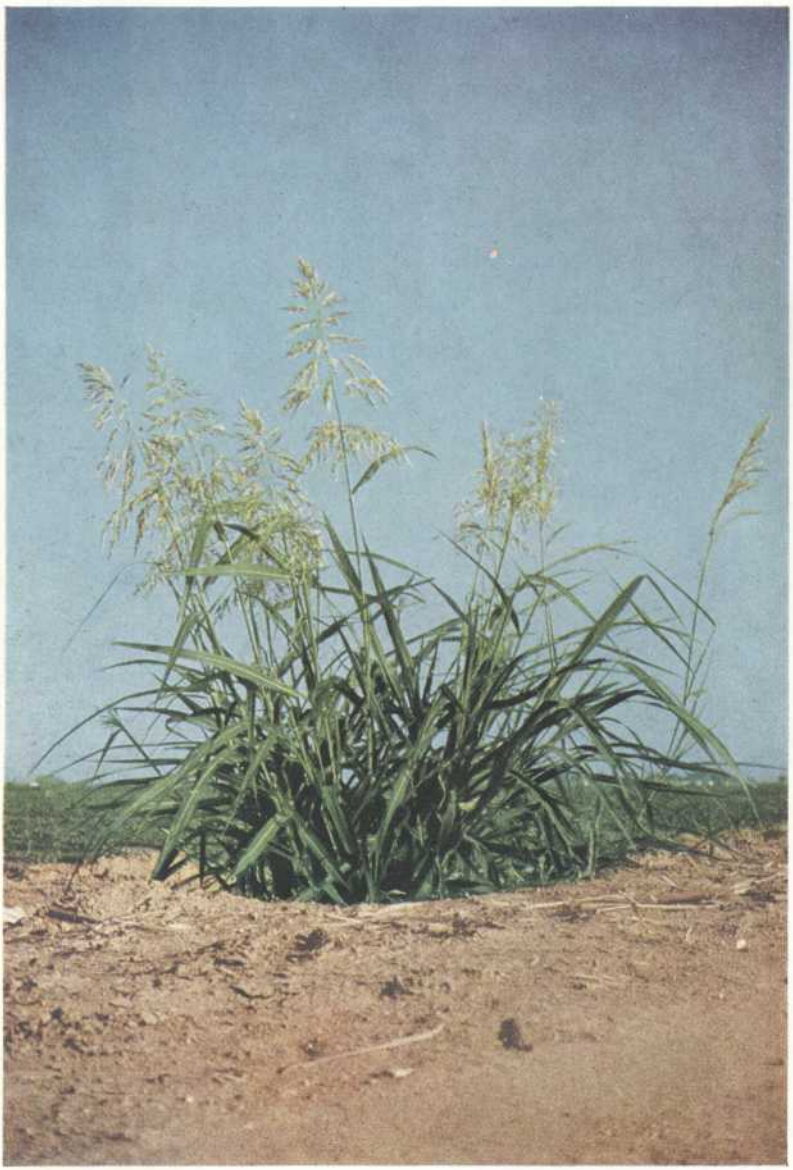
Johnsongrass Control In Arizona

Bulletin
A-53



COOPERATIVE EXTENSION SERVICE & AGRICULTURAL EXPERIMENT STATION
THE UNIVERSITY OF ARIZONA

Table of Contents

This publication is issued by the Cooperative Extension Service and the Agricultural Experiment Station of The University of Arizona. See your local County Extension Agent for additional information.

Issued in furtherance of cooperative extension work in agriculture and home economics, Acts of May 8 and June 30, 1914, in cooperation with the U. S. Department of Agriculture. George E. Hull, Director of Extension Service, The University of Arizona College of Agriculture, Tucson, Arizona. 7M—January 1968—Bulletin A-53

Johnsongrass Control In Arizona

By
K. C. Hamilton, Agronomist
And
Stanley Heathman, Extension Agronomist (Weed Control)
The University of Arizona

This publication summarizes the present recommendations for johnsongrass control in Arizona. It is based on the research and experience of the Arizona Agricultural Experiment Station and Cooperative Extension Service, the United State Department of Agriculture, the agricultural chemical industry, and farmers in Arizona and adjacent states.

New control measures developed following publication of this bulletin will be recommended in the College of Agriculture's Bulletin A-1, "Chemical Weed Control Recommendations for Irrigated Areas of Arizona."

Common and Trade Names of Herbicides

Common Name or Designation	Trade Name
Amitrole	Amino Triazole, Weedazol
Benefin	Balan
Bensulide	Prefar
Bromacil	Hyvar X
Cacodylic acid	*
Dalapon	Dowpon
DCPA	Dacthal
Dicamba	Banvel-D
Diquat	Diquat
Diuron	Karmex
DNBP	Dow General, Sinox General
DSMA	*
Ethylene dibromide	*
Methyl bromide	*
MSMA	*
Paraquat	Paraquat
Petroleum oils	
Nitralin	Planavin
Silvex	*
Sodium chlorate	*
TCA	TCA
Trifluralin	Treflan
2,4-D	

* Numerous trade names.

Herbicide rates used in this publication are stated as pounds of active ingredients.

Timetable for Johnsongrass Control on Croplands

CULTURAL

Proper Management

Of all crops to maintain their ability to compete (planting methods, fertilization, irrigation, insect and disease control).

Cultivation

To destroy seedlings and control established plants between rows.

Crop Rotation

Plant competitive winter crops — barley for hay or pasture.

Plant cultivated row crops.

Avoid sorghum on infested fields.

Mechanical Fallow

For general infestations every 5 weeks during the growing season.

CHEMICAL

Established Plants

Growing Season

Repeat, foliage applications of DSMA, MSMA, dalapon, aromatic petroleum oil, diquat, paraquat.....

All Year

Single, soil application of TCA, sodium chlorate, or bromacil for small clumps.

Seedlings

Before Emergence

Single, soil application of selective herbicides such as benefin, bensulide, DCPA, diuron, nitralin, and trifluralin.

After Emergence

One or more directed applications of selective herbicides such as DSMA, MSMA, or diuron.

Timetable for Johnsongrass Control in Ditchbanks

CULTURAL

All Year
Line ditches. Competitive grass.

Growing Season
Burning, disking, grazing, mowing.

CHEMICAL

Established Plants

Growing Season
Repeat, foliar applications of DSMA, MSMA, dalapon, aromatic petroleum oil, or amitrole.

Before Winter Rains
Single, soil application of chlorate combinations or TCA.

Seedlings

Growing Season
One or two foliar applications of DSMA, MSMA, dalapon or aromatic petrileum oil.

Before Winter Rains
Single, soil application of diuron or bromacil.

Introduction

Johnsongrass (*Sorghum halepense* (L.) Pers.) is the most troublesome perennial weed of the irrigated lands in Arizona. It reduces crop yields and quality by competing for water, nutrients, and light.

Johnsongrass growing on irrigaton ditches and drains reduces their water-carrying capacity. Dense stands of this weed harbor insects and diseases that attack crops. Dead johnsongrass can be a fire hazard along fences and bridges. At times, johngrass poisons livestock when grazed. People working in and around johnsongrass may become allergic to the plant or its pollen.

Although johnsongrass is usually a weed, it sometimes has value. It is often a forage and can be utilized as hay, silage, or pasture. It is used by wildlife for food and cover. Its roots and rhizomes reduce erosion on unlined ditches.

Johnsongrass is a serious weed in the desert valleys below 3,000 feet elevation. At the lower elevations it infests both ditchbanks and cultivated fields. At higher elevations it is troublesome on ditchbanks and pastures but less competitive in cultivated crops.

Johnsongrass usually is introduced by seed. Plants originating from seed are often called "seed grass". Once established, johnsongrass spreads both by seed and rhizomes. Spread by rhizomes can occur from the last spring frost until fall frost. Germination of seed is greatest after the first postemergence irrigation of summer crops, or after the start of summer rains.

Johnsongrass is a highly variable species. Its natural variability probably has been increased by crossing with other sorghums. When a johnsongrass plant is maintained vegetatively, most of its characteristics remain constant from year to year.

Growth of Johnsongrass Collected in Arizona

Johnsongrass strains collected in Arizona and maintained at Tucson differed in plant color and size (4 to 7 feet). The second leaf from the top of these plants ranged in width from ⅜ to 1⅔ inches and in length from 10 to 27 inches. The average length of heads of johnsongrass strains ranged from 9 to 20 inches.

Production of the first normal head varied 4 weeks between different strains. Rhizomes of johnsongrass strains varied in size, color, and distribution in the soil. Rhizomes are underground stems that contain stored foods and initiate buds which form new aerial stems.

Rate of spread by rhizomes varied from 2 to 6 feet per year. Rate of spread was affected by soil type and amount of soil cracking. Strains differ greatly in their ability to become established from rhizome segments planted in the soil.

Buds on rhizome segments differed in their ability to form aerial stems. Ability to form aerial stems was influenced by the age of the rhizome, the position of the rhizome, and soil moisture and temperature. Rhizome segments planted in the soil usually produced aerial stems within a few weeks but sometimes new growth was delayed for one to two months.

An infestation of established johngrass was perennial, but most parts of a plant lived for less than one year. In the spring aerial stems originated from rhizomes produced the previous year.

These rhizomes lost the ability to form new aerial stems by mid-summer. If new rhizomes were not produced with the aerial stems, removal of top growth during this period sometimes destroyed the established plants. There was seasonal variability in the production of new rhizomes by johnsongrass strains.

Johnsongrass strains also differed in their reaction to loose kernel smut. In certain strains most of the heads were attacked by smut, others had only a few heads affected. Smut was most severe during cool weather. Smut reduced seed production of johnsongrass but was not effective in controlling established plants. Infected stems and heads were reduced in size.

All of the strains studied resumed spring growth at the same time.

Control on Croplands

Cultural Control

The key to weed control is proper crop management. An error in management can create johnsongrass infestations that will take years to eradicate.

Proper crop rotations will simplify johnsongrass weed control. Crop rotation is most effective in controlling seedling infestations and less effective on established johnsongrass.

The effectiveness of crop rotation for weed control depends on the management of each crop. Avoid planting sorghums on fields that have johsongrass. Small grains or winter vegetables may be grown while fallowing the field during summer.

The intensive cultivation and cultural practices of vegetable production usually eliminate established johnsongrass. Summer row crops, such as cotton, can be cultivated and treated with selective herbicides to reduce infestations. Good stands of alfalfa harvested for hay control johnsongrass but poor stands of dormant alfalfa allow johnsongrass to increase during the summer.

Johnsongrass should be controlled on border ridges and field ends and edges to prevent encroachment into the field. Use short fallow periods between crops to apply control measures.

Mechanical fallow during the growing season is often the best control for general infestations of established johnsongrass. Mechanical fallow is most successful in drier areas. A season of fallow often reduces a general infestation to a few dozen plants per acre. These plants can be destroyed by directed applications of herbicides in the next crop.

When fallowing, fields should be cultivated every 4 to 5 weeks. Fallow operations remove the topgrowth and expose rhizomes to drying. Moldboard plows are more effective than disk plows. Late fall cultivation at higher elevations expose rhizomes to low temperatures. If rainfall interferes with mechanical operations, herbicide applications may be used.

Crop competition can often be used to control seedling johnsongrass. Any factor that favors growth of the crop increases its competition and reduces weed problems. The crop species and variety, planting methods and seeding rate, fertilization, irrigation, insect control, and disease control all influence crop growth and ability to compete with weeds.

Planting in moist soil under a dry mulch reduces early emergence of seedling johnsongrass. Because johnsongrass can emerge from deep in the soil this method is not completely effective. Delaying the first postemergence irrigation allows the crop to reach a stage where competition, cultivation, and herbicides will be more effective.

Early-season insect control insures normal crop growth so that the most effective cultivation and herbicide program can be employed. To reduce growth of established johnsongrass, irrigation should be scheduled to have soil moisture at a minimum when the crop matures or is dormant.

Poor stands or crops which do not shade row middles increase late-season johnsongrass growth. Shading of row middles by cotton after layby controls johnsongrass from seed but not from rhizomes. Shading of mature citrus can control johnsongrass from both seed and rhizomes.

Mechanical cultivation remains important for johnsongrass control in crops. During seedbed preparation topgrowth of johnsongrass should be destroyed.

After crops emerge, mechanical cultivation between the rows kills seedlings and retards the growth of established johnsongrass by removing the tops. Mechanical cultivaton also breaks up rhizomes and exposes them to drying. Mechanical cultivation is increasing in importance for soil incorporation of herbicides to control seedlings.

Repeated flame cultivation can be used to control seedling johnsongrass in the drill row of cotton and sorghum.

Repeated hand hoeing of general infestations or digging of rhizomes to eliminate spot infestations are no longer used extensively because of high costs and lack of labor.

Harvest methods can be altered on fields having severe johnsongrass infestations. Sorghum can be harvested

early for hay or silage rather than seed. Sometimes fields are plowed before seedling johnsongrass develops extensive rhizomes. Repeated mowing or intensive grazing weaken established johnsongrass.

Selective grazing with geese or cattle in crops has not been successful because of problems involved with handling the animals and poor weed control.

Chemical Control

When selecting a herbicide to control johnsongrass on croplands, one should consider which herbicides are available and registered for use in various crops.

Established Johnsongrass — Foliage Applications

Repeat, directed applications of herbicides to johnsongrass foliage have been effective for control of established johnsongrass in certain crops. Spot treatments are often a compromise between crop injury and weed control. Applications which emphasize crop safety may result in poor coverage and fail to control johnsongrass. Applications which give good coverage usually control johnsongrass and cause some crop injury.

In cotton, spot treatments with herbicides are economical when 5 percent or less of the field is infested. When more of the field is infested cultural controls are more practical.

The organic arsenicals, DSMA and MSMA, are the most effective herbicides for controlling established johnsongrass. Four to six pounds of herbicide per 100 gallons of water containing .2 to .5% surfactant by volume are applied to wet the clumps of johnsongrass (200 to 400 gallons per treated acre). Some formulations include the required surfactant. They are used as repeated foliage applications.

The topgrowth of the weeds is destroyed in 2 to 14 days. The first regrowth is usually chlorotic. When normal regrowth occurs another treatment is needed.

When first treated in the spring, johnsongrass is usually 8 to 24 inches high. The next application is required in 14 to 28 days depending on number of plants missed in the first treatment and rate of regrowth. The number of treatments needed for control vary with the crop and season, but may be limited by registered uses of the herbicides.

DSMA and MSMA are effective in controlling johnsongrass. The choice of materials is based on cost, effect on crop, ease of application and availability. Although MSMA gives faster top kill than DSMA, both achieve kill of rhizomes. In fallow fields, broadcast applications of DSMA and MSMA may be more economical than spot treatments. These herbicides have relatively low toxicity to mammals but treated grass should not be grazed.

Dalapon also can be applied as repeated, spot applications to control johnsongrass in cotton, grapes, and citrus. A solution containing 15 pounds of dalapon per 100 gallons of water is applied to wet johnsongrass foliage. Repeat treatments every 2 to 4 weeks are needed for plants surviving earlier applications. Dalapon may cause a temporary dormancy of buds on rhizomes. Control after one month appears good, but many stems usually emerge during following months.

Johnsongrass foliage treated with dalapon usually turns purple, then brown. Rate of top kill is dependent on temperature. In April, symptoms may not be visible for one to two weeks. In June, when temperatures are higher, topgrowth may turn brown within two days.

Repeated foliage applications of

contact herbicides such as aromatic petroleum oils, cacodylic acid, diquat, and paraquat can destroy established johnsongrass in certain crops. In fallow areas broadcast applications are possible. In crops, directed applications are often used.

The destruction of topgrowth is rapid but the plants establish regrowth quickly. Treatments must be repeated every 2 to 3 weeks.

These herbicides are expensive and control may not be obtained in a single season. Contact herbicides destroy the foliage of all plants. Water solutions of cacodylic acid, diquat, and paraquat will not injure stems of shrubs and trees as do the aromatic petroleum oils.

Established Johnsongrass — Soil Applications

Soil applications of herbicides are sometimes used to control established johnsongrass in croplands. Their use is limited to control of small clumps. Irrigation following treatment is needed. A single treatment usually destroys all johnsongrass.

Control with soil applied herbicides has been more dependable than control with foliage applications. The disadvantage of soil applications of herbicides is their high cost and injury of present and subsequent crops.

Established johnsongrass usually can be destroyed by soil applications of 600 to 700 pounds per acre of sodium chlorate (from herbicide mixtures containing sodium chlorate), 160 to 320 pounds per acre of TCA, of 10 to 15 pounds per acre of bromacil. These herbicides persist in the soil for one to several years and frequently affect following crops. Movement of herbicides from treated areas can be reduced by mechanical incorporation into the soil.

Seedling Johnsongrass — Soil Applications

Johnsongrass seedlings should be controlled before they form rhizomes. Seedling control is needed to prevent the initial cropland infestations. After established plants are destroyed, seedlings must be controlled to prevent reinfestation as long as viable seed persists in the soil.

Soil applications of several herbicides selectively control seedling johnsongrass in cotton and certain other crops. Herbicides are usually applied before planting or after crop emergence but before weeds emerge. Benefin, bensulide, DCPA, diuron, nitralin, and trifluralin control johnsongrass seedlings.

Rate must be varied with soil type. Depth of soil incorporation of herbicides is important because seedlings can emerge from relatively deep in the soil. Soils which crack when drying after irrigation allow emergence of seedlings through the cracks from below the treated layer.

Seedling Johnsongrass — Foliage Applications

Small johnsongrass seedlings can be selectively controlled in certain crops with one or more directed applications of herbicides. Low rates of DSMA, MSMA, or diuron in combination with a surfactant will destroy small johnsongrass. Weeds emerging after treatment can be controlled by additional applications.

Control on Ditchbanks

Johnsongrass is well adapted to survive on ditchbanks. It will grow during most of the year if water is available. It can also survive long periods between irrigations.

Johnsongrass on ditches is usually more difficult to control than when growing in the field. There is a greater mass of rhizomes on the ditchbank. Many of the rhizomes are independent and dormant.

In the field, cultivation breaks up the rhizomes system and fertilization and irrigation stimulates uniform sprouting of buds. Soil moisture on ditchbanks is often unfavorable for control. On ditchbanks, crop competition cannot be used to maintain control achieved with herbicides.

Control of johnsongrass on irrigation ditches is the key to complete control in a farm area. Eradication in the field is impossible if growth on ditchbanks is not controlled. Johnsongrass control in ditchbanks is more difficult where water comes from a large reservoir system. When irrigation water contains weed debris and seeds, screens can be used to remove them before water is applied to cropland.

Cultural Control

Lining ditches with concrete, gunite, or plastic or use of buried pipe are among the best methods to control weeds. If the ditches and pipe are waterproof, johnsongrass is easier to control.

Repeated mowing and disking can be used to retard johnsongrass on portions of ditches, but seldom give satisfactory control. For small ditches, intense grazing by sheep, cattle, and horses is effective but the animals may be injured or poisoned and should be provided with supplemental feed and water.

Repeated burning with liquefied petroleum can destroy established johnsongrass in a single season. Burning must be repeated every one or two weeks. The vegetation should only be seared, not charred.

Proper burning is expensive. The cost of overburning is prohibitive. Burning can be used in rotation with herbicides to remove the debris from previous treatments.

Competitive grasses can be established on ditchbanks to control johnsongrass and other weeds. Bermudagrass is very competitive but may become a more troublesome weed.

Chemical Control

The best control of johnsongrass on ditchbanks has been obtained by repeated applications of herbicides applied to the foliage. Aromatic petroleum oils were the first successful herbicides. Oil was then supplemented by dalapon. At present, DSMA and MSMA are the most successful herbicides for johnsongrass control on ditchbanks.

When herbicides are used for ditchbank weed control their effect on water quality must be considered. Contamination of irrigation water can be minimized by: (1) directing the spray to cover only the foliage of weeds, (2) spraying against, not with, water movement, and (3) diluting water from treated ditches with water from untreated sources. When herbicides are applied to ditches, the initial flow after treatment need not be applied to cropland but can be used for other purposes.

Established Johnsongrass — Foliage Applications

Control of established johnsongrass with repeated, foliage applications of herbicides is a compromise between rate of application and number of treatments. Within limits, higher rates of application require fewer treatments and lower rates require more applications to kill johnsongrass.

As successive applications weaken established infestations of johnsongrass, annual weeds and other perennials usually increase. If other weeds are not controlled, their growth may make it difficult or impossible to treat the remaining johnsongrass.

DSMA and MSMA are very effective for control of established johnsongrass. Treatment can be broadcast or directed to individual clumps of johnsongrass. Two to 6 pounds of herbicide per 100 gallons of water containing .2 to .5% surfactant by volume are applied at the rate of 100 to 400 gallons per acre. The highest rate must be used in the spring and fall while lower rates are effective during the summer.

The herbicides should be applied every 4 to 6 weeks during the growing season. After treatment has started, missing a treatment will prolong the time needed for complete control. When temperatures are low and as the plant weakens the interval between treatments may be slightly longer.

Control programs starting in the fall are sometimes more effective than the same program started the following spring. Repeated applications of DSMA and MSMA will often cause johnsongrass to be replaced by bermudagrass.

Dalapon also is used to control established johnsongrass on ditchbanks with broadcast or spot treatments. Control with dalapon is most effective when treatment is started in the early fall. Fifteen pounds of dalapon per 100 gallons of water applied at the rate of 150 gallons per acre four times per year will control most types of johnsongrass. Some strains will not be controlled by this program. Dalapon usually controls both johnsongrass and bermudagrass.

Amitrole can also be used to control established johnsongrass. Repeated applications of 15 pounds of amitrole per 100 gallons of water to wet foliage controls johnsongrass and many other grassy and broadleaved weeds. Johnsongrass leaves which develop after treatment are white or yellow. Retreatment is needed when green leaves are produced. Amitrole is more expensive than DSMA and MSMA for controlling johnsongrass.

Repeated applications of contact herbicides such as cacodylic acid, diquat, paraquat, aromatic petroleum oils, oil-water emulsions, and oil-water emulsions fortified with DNBP also control established johnsongrass. High volumes of herbicides (200 to 600 gallons per acre) are needed for complete coverage. These contact herbicides must be applied at least twice as often as DSMA, MSMA, dalapon, or amitrole. Control of johnsongrass with the contact herbicides is expensive and requires more time.

Established Johnsongrass — Soil Applications

In general, soil applications of herbicides are less effective than foliage applications for control of established johnsongrass. Herbicides applied to the soil depend on moisture to move them into the soil where they are taken up by johnsongrass roots. The success of soil applications depends on the amount and pattern of rainfall following treatment.

Poor control usually occurs under low, unpredictable rainfall. Supplemental irrigation is difficult to apply on many ditches because of the slope of the berm and soil texture. Soil herbicides should be applied before the winter rains which are more dependable than summer precipitation. Winter rains also cause less soil erosion which moves the herbicide from the treated area.

Herbicides should not be applied to the soil where they can injure desirable plants. Do not apply these herbicides to: (1) soil within the present or future root zone of trees, or (2) soil that may be moved by erosion to the root zone of trees or crop plants.

The success of soil-applied herbicides for johnsongrass control also depends on the type of ditch. These herbicides are not recommended for use on unlined ditches. On unlined ditches soil-applied herbicides usually fail to control johnsongrass at the water line. When these herbicides control all vegetation, increased erosion may change the shape of the ditch.

Soil-applied herbicides sometimes give satisfactory control of established johnsongrass on lined ditches. Control at the edge of ditches has not been satisfactory. Rhizomes under the edge of the lining are not affected by herbicides moving down in the soil. Regrowth from under the edge of ditches can best be controlled with herbicides applied to the foliage.

Where soil at the edge of ditches has a steep slope, poor control often occurs because herbicides are difficult to apply and activate. Granular formulations are more difficult to apply to sloped ditchbanks than are sprays.

When rainfall conditions are favorable, soil applications of 600 to 700 pounds per acre of sodium chlorate or 160 to 320 pounds per acre of TCA control established johnsongrass. Herbicide combinations containing sodium chlorate are difficult to apply because of the large quantities of chemical that must be applied. Rainfall must occur soon after TCA is applied or it will be decomposed by sunlight.

When soil applications of herbicides succeed on ditchbanks the results are outstanding. Many ditchbanks remain free of johnsongrass for five to ten years.

Seedling Johnsongrass

Control of seedling johnsongrass is needed to prevent the initial infestation of ditchbanks. Seedling control is also necessary to prevent reinfestation after established stands are destroyed. The small annual cost of seedling control protects the larger investment of destroying established johnsongrass.

Seedling johnsongrass usually can be destroyed by one or two applications of the herbicides applied to foliage for the control of established johnsongrass. Lower rates often can be used to control seedlings. However, new seedlings emerge when temperature and moisture are favorable.

On lined ditchbanks, seedling johnsongrass can be controlled best by soil applications of diuron or bromacil. Four to 5 pounds per acre of either herbicide should be applied before the winter rains. Control may be incomplete the first season.

A foliar-applied herbicide may be needed to control seedlings surviving the soil-applied herbicide. Retreatment will be needed in 1 or 2 years depending on the rainfall pattern after treatment. Where summer rains are dependable, diuron can be applied

with one of the foliage applications of DSMA or MSMA used to destroy the established johnsongrass.

Combinations of Controls

Johnsongrass on ditchbanks is best controlled by a combination of methods. Along lined canals the established plants can be destroyed by repeat, foliage applications of DSMA or MSMA. Soil applications of diuron or bromacil prevent seedlings from reinfesting the area. If soil sterilants are used to control most of the established johnsongrass, the surviving plants may be destroyed by repeat applications of DSMA or MSMA to the foliage.

On unlined ditches DSMA or MSMA will destroy established johnsongrass and seedlings can be controlled by: (1) low rates of soil-applied herbicides, (2) repeat applications of low rates of foliar-applied herbicides, or (3) a competitive grass such as bermudagrass.

Control in Other Areas

Established johnsongrass is often a problem in newly established bermudagrass turf. This is most common where the area was formerly cropland.

Close mowing every week destroys established johnsongrass within one year. Applications of DSMA and MSMA every four weeks also destroy johnsongrass with only slight discoloration of the bermudagrass. If the area has no ornamentals, a single application of methyl bromide or ethylene dibromide destroys clumps of established johnsongrass and treated areas are rapidly covered by adjacent bermudagrass.

Established johnsongrass along roads and in storage areas can be controlled by repeated applications of DSMA and MSMA. A single application of diuron applied to the soil controls seedlings. Repeated applications of contact herbicides such as aromatic petroleum oil control johnsongrass from both seed and rhizomes.

Johnsongrass in drainage ditches is usually only part of a neglected weed complex. Often a combination of herbicides with DSMA or MSMA for johnsongrass control and 2,4-D, silvex, or dicamba for broadleaved weeds is the best program. The application schedule and composition of the combination may be altered during the year.

On rangelands, general infestations of johnsongrass can be managed for forage production. Spots of johnsongrass can be destroyed by: (1) repeat foliage applications of DSMA and MSMA or (2) bromacil or TCA applied to soil prior to expected rains.

Choice of Programs

The best control program for johnsongrass depends on many factors which includes:

1. Type of infestation. Is the infestation in spots or general? Does it originate from seed, rhizomes, or both?
2. Land use and values. What crops are grown in the rotation? What is the value of the land?

3. Land ownership. Is the land owned, mortgaged, or rented?
4. Herbicide availability. What herbicides are commercially available, registered for use, and what is their relative cost?
5. Labor and equipment available. Is there sufficient labor and equipment to make 1 or more applications?
6. Rainfall pattern. Is there sufficient rainfall to activate herbicides applied to the soil or to interfere with mechanical operations?
7. Hand spraying vs. tractor sprayers. For limited infestations hand sprayers may be more practical than tractor sprayers.
8. Aerial vs. ground sprayers. Air applications may be necessary where there is no access along ditches, where labor and tractor time is limited, or when wet ground prevents access to the fields.

Remember

I. The cost of control should be prorated over a period of years and not charged against a single crop.

II. Control of seedling johnsongrass becomes increasingly important as the established stands are destroyed. Unless seedlings are destroyed, treated areas will become reinfested with established plants.

III. If weed control is not maintained as johnsongrass is weakened or destroyed other weeds even more difficult to control may become established.

Tables

TABLE I. Estimated control and costs of treating johnsongrass on a ditchbank with liquefied petroleum burning, aromatic petroleum oil, and dalapon in the Salt River Valley of Arizona.

Treatments	Rate/A	Number of treatments	Estimated control	Cost* per acre Herbicides and/or gas	Total
Liquefied petroleum burning		12	100%	$106.	$202.
Aromatic petroleum oil	80 gallons	7	95%	$113.	$149.
Dalapon	22 pounds	4	100%	$118.	$140.

1967 herbicide price for active ingredients: Oil = 20¢/gallon; liquefied petroleum = 4¢/pound; dalapon = $1.35/pound; labor = $1.25 per hour.

This test was conducted to determine costs of controlling johnsongrass on unlined ditchbank with liquefied petroleum burning, aromatic petroleum oil, and dalapon. Burning and herbicide applications were scheduled to obtain maximum control in a single season.

All treatments began April 12, 1957. Burning was conducted on a two-week schedule for 22 weeks. Aromatic petroleum oil and dalapon were applied when regrowth was 12-15 inches high.

Established johnsongrass was completely destroyed in one season using dalapon or burning. Seven applications of aromatic petroleum oil reduced and weakened the stand of johnsongrass but kill was not ocmplete.

The most expensive control method was the use of liquefied petroleum burning. There was little difference in cost of herbicide or gas for the various treatments. The high total cost of burning was due to the high labor requirement. Use of aromatic petroleum oil was intermediate in cost. Since grass control was incomplete, the cost of retreatment the following year must be considered. In this test dalapon gave maximum control at lowest cost.

TABLE II. Estimated control of five strains of johnsongrass and cost after repeated applications of herbicides at Tucson, Arizona.

Treatment 1964-65	Rate lb/A	Number of treatments	Estimated control April, 1966	Cost per acre for herbicide
DSMA	6.3	7	100%	$ 52.
Dalapon + TCA	10 + 5	9	97%	$120.
Dalapon	15	9	99%	$170.

1967 herbicide price for active ingredients: DSMA = 80¢/lb; dalapon = $1.35/lb, TCA = 50¢/lb.; surfactant = $5.00/gal

Herbicide applications were made in 5 strains of johnsongrass space-planted in 1963. When treatment started in the fall of 1964 plants had 100 to 200 stems. Herbicides were applied to the foliage at about 4-week intervals during the growing season until the fall of 1965. Herbicides were applied in 100 gallons of water containing ½% surfactant per acre.

Herbicide applications in 100 gallons per acre of water did not completely wet johnsongrass but gave satisfactory control. DSMA was the most effective herbicide. Four to seven applications destroyed each strain of johnsongrass. There was little difference in the effectiveness of dalapon and dalapon-TCA. Nine applications of dalapon and dalapon-TCA failed to destroy all strains of johnsongrass.

TABLE III. Estimated control of three strains of johnsongrass and herbicide costs after repeated applications of DSMA and MSMA at Tucson, Arizona.

Treatment Herbicide	Pounds per 100 gallons	Number of treatments	Estimated control November, 1967	Cost per acre for herbicide
DSMA	6	6	100.0%	$55.
DSMA	3	8	99.9%	$52.
MSMA	6	6	100.0%	$51.
MSMA	3	7	100.0%	$42.

1967 herbicide price for active ingredients: DSMA = 80¢/lb.; MSMA = 80¢/lb.; surfactant = $5.00/gal.

This test included three strains of johnsongrass space-planted in 1966. When first treated in October, 1966 plants had 60 to 80 stems. Herbicides were applied at 4-week intervals starting in April, 1967. Herbicides were applied in 200 to 400 gallons of water containing ½% surfactant per acre.

MSMA destroyed topgrowth faster and weakened regrowth sooner than DSMA. The higher rate gave complete control with less treatments than the lower rate.

* * *

For other agricultural and home-economics information see the County Extension Agents located in your county. Ask for a copy of Folder 68, List of Arizona Farm and Home Publications.