during successive years.¹

B. Spots or Patches

- (1) Treat soil with dry sodium chlorate 1 to 1½ lb/100 sq ft, or spray with sodium TCA powder 4 to 6 oz/100 sq ft in enough water to spray or sprinkle soil uniformly. Treat soil when early growth is small, or remove taller growth no later than bloom stage of plants and treat in the stubble. The lower rates mentioned of either material may be used most effectively if area is worked before treatment, or spray short grass (9-15 inches high) at 6-week intervals with sodium dalapon 1 oz/gal water/100 sq ft.
- (2) Repeat treatment as required to destroy escaped plants and seedlings before they reach 7-leaf stage.

¹ Trace infestations remaining after two or more seasons of clean cultivation may be kept in check while growing corn on the land, if the crop is check-planted, Johnson grass in the middles destroyed by cross-cultivation with flat sweeps, and that in the corn hills destroyed by spot treating old plants and pulling or chopping seedlings before 7-leaf stage. In preliminary trials, soil preplanting treatments with EPTC herbicide, appears promising for partial control of seedlings in the corn row.

Table 3.—Cost of Various Methods of Control¹

	Cost/acre
Solidly infested fields—First season:	
1. Repeated dalapon sprays, plowing, and repeated clean cultivation (15 lb sodium dalapon plus 2 spray applications plus 1 plowing plus 3 diskings)	\$29.75
2. Summer fallow (plowing plus 6 diskings)	14.00
Follow-up treatments—second and later seasons:	
1. Summer fallow (after small grain, 5 diskings, 3 weeks apart)	7.50
	Cost/100 sq ft ²
Patch or spot infestations	
1. Spot treat with chemicals	
(a) Sodium chlorate 1 lb/100 sq ft. Use dry on stubble or worked soil	0.18
(b) Sodium chlorate 1½ lb/100 sq ft. Use dry on soil in short grass	0.27
(c) Sodium TCA 4 oz/gal water/100 sq ft on stubble or worked soil	0.12
(d) Sodium TCA 6 oz/gal water/100 sq ft sprayed on short grass	0.18
(e) Sodium dalapon 1 oz/gal water/100 sq ft sprayed on short grass, repeat at 6-week intervals (3 applications)	0.21

¹ Costs for herbicides are based on customary bulk retail prices; cost of field operations are custom rates per acre: plowing (breaking land) \$5.00; field spraying, \$1.50; disking, \$1.50. These rates are the median in range of prices for these operations in Kentucky Economic Area VI-a as shown in Miscellaneous Publication 65, University of Kentucky Extension Service, "Custom Rates for Farm Jobs in Kentucky—1955."

² Cost of labor in spot treating with chemicals is not included.