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Weed Control in Sorghum: 2011

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WEED CONTROL in Sorghum: 2011



FS525D

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Early competition, especially from grass is critical. Preemergence and postemergence herbicides are now available for sorghum. Treat broadleaved weeds early for best control. Crop stage is a critical factor for some postemergence treatments.

Grain sorghum works well in no-till systems. Herbicides to burn down existing weeds or residual treatments are useful. Early preplant and planting-time combinations for no-till are included in several sections of this publication.

Herbicide Information

Information in this publication is based on South Dakota Agricultural Experiment Station research and other research or observations. A herbicide is included only after the chemical is registered by the Environmental Protection Agency (EPA).

This information provides a summary of uses and does not imply a guarantee or responsibility for results. The label is the final guide.

Rates. Rates for most herbicides are listed as product per acre; however rates for glyphosate, 2,4-D, and bromoxynil are listed as acid equivalent (ae) per acre. Refer to charts provided to determine the amount required for the specific product being used.

Herbicide Cost. The cost per acre for the low and high rate of the most common formulation is listed. Cost of additives is included.

Time to Apply.

EPPS=Early Preplant Surface:

Applications usually 2 to 6 weeks before planting in no-till situations.

SPPI=Shallow Preplant Incorporated:

Preplant incorporated, but usually restricted to the top 2 inches of soil with single-pass incorporation.

PPI=Preplant Incorporated:

Incorporated before the crop is planted.

PRE=Preemergence:

After planting but before crop or weeds emerge.

EPOST=Early Postemergence:

POST=Postemergence: After the crop or weeds have emerged.

Resistance Management.

Refer to the table on page 11 for a brief description of each herbicide site of action. Repeated use of similar herbicide modes of action over

Multiple years may result in herbicide resistant weed populations or shifts in weed populations toward weed species that are difficult or costly to control. Maintaining the efficacy of herbicide chemistries through herbicide rotations may be an effective long-term strategy to reduce weed control costs as herbicide patents expire and weed control technology becomes less expensive. To facilitate proper herbicide site of action number is listed next to the herbicide products in this publication.

Abbreviations Used

pt	=	pint
qt	=	quart
gal	=	gallon
oz	=	ounce
lb	=	pound
ai	=	active ingredient
ae	=	acid equivalent
gpa	=	gallons per acre
L	=	liquid
DF, DG,		
SG, WDG	=	dry sprayable
WSP	=	water soluble packet
WSC	=	water soluble crystals
NIS	=	nonionic surfactant
AMS	=	ammonium sulfate
COC	=	crop oil concentrate

Safety First

Follow the Label. It is a violation of federal pesticide laws to use an herbicide in a manner inconsistent with its labeling. Read the entire label for using.

Applicator Safety. The most serious risk of exposure is during handling and mixing the concentrated product. Use protective equipment specified on the label. Use chemical resistant gloves, eye shield, long-sleeved clothing, rubber boots, and appropriate respirator as required. In case of emergency, contact the Poison Control Center via 24 hour phone line:

Poison Control Center – 1-800-222-1222

Water Protection. Water quality is a public concern. Preventing spills and accidents reduces risk of groundwater and surface water contamination. Mix herbicides away from wells and water sources. Prevent back siphoning. Install anti-backflow devices in irrigation equipment used for pesticides. Triple rinse containers. Store herbicides properly. Identify high-risk areas such as coarse soils or areas where the water table is near the surface. Be aware of herbicide properties that increase the risk of contamination in the critical area. Some treatments have specific restrictions requiring buffer strips and border areas around wells, lakes, and streams.

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Trade names for herbicides are used in this publication to aid reader recognition. The common name is also listed and is used for herbicides that are available in many labeled products. Examples of other product names are listed where possible based on information available. As patents expire and marketing agreements are formed, additional products may be marketed. Be sure crop use and application directions are followed for the product being used.

LIST of SORGHUM HERBICIDES

Aatrex, Atrazine (atrazine)	7	Metolachlor (Dual) products (s-metolachlor)	
Aim (carfentrazone)	13	Dual, Brawl, Charger Basic, Cinch, Medal ..	3
Basagran (bentazon)	12	Micro-Tech (alachlor)	5
Bicep products (s-metolachlor + atrazine)	3	Outlook (dimethenamid)	6
Bromoxynil (Buctril) products (bromoxynil)		Parallel (metolachlor)	4
Buctril, Broclean, Brox, Maestro, Moxy	11	Paramount (quinclorac)	14
Brozine (bromoxynil + atrazine)	11	Peak (prosulfuron)	14
Bullet (alachlor + atrazine)	5	Pendimethalin products (pendimethalin)	7
Callisto (mesotrione)	9	Permit (halosulfuron)	12
Degree Xtra (acetochlor + atrazine)	6	Priority (halosulfuron + carfentrazone)	13
Dicamba products (dicamba)	9	Prowl (pendimethalin)	7
Dicamba + 2,4-D		QuinStar (quinclorac)	14
Banvel + 2,4-D, Brush, WeedMaster,		Rage D-Tech (carfentrazone + 2,4-D ester) ...	13
Range Star, Rifle-D	10	Sandea (halosulfuron)	12
Dicamba + atrazine		Sequence (glyphosate + s-metolachlor)	17
Banvel + Atrazine, Marksman,		Sharpen (saflufenacil)	8
Sterling Plus, Rifle Plus	10	Shotgun (2,4-D + atrazine)	9
Establish (dimethenamid)	6	Slider (dimethenamid)	6
Expert (glyphosate+atrazine+s-metolachlor) ..	17	Sortie ATZ Lite (dimethenamid + atrazine)	7
Fallow Master (glyphosate + dicamba)	17	Stalwart (metolachlor)	4
Glyphosate products (glyphosate)	15	Starane (fluroxypyr)	10
G-Max Lite (dimethenamid + atrazine)	7	Verdict (saflufenacil + dimethenamid)	8
Gramoxone Inteon (paraquat)	15	Warrant (acetochlor)	5
Intrro (alachlor)	5	Yukon (halosulfuron + dicamba)	13
Landmaster BW (glyphosate + 2,4-D)	17	2,4-D (amine or ester)	9
Lariat (alachlor + atrazine)	5		
Lumax (s-metolachlor+mesotrione+atrazine) ...	3	Mode of Action Table	17
		Weed Response Table	18

SORGHUM HERBICIDES

DUAL or BRAWL or CHARGER BASIC or MEDAL or CINCH

(s-metolachlor) *Site of Action: 15*

(\$15.10-25.20)

1 - 1.67 pt Brawl, Charger Basic, Medal 7.62L (1 - 1.6 lb ai)

1 - 1.67 pt Dual II Magnum, Brawl II, Cinch, Medal II 7.64L (1 - 1.6 lb ai)

Grain and forage sorghum. Concep safened seed required. Very good control of several annual grasses. Fair on pigweed; does not control most other broadleaves. Rainfall is required. Good crop tolerance when using safened seed. Rates of 1.33 to 1.67 pt per acre have been satisfactory in SDSU tests on heavy soil. Minimum carrier is 10 gpa for ground or 2 gpa for air. Granules not labeled. Dual II Magnum contains benoxacor, a protectant to enhance crop safety.

EPPS. Apply 2/3 of the herbicide early preplant and the remainder at planting if treating 30 to 45 days prior. Use a split or single application if treating less than 30 days before planting.

SPPI. Usually more consistent than preemergence application. Incorporate into top 2 inches within 14 days of planting. Deeper incorporation reduces control.

PRE. Must have 0.5 to 0.75 inch of rain within one week after application.

TANK-MIX

Grain and forage sorghum. Not for lister-planted sorghum. Very good control of several annual grasses and small-seeded annual broadleaves such as pigweed, kochia, and lambsquarters. Limited control of large-seeded annual broadleaves such as sunflower. Crop injury may occur under cool, wet conditions or on alkaline or calcareous soils when using the higher rates. Use only on medium or heavy textured soils with over 1.5% OM. Tank-mix rates of 1.33 pt Dual II Magnum or Cinch plus atrazine at 1 qt of 4L or 1.1 lb of 90DF formulation per acre are suggested for most heavier soils. Minimum carrier is 10 gpa for ground or 2 gpa for air. Note atrazine carryover limitations. Atrazine is a Restricted Use Pesticide.

1-1.67 pt Dual II Magnum or Cinch 7.6L + 1-1.5 qt atrazine 4L or 1.1-1.7 lb atrazine 90DF

(\$16.00-31.80)

EPPS. As for Dual or Cinch alone.

SPPI. As for Dual or Cinch alone. Gives more consistent weed control but slightly less crop tolerance than preemergence, especially with higher atrazine rates.

PRE. As for Dual or Cinch alone.

PREMIX

BICEP II MAGNUM or BICEP LITE II MAGNUM or CINCH ATZ LITE *Site of Action: 15+5* (s-metolachlor + atrazine) (\$12.60-29.15)

Grain and forage sorghum. "Lite" formulations of Bicep or Cinch contain less atrazine and are used in situations where rotation restrictions are a concern. Bicep or Cinch products contain a safener for added metolachlor tolerance.

	<i>s-metolachlor</i> + atrazine <i>lb/gal</i>	<i>Product/A</i> <i>qt</i>	<i>Atrazine/A</i> <i>lb ai</i>	<i>EPP</i> <i>Product/A</i> <i>qt</i>
Bicep II Magnum 5.5L	2.4+3.1	1.6-2.6	1.2-2	2.1-2.6
Bicep Lite II Magnum 6L	3.3+2.7	1.1-1.9	0.9-1.3	1.5-1.9
Cinch ATZ Lite	3.3+2.7	1.1-1.9	0.9-1.3	1.5-1.9
Medal II AT	2.4+3.1	1.6-2.6	1.2-2	2.1-2.6

SPPI, EPP or PRE. Apply as for tank-mix. Note restrictions as for atrazine. Safened seed required.

LUMAX (s-metolachlor + mesotrione + atrazine) *Site of Action: 15+27+5*

(\$39.50)

2.5 qt/A. Controls several grass and broadleaf weed species, such as foxtails, witchgrass, lambsquarters, pigweed, velvetleaf, wild buckwheat, horseweed (marestail), kochia, and others. Only for use on seed treated with a safener such as Concep III. Do not apply on sandy soils. Do not use of forage sorghums.

DUAL (continued . . .)

For foliar activity on emerged weeds, add NIS at 0.25% v/v (1 qt per 100 gallons spray solution) or COC at 1% v/v (1 gallon per 100 gallons spray solution). A nitrogen product, such as AMS (8.5 lb per 100 gallons) or UAN (2.5% v/v) may also be added.

EPP or **PRE**. Do not apply after sorghum emergence. Apply from 21 days prior to planting up to preemergence. Applying within 7 days of planting increases the risk for sorghum injury. Do not incorporate.

STALWART or PARALLEL (metolachlor) *Site of Action: 15*

(\$6.55-10.95)

1-1.67 pt Stalwart or Parallel PCS 8L (1 - 1.67 lb ai)

Herbicide efficacy may be similar to or slightly less than s-metolachlor, but Stalwart is often less expensive than Dual II Magnum. As for Dual, use only where sorghum seed has been treated with a safener (Concep or Screen).

EPPS. For applications 30-45 days before planting, make a split application of 1.5 pt/A on medium texture soils or 1.67 pt/a on fine textured soils. Apply 2/3 the rate initially and the last 1/3 rate of planting. Applications less than 30 days prior to planting may be made with split or single applications. On coarse soils, apply 1.33 pt/A no earlier than 2 weeks prior to planting.

SPPI or **PRE**. Apply 1-1.33 pt/A on coarse texture soil, 1.33-1.5 pt/A on medium texture soil, or 1.33-1.67 pt/A on fine texture soils.

TANK-MIX

May be tank-mixed with atrazine for EPPS, SPPI, or PRE applications, but there is a risk of sorghum injury when conditions are cool and wet or on highly alkaline soils. Do not use on coarse texture soil or medium texture soil with less than 1.5% OM.

EPPS. Make split applications if applying 30-45 days prior to planting with 2/3 of the rate applied initially and 1/3 applied at planting. For medium texture soil, apply 1.5 pt/A Stalwart + 1.7-2 lb/A atrazine 90DF where soil OM is at least 1.5%. For fine texture soil, apply 1.5 pt/A Stalwart + 1.7-2 lb/A atrazine 90DF where soil OM is less than 1.5% or 1.67 pt/A Stalwart + 2-2.2 lb/A atrazine 90DF where soil OM is greater than 1.5%.

SPPI or **PRE**. For medium texture soil, apply 1 pt/a Stalwart + 1.3 lb/A atrazine 90DF where soil OM is at least 1.5%. For fine texture soil, apply 1 pt/A Stalwart + 1.3 lb/A atrazine 90DF where soil OM is less than 1.5% or 1.2-1.33 pt/a Stalwart + 1.6-1.8 lb/A atrazine 90DF where soil OM is greater than 1.5%.

May also tank-mix Stalwart or Stalwart + atrazine with Gramoxone, Landmaster BW, or glyphosate for applications before, during, or after planting but before sorghum emergence. Rates of the tank-mix partners vary with weed sizes.

PREMIX

PARALLEL PLUS (metolachlor + atrazine) *Site of Action: 15+5*

Grain or forage sorghum. Seed must be treated with a safener (Concep or Screen). Minimum carrier volume is 10 gpa. Apply as directed for metolachlor above.

	Metolachlor+ atrazine lb/gal	Product/A qt	Metolachlor/A lb ai	Atrazine/A lb ai
Triangle	3.2+2.7	1.84-2	1.5-1.6	1.2-1.4
Parallel Plus	2.7+2.8	2.18-2.37	1.5-1.6	1.5-1.7

MICRO-TECH or INTRRO (alachlor) Site of Action: 15**(\$10.70-21.40)****1.5-3 qt Micro-Tech 4L (1.5 - 3 lb ai)**

Grain sorghum. Concep or ProTec treated seed required. Very good control of several annual grasses. Fair on pigweed; does not control most other broadleaves. Rainfall required. Good crop tolerance when using safened seed. Rates of 2.5 to 3 qt per acre have been satisfactory in most SDSU tests. Use the high rate range for high residue applications. Minimum carrier is 10 gpa for ground or 3 gpa for air. Granules not labeled. No carryover. Restricted Use Pesticide.

EPPS. Apply 2.25-3 qt/A within 30 days prior to planting. If making split applications, first application may be applied 45 days prior to planting. May tank mix 1-2 qt/A atrazine 4L.

SPPI. Rate is 2-3 qt/A. Incorporate within 7 days of planting into the top 1 to 2 inches. Deep incorporation reduces control.

PRE. Rate is 1.5-2.25 qt/A in conventional tillage or 2-3 qt/A in minimum tillage. Must have 0.5 to 0.75 inch of rain before weed emergence.

1.5-2.5 qt Micro-Tech 4L + 0.75-1.5 qt atrazine 4L or 0.8-1.7 lb atrazine 90DF (\$13.55-24.45)

EPPS. Apply within 30 days of planting. For split application, apply 1.75-2 qt Micro-Tech plus 1-2 qt atrazine 4L within 45 days prior to planting, and an additional 0.75-1 qt at planting. Rates vary with soil texture. Do not use on sand or fine textured soil. Restricted Use Pesticide.

SPPI. If O.M.<1.5%, apply 1.5-2 qt Micro-Tech plus 1-1.5 qt atrazine 4L. If O.M.>1.5%, apply 1.75-2.5 qt Micro-Tech + 1.0-1.75 qt atrazine 4L. Rates vary with soil texture. Gives more consistent control but slightly less crop tolerance, especially at higher atrazine rates.

PRE. For conservation or minimum tillage, apply 1.5-2.5 qt Micro-Tech and 0.75-1.5 qt atrazine 4L. Rates vary with soil texture. Use slightly lower rates for conventional tillage.

PREMIX**LARIAT or BULLET (alachlor + atrazine) Site of Action: 15+5****(\$16.25-32.50)**

Grain sorghum. Use 2.5 to 5 qt Lariat 4L containing 2.5 lb alachlor (Micro-Tech) plus 1.5 lb atrazine/gal or Bullet 4L. For split application apply 3.5 qt Lariat early and an additional 1 to 1.5 qt per acre at planting. Bullet rates are 3.75 to 5 qt in a single application or 2.75 to 3 qt within 45 days of planting followed by 1 to 2 qt per acre at planting. Refer to tank-mix section for application information and precautions. Do not graze or harvest forage from treated fields for 70 days.

EPPS, SPPI, PRE. Apply as for tank-mix. Note atrazine restrictions. Safened seed required.

WARRANT (acetochlor) Site of Action: 15**1.5 - 3 qt Warrant (1.1 - 2.3 lb acetochlor)**

Supplemental label for use in grain sorghum. Rates will vary based on soil texture and organic matter. Apply 1.5 – 2.5 qt/A on coarse texture soil or 1.5 – 3 qt/A on medium or fine texture soil. Provides residual control of several annual grass weed species and some small-seeded broadleaf weed species.

SPPI, PRE. Must use seed treated with a safener.

POST. May apply to sorghum up to 11 inches tall (5-6 leaf stage). Do not use liquid fertilizer as a carrier.

DEGREE XTRA (acetochlor + atrazine) *Site of Action: 15+5* (\$19.50-36.10)

2 - 3.7 qt Degree Xtra (1.35 - 2.5 lb acetochlor + 0.67 - 1.2 lb atrazine)

Supplemental label for use in grain sorghum. Rates will vary based on soil texture and organic matter. Apply 2 – 2.9 qt/A on coarse texture soil or 2 – 3.7 qt/A on medium or fine texture soil. Controls several annual grass weed species and some annual broadleaf weed species. Degree is an encapsulated formulation of acetochlor that is released as the temperature rises above 50°F.

SPPI, PRE. Must use seed treated with a safener. Do not apply preplant incorporated on coarse or medium texture soil.

POST. May apply to sorghum up to 11 inches tall (5-6 leaf stage).

OUTLOOK or ESTABLISH or SLIDER (dimethenamid-p) *Site of Action: 15* (\$13.95-29.80)

10-21 oz Outlook or Establish or Slider 6L (0.5 - 1 lb ai)

Grain sorghum. Chemically related to Intrro or Dual. Chloroacetamide safener must be applied on the seed. Very good control of several annual grasses; sandbur and wild proso millet are partially controlled. Fair to good control of annual broadleaves such as pigweed or black nightshade if conditions are favorable. Crop tolerance appears adequate under conditions in SDSU tests. Temporary stunting or leaf wrapping may occur under high soil moisture and cool conditions. Outlook contains a more active form of dimethenamid and is used at lower rates. Weed control has been similar in SDSU tests.

Higher rates are for fine-textured soils and soils over 3% OM. Use 12 oz per acre Outlook in coarse textured soils. For grain sorghum produced under irrigation, use a minimum of 13 oz Outlook per acre. Do not apply to coarse soil (sand) with less than 3% OM and where groundwater is 30 feet or less below the surface. Minimum carrier is 2 gpa for ground or air equipment. There are no rotational crop restrictions for the next season. Winter wheat can be planted 4 months after application. Grain sorghum forage may be grazed or fed 60 days after application. Grain and fodder may be harvested and fed 80 days after application.

EPPS. For reduced or no-till systems. May be applied up to 45 days before planting; use the highest rate in the range for soil type. A split application (2/3 early and 1/3 at planting) is preferred if applying more than 30 days before planting. Burndown herbicide may be added for emerged weeds.

SPPI. Apply within 2 weeks of planting and incorporate shallowly into the top 1 to 2 inches. Avoid deep incorporation.

PRE. Requires rain prior to weed emergence.

TANK-MIX

Outlook can be tank-mixed with Gramoxone Max (12-21 oz/A), or glyphosate 3 lb ae (1-8 pt), or Fallowmaster for burndown of emerged weeds in minimum or no-till systems. Dicamba may be added to mixtures if application is made 15 or more days before planting.

10-21 oz Outlook 6L + 0.5-1 pt dicamba 4L (\$17.75-40.00)

10-21 oz Outlook 6L + 2-3.5 pt Marksman 3.3L

EPPS, PRE. Tank-mix. Do not apply preemergence on coarse soil with less than 2.5% OM.

10-21 oz Outlook 6L + 0.75-2 lb ai atrazine (\$17.00-37.95)

Tank-mix. Atrazine improves control of small-seeded annual broadleaves. Seed must be treated with a chloroacetamide herbicide safener.

Do not apply on coarse textured soils or medium textured soils with less than 1.5% OM. Higher rates are for fine-textured soils and soils with over 3% OM. For coarse textured soils use 3 pt per acre. Use a minimum of 3.5 pt per acre for sorghum under irrigation. Minimum carrier is 2 gpa for ground or air application. Under high soil moisture and/or cool conditions, temporary stunting or leaf wrapping may occur. For best performance, make preemergence surface applications within 5 days of the last tillage.

OUTLOOK or ESTABLISH or SLIDER (continued . . .)

EPPS. As for Outlook alone.

PPI. Apply within 2 weeks of planting and incorporate into the top 2 inches.

PRE. Broadcast prior to crop emergence. Rainfall required.

PREMIX

G-MAX LITE or ESTABLISH LITE or SORTIE ATZ LITE or SLIDER ATZ LITE (dimethenamid + atrazine) (\$17.70-30.95)

Grain sorghum. Use 2 to 3.5 pt G-Max Lite premix containing 2.25 lb dimethenamid-p (Outlook) plus 2.75 lb atrazine/gal. Refer to sections for Outlook alone or tank-mixes with atrazine.

PPS, SPPI, PRE, or POST. May be applied early postemergence. Best results with soil application.

PROWL 3.3L or PROWL H₂O (pendimethalin) Site of Action: 3 (\$8.30-16.65)

1.8-3.6 pt Prowl 3.3L (0.74 - 1.5 lb ai) or 2-3 pt Prowl H₂O (0.95 - 1.4 lb ai)

Acumen, Pendimax, and Stealth are other 3.3L pendimethalin products. Good control of several annual grass weed species and some small-seeded broadleaf weed species, such as kochia, pigweed, and common lambsquarters. Application options in sorghum are restricted.

POST. Apply only postemergence with incorporation (cultispray) in grain sorghum. Movement of soil to the base of sorghum plants will minimize pendimethalin contact with brace roots. Serious injury can result if applied preplant incorporated or preemergence. May be applied from 4 inch tall sorghum to the last cultivation.

AATREX, ATRAZINE (atrazine) Site of Action: 5

Grain and forage sorghum, sorghum-sudan hybrids. Excellent control of small-seeded annual broadleaves. Good control of large-seeded annual broadleaves. Poor to fair control of annual grasses. Fair crop tolerance on heavy soils. Risk of injury greatest on light, low-organic-matter soil and under cold, wet conditions. Stands may be reduced. Do not use on sandy soil.

Minimum carrier for ground application is 10 gpa. Minimum carrier is 1 qt for each quart of 4L or 1 gallon for each pound of dry formulation for aerial preplant or preemergence application. Minimum carrier is 2 gpa for postemergence aerial applications.

Corn or sorghum may be planted the following year. Lower rate used in combinations reduces carryover, but may still damage susceptible crops. Not for furrow-planted crops. Do not graze or feed forage for 21 days after application. Restricted Use Pesticide.

The maximum atrazine rate is 2 lb per acre for soil applications. The maximum rate is reduced to 1.6 lb ai per acre on fields designated at "highly erodible soils" (NEL) if there is less than 30% residue. A 66-foot buffer setback is required on HEL land. Atrazine cannot be applied within 66 feet of points where surface water enters streams or rivers or within 200 feet of lakes or reservoirs or loaded or applied within 50 feet of a well or sinkhole.

3.25-4 pt atrazine 4L or 1.8-2.2 lb atrazine 90DF (1.66 - 2 lb ai) (\$6.40-8.55)

EPPS. Apply 2/3 of the usual rate 30 to 45 days before planting and the remainder at planting. Applications less than 30 days before planting may be applied as a split or single application. Excellent broadleaf control. Restricted Use Pesticide.

SPPI. Apply within 2 weeks of planting and incorporate into the top 2 inches. Most consistent application.

PRE. Requires 0.75 to 1 inch of rain within one week of application. Less consistent than preplant.

AATREX , ATRAZINE (continued . . .)

4 pt atrazine 4L or 2.2 lb atrazine 90DF (2 lb ai) (\$7.85-8.55)

The maximum postemergence atrazine rate is 2 lb ai per acre on fields with no soil-applied atrazine in the same year. The maximum is 2.5 lb ai per acre if soil-applied atrazine is used in the same year.

EPOST. Without oil. Crop completely emerged to 12 inches high. Slightly better crop tolerance but less consistent weed control. Minimum carrier is 2 gpa for air and 10 gpa for ground.

2.4 pt atrazine 4L or 1.3 lb atrazine 90DF (1.2 lb ai) (\$4.65-5.05)

EPOST with OIL. Apply when crop is in 3-leaf to 12-inch stage. Intended for annual broadleaves less than 4 inches high. Fair crop tolerance. Greatest risk is on lighter, low-organic-matter soil and under wet, cold conditions. Stands can be reduced. Do not use on sandy soil. Add emulsifiable oil at 1 gal/A for ground applications or 0.5 gal/A for aerial applications. COC at 1 qt/A may be used for ground application. Minimum carrier is 10 gpa for ground or 2 gpa for air. Do not use liquid fertilizer carrier.

4 pt atrazine 4L or 2.2 lb atrazine 90DF (2 lb ai) (\$7.85-8.55)

WHEAT-SORGHUM FALLOW. Apply atrazine in wheat stubble as soon as possible after wheat harvest. Lower rate (1-1.5 lb/A ai) has provided short-term control when risk of carryover must be minimized. Maximum of 1 lb ai per acre suggested if pH exceeds 7.5.

SHARPEN (saflufenacil) *Site of Action: 14* (\$4.80-9.60)

1-2 fl oz Sharpen (0.02 - 0.04 lb ai)

May be used to enhance foliar activity during burndown or preemergence applications and provide about 2-4 weeks of residual weed control. Has activity on broadleaf weed species such as wild buckwheat, common lambsquarters, waterhemp, pigweed, mustard species, horseweed (maretail), cocklebur, and several others.

Some sorghum varieties may be sensitive. After application, at least 0.5 inches of rain is needed to activate the herbicide in the soil. Do not apply in fields where organophosphate or carbamate insecticides were applied at planting. More flexible rotation options than atrazine. Crop rotation restriction is 5 months or less for most crops. May tank mix with glyphosate, atrazine, Outlook, Guardsman, Clarity or other herbicides for control of grass and additional broadleaf weed species.

For foliar activity, add either MSO (1% v/v or 1 gallon per 100 gallons) or COC (1% v/v) and either AMS (8.5-17 lb per 100 gallons) or UAN (1.35-2.5% v/v or 1.25-2.5 gallons per 100 gallons). Minimum carrier volume is 5 gpa for ground applications or 3 gpa for aerial applications.

EPP or PRE. Do not apply after sorghum emergence.

PREMIX

VERDICT (saflufenacil + dimethenamid)

Grain sorghum. Seed must be treated with a chloroacetamide safener. Do not use on soils with less than 1.5% organic matter. Apply 10 – 12 fl. oz/A on coarse soils, 13 – 15 fl. oz/A on medium texture soils, or 16 – 18 fl. oz/A on fine texture soil. May have some foliar activity on weeds and short-term residual activity. Add tank mix partner, such as atrazine, if longer residual activity is desired.

PPS, PPI, or PRE. May apply up to 14 days prior to planting. If incorporating, mix only in to the upper 1 – 2 inches of the soil surface. Applications must be made prior to sorghum emergence to avoid crop injury.

CALLISTO (mesotrione) Site of Action: 27**6 – 6.4 fl. oz Callisto (0.18 – 0.20 lb ai)**

Provides residual activity on several broadleaf weed species and suppression of crabgrass. Also has foliar activity if weeds are emerged at the time of application. Callisto is sometimes referred to as a "bleacher" herbicide because it can whiten weed leaves. Tank mixing with atrazine will result in wild buckwheat control and provide more consistent weed control.

EPP or PRE. Do not apply after sorghum emergence. May apply up to 21 days prior to sorghum planting. Do not incorporate. Applications less than 7 days prior to planting increase the risk of sorghum injury if excessive moisture washes Callisto in to the soil. Injury symptoms may include whitening or bleaching of the sorghum leaves.

2,4-D Site of Action: 4**(\$1.10-1.70)****0.66-1 pt 2,4-D amine 3.8L or 0.5 pt 2,4-D ester 3.8L or 0.33 pt 2,4-D ester 5.7L or 0.5-0.6 lb/A dry amine 90WSC or 1 (2 lb-13 oz) pack 80WSP/5-7.5A (0.25 - 0.5 lb ae)**

Grain and forage sorghum. For annual or perennial broadleaf weeds. Very good control of several annual broadleaves such a sunflower or Russian thistle. Erratic on pigweed under dry conditions. Poor on kochia. Marginal crop tolerance. Small weeds may be controlled by lower rates than listed on labels. Some labels provide for higher rates to improve perennial weed control; however, users must assume increased injury risk.

Labels for 2,4-D vary. Sorghum is being interpreted by some labelers to include all forage types. Some labels include applications of 2 lb ae per acre after the dough stage as a harvest aid for grain sorghum. Consult product label.

POST. Apply when crop is 5 to 12 inches high from soil to tip of whorl leaf. Tolerance is best at the early stage. Treating at early emergence may inhibit root development and cause lodging; later spraying may cause poor seed development. Use drop nozzles after the crop is 8 inches high to minimize injury.

PREMIX**SHOTGUN (2,4-D + atrazine) Site of Action: 4+5****(\$7.90-11.80)**

Grain or forage sorghum. Shotgun 3.25L premix contains 1 lb 2,4-D ester + 2.25 lb atrazine per gallon. Rate is 2 to 3 pt per acre. A 3 pt rate provides 0.8 lb atrazine + 0.38 lb 2,4-D per acre. Total atrazine used in the season should not exceed maximum of 1.6 to 2 lb per acre for most situations. Follow crop rotation restrictions for atrazine; soybeans and other sensitive crops may be injured. South Dakota is not included in labeling for use after wheat harvest in wheat-sorghum-fallow rotations. Minimum carrier is 10 gpa for ground and 3 gpa for air. Control of several annual broadleaves is excellent. Grass control is variable. Atrazine is a Restricted Use Pesticide.

POST. Apply at 4-leaf to 12-inch crop stage. Use drop nozzles when applying more than 2 pt per acre or when crop exceeds 8 inches. Seed should be planted at least 1.5 inches deep and planting furrows should be leveled. Rate is 2 to 3 pt per acre.

DICAMBA PRODUCTS (dicamba) Site of Action: 4**(\$3.80-5.60)**

There are several dicamba products available, including **Banvel, Clarity, Sterling, and others.** Refer to specific product.

0.5 pt dicamba 4L (0.25 lb ae)

Grain sorghum. Very good control of annual broadleaves. Especially effective on kochia and pigweed. Fair to marginal crop tolerance. Maximum rate is 0.5 pt per acre. Lower rates (0.33 pt) improve crop tolerance and may be adequate for small weeds. Minimum carrier is 5 gpa for ground and 3 gpa for air. Do not add surfactant or mix with 2,4-D.

EPPS. May be applied up to 15 days before planting. Rates to 4 pt per acre may be used in fields planted to sorghum the following year.

POST. Best time to apply is the 3- to 5-leaf stage, usually within 25 days after planting. Use drop nozzles after crop is 8 inches. Do not apply after 15 inches. Injury may be severe if applied late. Do not harvest for forage before mature grain stage.

DICAMBA PRODUCTS (continued . . .)

TANK-MIX

0.5 pt dicamba 4L + 0.5-2 qt atrazine 4L or 0.6-2.2 lb atrazine 90DF **(\$5.85-14.15)**

Grain sorghum. Excellent control of annual broadleaves. Grass control is variable. Atrazine is a Restricted Use Pesticide.

POST. Best tolerance when sorghum is 3 to 4 inches. Broadleaved weeds should be less than 6 inches. Marginal crop tolerance. Risk of injury from dicamba increases at later crop stages; risk of injury from atrazine increases with cold, wet conditions. Use 0.5 to 1.25 qt of 4L or 0.5 to 1.3 lb of 90DF per acre for annual broadleaves. The maximum post-emergence atrazine rate is 2 lb on fields with no soil-applied atrazine in the same year; the maximum increases to 2.5 lb ai per acre if soil-applied atrazine is used in the same year. Do not use COC or NIS. Note rotation guidelines for atrazine. Refer to sections for dicamba or atrazine alone.

PREMIX

MARKSMAN or STERLING PLUS or BANVEL + ATRAZINE or RIFLE PLUS
(dicamba + atrazine) Site of Action: 4+5

POST. Grain sorghum. Marksman or Sterling Plus premixes contain 1.1 lb dicamba + 2.1 lb atrazine per gallon. Rate is 1.5 to 2 pt per acre. Apply as for tank-mix. Note precautions and restrictions.

BRASH, BANVEL + 2,4-D, RANGE STAR, WEEDMASTER , or RIFLE-D
(dicamba + 2,4-D amine) Site of Action: 4+4 **(\$2.75-3.70)**

POST. Apply 1 pt/A in the 3-5 leaf stage (4-8 inches tall). Best control when weeds are small (less than 3 inches tall). Application during periods of rapid growth may result in temporary plant leaning. Sorghum may be most sensitive to injury if applied during stressful conditions, such as high moisture, low fertility, or abnormal temperatures.

Recommended carrier rate is 5-40 gpa for broadcast applications, 3-10 gpa for aerial applications. Use greater volumes when applying to dense vegetation. Do not use surfactants or oils. Do not apply to sorghum grown for seed production.

Tank-mix partners may include atrazine, Basagran, Buctril, Paramount, Peak, and Permit.

STARANE (fluroxypyr) Site of Action: 4 **(\$13.25)**

0.66 pt Starane (0.14 lb ae)
0.4 pt Starane Ultra (0.14 lb ae)

For control of broadleaf weeds such as kochia (including ALS resistant), common ragweed, puncturevine, and sunflower. Apply while weeds are actively growing but before they are 8 inches tall. May be tank-mixed with several other herbicides labeled for sorghum.

Do not make more than 2 applications per season or apply more than 1.33 pt/A per season. Do not graze or harvest for forage within 40 days after application.

PRE. May be tank-mixed for burndown application after weed emergence but prior to sorghum emergence. Starane does not provide residual weed control.

POST. Make broadcast applications between the 3 and 7 leaf stage of sorghum. Drop nozzles may be used between the 8 leaf stage and boot. Do not apply after the boot stage.

BROMOXYNIL PRODUCTS (bromoxynil) Site of Action: 6**(\$7.80-13.30)****1 - 1.5 pt Buctril, Broclean, Brox, Moxy, Maestro 2L (0.25 - 0.38 lb ae)
0.5 – 0.75 pt Buctril 4EC (0.25 – 0.38 lb ae)**

Grain and forage sorghum. Most effective on small weeds. Very good to excellent control of sunflower, cocklebur, and wild buckwheat. Good control has been noted on small, actively growing kochia. Weak on pigweed. Does not control grasses or eliminate perennials. Apply bromoxynil before weeds exceed the most susceptible stage; cocklebur (8 inches), sunflower (6 inches), or wild buckwheat (6 inches). Less susceptible weeds like pigweed, velvetleaf, and wild mustard require the higher rate and must be treated before they reach 2 to 4 inches. Depending on species. Excellent crop safety. Does not cause lodging. Some leaf burn may be noted under warm, humid conditions. Contact herbicide, coverage important. Minimum carrier is 10 gpa for ground or 5 gpa for air; 5 gpa for ground or 3 gpa for air may be used if coverage is adequate with small weeds or low densities. Do not cut for feed or graze treated areas for 30 days after application.

PRE. Apply anytime before planting to crop emergence.

POST. Weeds must be emerged. Apply when sorghum is at the 3-leaf to boot stage. The crop should have reached the 4-leaf stage for the high rates.

TANK-MIX**0.75-1.5 pt bromoxynil 2L + 0.5-1.2 qt atrazine 4L or 0.6-1.3 lb atrazine 90DF (\$7.90-18.40)**

Atrazine improves control of pigweed and velvetleaf and provides short residual activity. Low atrazine rate reduced carryover and may allow rotating to crops with intermediate tolerance; however, small grain and other susceptible crops are not recommended. Apply as for bromoxynil alone. Atrazine is a Restricted Use Pesticide.

PRE. Apply bromoxynil + atrazine anytime before planting to crop emergence.

POST. As for bromoxynil alone. Crop should be at the 4-leaf stage for the high bromoxynil rate. Crop may be treated up to 12-inch stage. Crop may be retreated. Do not add COC.

**1-1.5 pt bromoxynil 2L + 0.12-0.5 pt dicamba 4L (\$8.75-18.90)
1-1.5 pt bromoxynil 2L + 0.5-1.2 qt atrazine 4L or 0.6-1.3 lb atrazine 90DF (\$9.85-18.40)**

Designed for special situations where dicamba or 2,4-D is needed to control annual or perennial broadleaf weeds. Refer to sections for each herbicide use alone. Atrazine is a Restricted Use Pesticide.

1-1.5 pt bromoxynil 2L + 0.5-3 pt glyphosate 3 lb ae (\$8.50-17.45)

Burndown prior to planting. Will improve burndown of weeds such as wild buckwheat.

PREMIX**BROZINE (bromoxynil + atrazine)**

Premix contains 1 lb bromoxynil (Buctril) plus 2 lb atrazine per gallon. Rate is 1.5 to 3 pt product/A, which is equivalent to 0.75 pt/A Buctril 2L and 0.75 pt/A Atrazine 4L. Apply as for tank-mix. Note restrictions and precautions as for bromoxynil and atrazine.

BASAGRAN (bentazon) *Site of Action: 6***(\$18.75-25.00)****0.75-1 qt Basagran 4L (0.75 - 1 lb ai)**

POST. Grain sorghum. Excellent control of cocklebur. Very good control of small sunflower. Weak on pigweed and kochia. Contact herbicide. Excellent crop tolerance. Usually applied at the 1- to 5-leaf stage. Use 1 qt COC and 2 qt 28% N per acre in minimum of 20 gpa for ground; reduce 28% N to 1 pt per acre in a minimum of 5 gpa for air. Coverage important.

TANK-MIX**1-1.5 pt Basagran 4L + 1-1.5 pt atrazine 4L or 0.6-0.7 lb atrazine 90DF (\$14.50-21.80)**

Improves control of kochia, pigweed, and lambsquarters. Atrazine rate in combination is lower than for atrazine alone, reducing risk of carryover for some crops.

POST. Apply as for Basagran alone.

PERMIT or SANDEA (halosulfuron) *Site of Action: 2***(\$12.70)****0.67 oz Permit or Sandea 75WDG (0.032 lb ai)**

Grain sorghum. Permit provides very good to excellent control of cocklebur, sunflower, common ragweed, and velvetleaf. It also controls non-ALS kochia and smartweed. Labeling includes cocklebur and velvetleaf up to 9 inches; sunflower to 12 inches. Lambsquarters control is variable. Suppression activity on milkweed has been noted. There is no activity on annual grasses. Crop tolerance is considered adequate; slight stunting and delay has been noted as the result of early, cold stress conditions.

The rate is 0.67 oz Permit per acre. Use NIS at 1 to 2 qt/100 gal. Minimum carrier is 10 gpa for ground equipment only. COC may be used in place of surfactant.

Treated fields may be replanted or rotated only to milo, field corn, soybeans (10 mo), or winter or spring wheat (3 mo). Do not graze or harvest for forage for 30 days after application.

POST. Apply from the 2-leaf but before head emergence.

TANK-MIXES**0.67 oz Permit 75SG + 0.25-0.5 pt dicamba 4L (\$14.60-18.25)**

POST. Apply before sorghum reaches 15 in; drop nozzles suggested after 8 in. Best crop tolerance at 3- to 5-leaf stage. Add NIS. Surfactant increases dicamba activity. Marksman may also be used.

0.67 oz Permit 75SG + 0.25-0.5 pt 2,4-D 3.8L (\$13.25-13.80)

POST. Apply before 8 inches. Add NIS. Considerable risk of injury.

0.67 oz Permit 75SG + 1-1.5 pt bromoxynil 2L (\$20.50-26.00)

POST. Apply as for bromoxynil. Add NIS. Some risk of temporary leaf burn.

0.67 oz Permit 75SG + 0.75-1.5 lb ai atrazine (\$15.70-18.80)

POST. Apply early post as for atrazine.

PERMIT or SANDEA (continued . . .)

PREMIX

YUKON (halosulfuron + dicamba) Site of Action: 2+4 (\$11.20-16.80)

Grain sorghum. Premix containing 12.5% halosulfuron (Permit) plus 55% sodium salt of dicamba. Rates are 4 to 6 oz per acre. Apply at 3- to 5-leaf stage for best crop safety. Use drop nozzles after 8 inches. Effective for kochia, lambsquarters, pigweed, ragweed and others.

POST. Apply as for premix. Note crop precautions. Yukon may be tank-mixed with atrazine.

PRIORITY (halosulfuron + carfentrazone) Site of Action: 2+14 (\$6.30)

1 oz Priority (0.032 lb halosulfuron + 0.008 lb carfentrazone)

Controls several broadleaf weed species, such as buffalobur, cocklebur, purslane, kochia, pigweed, common ragweed, Russian thistle, wild buckwheat, and others. May be tank-mixed with Banvel, Clarity, Marksman, 2,4-D, atrazine, or others.

Apply with NIS at 0.25% v/v (1 qt/100 gallons solution). For directed applications, 28% N (2-4 qt/100 gallons solution) or AMS (2-4 lb/A) may also be added. Minimum carrier volume is 10 gpa for ground applications or 3 gpa for aerial applications.

Avoid excessive herbicide rates directly over the row or whorls. Risk of crop injury increases with applications to wet foliage or adverse environmental conditions such as cool, cloudy, wet, or high humidity. Drop nozzles are recommended in these situations, particularly if sorghum is being grown for seed production.

POST. Apply from the 2 to 6 leaf growth stage of grain sorghum. Make applications to actively growing weeds less than 4 inches tall or rosettes less than 3 inches wide.

AIM (carfentrazone) Site of Action: 14 (\$3.45)

0.5 oz Aim EW or EC 1.9L (0.008 lb ai)

Grain sorghum. For annual broadleaf weeds. Aim gives very good to excellent control of ALS and normal kochia and velvetleaf. It also controls black nightshade, pigweed, and lambsquarters.

Apply before weeds exceed 2 to 4 inches. Crop tolerance is adequate; however application to wet foliage or during stress such as cool, cloudy, or wet weather increases foliar response. Drop nozzles may be used. Minimum carrier is 10 gpa for ground or 3 gpa for air. Add NIS at 2 pt/100 gal. No rotation restriction for labeled crops; 30 day interval for others.

POST. Apply from 30 days before planting through the 6-leaf crop stage. Rate is 0.5 oz of 1.9L per acre.

FALLOW. Apply 0.5 to 1.9 oz of 1.9L per acre with NIS or COC as a post harvest fallow or burndown prior to planting. Add NIS at 2 pt/100 gal or use COC at 1.5 to 2 pt/A. For annual weeds up to 4 inches tall or rosettes less than 3 inches.

TANK-MIXES

Aim or Avalanche may be tank-mixed with several labeled herbicides including dicamba, Paramount, Peak, or Permit.

RAGE D-TECH (carfentrazone + 2,4-D ester) Site of Action: 14+4 (\$1.85-3.70)

8-16 fl oz Rage D-Tech (0.008 - 0.016 lbs ai + 0.25 - 0.50 lbs ae)

Controls several broadleaf weed species, including winter annuals (mustards, horseweed, and others) and summer annuals (common lambsquarters, pigweed, kochia, velvetleaf, and others).

Minimum carrier is 10 gpa for ground application or 3 gpa for aerial application. Coverage is important for good weed control. Add a NIS (0.25% v/v or 1 qt per 100 gallons spray solution), COC (1-2% v/v or 1-2 gallons per 100 gallons spray solution), or a MSO (1-2% v/v or 1-2 gallons per 100 gallons spray solution).

RAGE D-TECH (continued . . .)

BURNDOWN. Apply to weeds less than 6 inches tall. May apply up to 8-16 fl oz/A at least 10 days prior to planting. Use higher rates when weeds exceed 4-6 inches tall, high weed densities, or dense residue. In addition to NIS, COC, or MSO, may add liquid nitrogen fertilizer (2-4% v/v or 2-4 gallons per 100 gallons spray solution) or AMS (2-4 lbs/A). May tank-mix with glyphosate, glufosinate, paraquat, atrazine, and others. Use appropriate adjuvants for the selected tank-mix partner. Do not apply to light, sandy soils, or soils containing less than 1% organic matter.

HARVEST AID. Apply from the hard dough stage up to 30 days before harvest (30 day preharvest interval). If canopy is dense, increase carrier rates to 15 gpa for ground or 5 gpa for aerial application.

PARAMOUNT (quinclorac) *Site of Action: 4*

(\$18.50-27.90)

5.3-8 oz Paramount 75DG (0.25-0.38 lb ai)

0.5-0.75 pt QuinStar 3.8L (0.24-0.36 lb ai)

Grain and forage sorghum. Foxtail control has been good in SDSU tests. Field bindweed is also controlled. There is activity on annual broadleaf weeds such as kochia, lambsquarters, sunflower, and Russian thistle. Weed control, especially for annual broadleaves, has been most consistent when used in a tank-mix with atrazine. The higher rates improve bindweed stand reduction. Treat foxtail before it exceeds 1 to 2 inches. Drought stress reduces activity. Crop tolerance has been adequate. Paramount 75DG at 5.3 oz rate has been used in most SDSU tests for foxtail.

Minimum carrier is 5 to 30 gpa for ground equipment. Good coverage is important. Add MSO at 1 to 2 pt or COC at 2 pt plus 2 to 4 qt 28% N or 2.5 lb AMS per acre. Only spring or winter wheat or sorghum may be planted within 10 months. Do not plant alfalfa, flax, peas, and lentils, and several solanaceous crops for 24 months and complete a bioassay. Other crops may be planted after 10 months.

POST. Apply from emergence to 12 inch sorghum. Avoid drift.

FALLOW. Paramount may be applied in fallow at 3 to 5.3 oz per acre prior to planting wheat or sorghum.

TANK-MIXES

Tank-mixes improve annual broadleaf control and provide burndown in no-till systems. In addition to atrazine, Paramount can be tank-mixed with 2,4-D, Clarity, or Peak when used postemergence in sorghum. Crop tolerance is reduced with some combinations.

5.3-8 oz Paramount 75DG + 0.5-1 lb ai atrazine

(\$20.50-32.00)

PEAK (prosulfuron) *Site of Action: 2*

(\$6.60-13.20)

0.5-1 oz Peak 75DF (0.018-0.036 lb ai)

Grain sorghum. Sulfonyl-urea (ALS) herbicide. Peak gives good to very good control of several annual broadleaved weeds including pigweed, lambsquarters, kochia, sunflower, and Russian thistle. Crop tolerance is adequate. Weeds should be small for best results.

Minimum carrier is 5 gpa for ground or 2 gpa for air. Add NIS at 1 to 4 pt/100 gal or COC at 1 to 2 qt. Rate is 0.5 to 1 oz Peak per acre; 0.75 oz (1 packet/4A) is suggested for most situations. Use the low rate (1 packet/6A) in tank-mixes for small weeds.

Crop rotation guidelines include soil pH and application dates. Carryover is extended on high pH. Corn, grain sorghum, small grain, and proso millet may be planted the following year when using the low rate and following guidelines.

POST. Apply at 5 to 30 inches. Crop tolerance is less at earlier stages.

PEAK (continued . . .)

TANK-MIXES

Combinations using the lower rate of Peak with other herbicides improve consistency for several weeds. Lower rates of Peak reduce carryover risk. Several tank-mixes are listed below:

0.5 oz Peak 75DF + 0.25-0.5 pt dicamba 4L or 1-2 pt Marksman	(\$8.50-12.20)
0.5 oz Peak 75DF + 0.25-0.5 pt 2,4-D 4L ester	(\$7.15-7.70)
0.5 oz Peak 75DF + 0.75-1 qt atrazine 4L	(\$9.65-10.70)
0.5 oz Peak 75DF + 0.5-1 pt bromoxynil 2L or 1-2 pt bromoxynil/atrazine	(\$10.50-15.50)

POST. Follow crop stage guidelines for each product. Only NIS additive is used with tank-mixes; except COC may be used with atrazine. Crop tolerance will be reduced with some combinations that include growth regulator products with surfactant additives.

GRAMOXONE (paraquat) *Site of Action: 22* (\$4.45-8.95)

1-2 pt Gramoxone Inteon 2L (0.25-0.5 lb ai)

HOODED or **DIRECTED SPRAY.** Grain sorghum. Nonselective, no residual. Controls emerged weeds between the rows. Hooded or shielded sprayers should have wheels or skids to maintain uniform height. Directed spray without hood or shield has greater risk of crop injury; sorghum must be 12 in., maximum pressure is 30 psi. No more than the lower 3 inches of the sorghum stalk may be contacted. Minimum carrier is 10 gpa. Add NIS at 1 to 2 pt or COC at 1 gal/100 gal. Weeds should be less than 6 in. Some visual crop speckling should be expected. Allow 20 days for forage or 48 days before harvesting grain.

NO-TILL

Grain sorghum works well in reduced- or no-till systems. Several soil-applied herbicides described previously are available for use at planting in minimum-till systems. These systems utilize shallow tillage to destroy emerged weeds at planting. For no-till, residual or contact herbicides replace seedbed tillage operations. Herbicides specifically for no-till grain sorghum are listed in the section below.

GRAMOXONE (paraquat) *Site of Action: 22* (\$8.95-17.85)

2-4 pt Gramoxone Inteon 2L (0.5-1 lb ai)

Paraquat is a non-selective, non-residual, contact herbicide used at planting in combination with other herbicides in no-till or reduced-tillage systems. Paraquat controls emerged grasses and broadleaves and kills top growth or perennials. Weather and temperature have less effect on performance than weed size. Weeds under 2 inches usually are controlled by the lower rate; high rate is for larger weeds or dense stands. Apply in a minimum of 10 gpa carrier for ground or 5 gpa for aerial equipment. Add NIS at 1 to 2 pt or COC at 1 gal/100 gal for ground application. For air, add 1 pt COC per acre. Paraquat is toxic if ingested. Follow handling and safety precautions. Restricted Use Pesticide.

TANK-MIXES

Paraquat products may be tank-mixed with other herbicides used for residual control. Paraquat provides burndown of emerged weeds. Add NIS at 1 to 2 pt or COC at 1 gal/100 gal for ground. Use NIS at 2 pt or COC at 1 ot/100 gal for air.

GLYPHOSATE PRODUCTS (glyphosate) *Site of Action: 9*

Glyphosate is available in several products having different formulations and different amounts of acid equivalent (**ae**) and active ingredient (**ai**). Examples include:

3 ae, 4 ai; Roundup Original (II) (RT), ClearOut 41 (Plus), Credit (Duo) (Duo Extra) (Extra), Glystar (Plus), Glyphomax (Plus), Honcho (Plus), Mirage (Plus), Cornerstone (Plus), Glyphos (X-Tra), Gly-4 (Plus), Buccaneer (Plus), Glyphosate Original, Gly-Pro, Glyphosate 41, Glyphosate 4, and Acquire. **3.75 ae, 5 ai;** Roundup UltraMax RT, Roundup UltraMax. **4 ae, 5.4 ai;** GlyStar 5, Roundup Custom. **4.17 ae;** Touchodwn Total. **4.5 ae, 5.5 ai;** Roundup Original Max, Roundup UltraMax II, Roundup WeatherMax, RT Master II. Some products require the addition of NIS; AMS products at the equivalent rate of 8.5 to 17 lb/100 gal are required for most formulations. Check crop use and application directions on the product being used.

GLYPHOSATE PRODUCTS (continued . . .)

16-64 oz glyphosate 3 lb ae (0.38-1.5 lb ae)	(\$1.40-5.50)
12-48 oz glyphosate 4 lb ae (0.38-1.5 lb ae)	(\$1.75-7.10)
12-46 oz glyphosate 4.17 lb ae (0.38-1.5 lb ae)	(\$1.30-7.10)
11-43 oz glyphosate 4.5 lb ae (0.38-1.5 lb ae)	(\$1.65-9.15)

Grain sorghum. Glyphosate is a non-selective, translocated herbicide with no soil residual weed control. It may be applied before planting or at planting before crop emergence.

BURNDOWN. Weeds should be growing actively. Water having more than 500 pm combined calcium, magnesium, or iron may reduce activity; especially at high carrier volumes. Daytime temperatures under 65° F. may also reduce activity. Avoid tillage for one day after application.

Carrier is 3 to 40 gpa for ground and 3 to 15 gpa for air. Maximum rate for air is 1 qt of 3 lb ae product. Use precaution to avoid droplet drift to non-target crops. Follow cleanup procedures to avoid damage from equipment contamination.

Glyphosate rates in this section are listed for products having 3 lb acid equivalent (4 lb ai). Use the chart below to adjust for other concentrations.

<u>Formulation</u>		<u>Amount of Product for lb ae)</u>			
		<u>0.38 ae</u>	<u>0.75 ae</u>	<u>1.5 ae</u>	<u>3 ae</u>
3 lb ae (4 lb ai)	L	16 oz	32 oz	64 oz	128 oz
3.75 lb ae (5 lb ai)	L	13 oz	26 oz	52 oz	104 oz
4 lb ae (5 or 5.4 lb ai)	L	12 oz	24 oz	48 oz	96 oz
4.17 lb ae (----)	L	12 oz	23 oz	46 oz	93 oz
4.5 lb ae (5.5 lb ai)	L	11 oz	21 oz	43 oz	86 oz

The amount of required varies according to weed species and size. Green foxtail, mustard, sandbur seedlings, and volunteer wheat seedlings are more susceptible than many other species. Suggested rate of 3 lb ae product is 16 oz for most small annuals; 12 oz per acre may be adequate for some situations. Use 20 to 24 oz of 3 lb ae per acre for large or most tolerant annuals or for post harvest stubble burndown. Rate of 32 oz of 3 lb ae per acre is for perennials.

SPOT TREATMENT. Apply before heading. Crop will be killed. Not more than 10% of total field area can be treated.

PREHARVEST. Apply after grain is less than 30% moisture. Maximum rate is 2 qt of 3 lb ae per acre. Allow minimum of 7 days before harvest.

TANK-MIX

Glyphosate is frequently used in tank-mix or premix combinations. Glyphosate 3 lb ae rates are 16 to 24 oz per acre for most situations; lower rates of 2,4-D may be adequate for some weeds. Apply before planting. Refer to label restrictions.

16-24 oz glyphosate 3 lb ae + 1 pt 2,4-D 4L (0.38 - 0.5 lb ae)	(\$3.10-3.80)
16-24 oz glyphosate 3 lb ae + 0.5 pt dicamba 4L (0.38 - 0.5 + 0.25 lb ae)	(\$5.20-7.65)

FALLOW/BURNDOWN. Banvel improves wild buckwheat control. Delay planting sorghum for 15 days after application.

16-24 oz glyphosate 3L ae + 0.66-1 pt 2,4-D 3.8L + 0.8-1.1 lb atrazine 90DF	
(0.38 - 0.5 + 0.3 - 0.5 + 0.75 - 1 lb ae)	(\$6.05-8.75)

BURNDOWN. Grain sorghum. Before planting in no-till. Less susceptible weeds such as barnyardgrass will require higher rates of glyphosate. Atrazine is a Restricted Use Pesticide.

GLYPHOSATE PRODUCTS (continued . . .)

PREMIXES

LANDMASTER BW (glyphosate + 2,4-D) (\$1.65-16.80)

BURNDOWN. Grain sorghum. LandMaster contains 0.9 lb ae glyphosate plus 1.5 lb ae 2,4-D amine per gallon and Recoil contains 1.6 lb ae glyphosate and 1.07 lbs ai 2,4-D per gallon. LandMaster BW rates are 16 to 64 oz providing 5 to 20 oz of glyphosate 3 lb ae and approximately 0.5 to 2 pt 2,4-D 4L product. Recoil rates are 36-56 fl oz/A. Apply at least 5-7 days prior to emergence.

FALLOW MASTER (glyphosate + dicamba) (\$5.80-7.95)

BURNDOWN. Grain and forage sorghum. Premix containing 1.6 lb ae glyphosate plus 0.4 lb ae dicamba per gallon> Rates are 32 to 44 oz per acre for most situations; providing 17 to 23 oz glyphosate 3 lb ae plus 3.2 to 4.5 oz dicamba 4L. Do not plant for 15 days after application.

SEQUENCE (glyphosate + s-metolachlor) (\$16.40-22.95)

BURNDOWN/PRE. Sorghum seed must be treated with a safener (Concep). The 2.5-3.5 pt/A Sequence rate is equivalent to 1-1.4 pt/A Dual II Magnum and 22-30 oz/A Touchdown Total. May add AMS at 8.5-17 lbs/100 gallons spray solution. Minimum carrier volume is 10 gpa for ground applications or 3 gpa for aerial applications.

EXPERT (glyphosate + atrazine + s-metolachlor) (\$18.90-28.35)

BURNDOWN/PRE. Sorghum seed must be treated with a safener (Concep). Premix containing 1 lb ai glyphosate plus 2.14 lb atrazine plus 1.74 lb s-metolachlor per gallon. Application rates range from 2.5 to 3.75 qt/A depending on soil texture and organic matter. Apply 3 qt/A on medium texture sol with more than 1.5% O.M., which is equivalent to 24 oz glyphosate 3 lb ae, approximately 1.5 lb atrazine, and 1.4 pt Dual II Magnum. Do not apply on sols with a pH greater than 8. Note atrazine restrictions.

Group Numbers Associated with Herbicide Sites or Modes of Action

WSSA Group Number	Site of Mode of Action	Examples
2	ALS inhibitor	prosulfuron, halosulfuron
4	Growth regulator	2,4-D, dicamba
5	Photosynthesis inhibitor (triazine, triazinone)	atrazine
6	Photosynthesis inhibitor (contact)	bentazon, bromoxynil
9	EPSP inhibitor	glyphosate
14	Cell membrane disrupter (PPO inhibitor)	carfentrazone
15	Seedling shoot inhibitor	acetochlor, metolachlor
22	Cell membrane disrupter (PSI inhibitor)	paraquat

WEED RESPONSE to HERBICIDES

WEED RESPONSE: Weed control percentages are intended as a guide for comparing alternatives. Percentages are estimated based on favorable conditions.

9 - 10	Excellent	Usually over 90%. Seldom 100%.	Best choice for weed.
7 - 8	Good	Sometimes under 80%. Seldom over 90%.	Usually satisfactory.
6	Fair	Sometimes under 70%. Seldom over 80%	Sometimes unsatisfactory.
5	Marginal	Sometimes under 50%. Seldom over 70%.	Seldom satisfactory.
4	Poor	Seldom over 50%. Erratic.	Not effective.
0	None	No control.	Not recommended.

CROP RESPONSE: Crop response is based on visual symptoms. Early-season symptoms do not necessarily cause yield losses.

N = none; VS = very slight; S = slight; M = moderate; H = High
+ = usually high part of range

Herbicide	Foxtail	Sandbur	General Broadleaves	W. buckwheat	Kochia (ALS)	Pigweed	Cocklebur	Sunflower	Field bindweed	Crop	Carryover
<u>PPI/PRE</u>											
Atrazine	5	4	8	10	10	10	7	7	2	S+	H
Dual II Magnum	9	5	4	0	4	7	0	0	0	S	N
Lumax	9	5	8	9	9	9	7	6	2	S	M
Micro-Tech/Intro	9	5	5	0	4	8	0	0	0	S	N
Outlook	9	5	4	0	4	7	0	0	0	S	N
Sharpen	0	0	7	6	4	7	7	7	0	S	N
Verdict	9	5	7	6	4	7	7	7	0	S	N
Warrant/Degree	9	5	5	0	4	8	0	0	0	S	N
<u>POST</u>											
Aim	0	0	7	4	7	8	6	6	3	S+	N
Atrazine+oil	4	3	8	10	9	10	8	9	3	M	M
Basagran	0	0	6	8	6	9	5	5	5	VS	N
Bromoxynil	0	0	8	9	9	6	9	9	4	S	N
Bromoxynil/atrazine	4	3	9	10	10	9	9	9	4	S	M
dicamba	0	0	9	9	9	9	7	8	7	M+	N
dicamba+atrazine	4	3	9	10	9	9	9	9	7	S	S+
dicamba+2,4-D	0	0	9	9	9	9	9	9	7	M+	N
Paramount	7	6	4	2	2	4	0	3	8	VS	S
Paramount+atrazine	7	6	8	9	9	9	8	9	8	S	M
Peak	0	0	7	8	3	8	9	9	4	S+	M
Permit	0	0	7	4	3	8	9	8	2	S+	S
Priority	0	0	7	5	7	9	9	9	3	S+	S
Rage D-Tech	0	0	7	7	8	8	8	7	6	F	N
Starane	0	0	6	6	10	2	6	6	0	VS	N
Yukon	0	0	8	7	7	9	9	9	6	S+	M
2,4-D	0	0	7	6	5	8	9	7	7	M	N

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South Dakota
Cooperative Extension Service

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