IMIFLEX™ HERBICIDE

PRODUCT USE GUIDE

UPL

OpenAg™

Introduction

This Product Use Guide provides technical information and best practices for IMIFLEX™ Herbicide for use with **igrowth®** sorghum. This guide is not a product label. Please read and follow all label instructions, precautions and stewardship guidelines of any agricultural or pesticide products used in your operation.

For more information about IMIFLEX, talk to your consultant, local UPL representative or retailer, or visit **www.sorghumpotential.com**.

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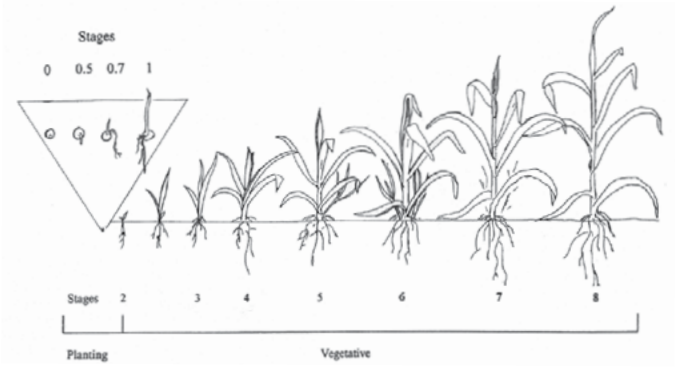
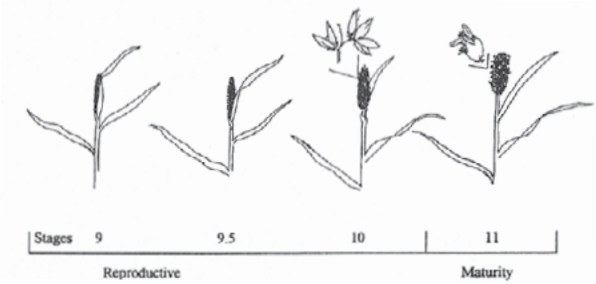
GROWTH STAGES

STAGE	DESCRIPTION
1	Emergence
2	1st leaf visible
3	3rd leaf visible
4	5th leaf visible
5	Tillering
6	Stem elongation
7	Flag leaf visible
8	Booting, end of vegetative growth
9	Inflorescense emergence
10	Anthesis; 50% of panicle flowering
11.1	Grains at milk stage
11.2	Grains at early dough stage
11.3	Grains at late dough stage
11.4	Grains at black layer
11.5	Mature grains; ~15% moisture





GROWTH STAGE MANAGEMENT CONSIDERATIONS

GROWTH STAGE	MANAGEMENT CONSIDERATIONS
Emergence	• Planting depth, date and soil conditions can all influence stand establishment. • Seed treatment can aid establishment and mitigation of early season stress. • Apply pre-emergence herbicides prior to crop emergence and weed seed germination.
3-Leaf Stage	• Approximately 10 days after emergence. • Slow growth and poor weed control can seriously reduce yield.
5-Leaf Stage	• Approximately 3 weeks after emergence. • Yield potential begins to develop as plant enters a rapid period of growth. • Stress at this stage can significantly reduce yields. • Control weeds and side-dress nitrogen prior to or at this growth stage.
Growing Point Differentiation	• Approximately 30 days after emergence. • Period of rapid growth and nutrient uptake.
Boot Stage, Flowering and Grain Fill	• Severe moisture and heat stress at these times can result in poor head exertion, pollination and grain fill. • Maximum water use occurs during boot and flowering.

HYBRID SELECTION

- **Maturity** is one of the first characteristics for sorghum hybrid selection.
- Consider traditional weather patterns, first frost and available resources.
  Early: ≤ 60 days to mid-bloom
  Medium-early: 61–65 days
  Medium: 66–70 days
  Medium-late: 71–75 days
  Late: ≥ 76 days
- Evaluate regional yield data of hybrids under consideration.
- **Tillering** characteristics of a hybrid can determine its ability to produce more tillers in the presence of early, favorable growing conditions or maintain the intended planting population.

  Growers should consider traditional weather patterns and available resources to determine the tiller population their environment can likely sustain.
- **Standability** of hybrids references their lodging resistance.
- **Weathering** is an important characteristic that describes the hybrid's ability to withstand storm damage and maintain quality between maturity and harvest.
- **Stay-green** is a characteristic that allows producers to understand the hybrid's ability to maintain prolonged leaf and stalk integrity following flowering.

  This trait can allow hybrids to take advantage of late season rains and maintain stalk health.
- **Aphid tolerance** is an important consideration, as this can help producers offer an integrated approach to managing pests such as sugarcane aphids.

  Alta Seeds™ offers premier sugarcane aphid tolerance with their Aphix™ hybrids.
- **Panicle (head) type** references the compactness of the grain head — loose, open heads may be preferred in areas with high humidity and greater pressure from insect feeding.
- **Herbicide tolerance** is a new characteristic available to sorghum producers with the introduction of the innovative **igrowth®** production system from Alta Seeds.

  Growers have a new avenue to manage tough-to-control weeds with IMIFLEX Herbicide for use with **igrowth** grain and forage sorghum.

PRODUCTION BASICS

PLANTING

- 5-day average soil temperature is a key consideration for determining sorghum planting date.

  Ideal soil conditions are at least 60–65°F — temperatures colder than this can result in poor stand establishment and slow growth.

- Growers should also consider maturity, environmental conditions and weather forecasts when determining the proper planting date.
- Target seeding rates in seeds per acre appropriate for the environment, management strategies and tillering/growth characteristics of the hybrid.
- Traditional row spacing of 30″ is common in sorghum production, with the ability to be planted down to 15″ rows with respective adjustments to seeding rate.
- Ensure good seed to soil contact and available soil moisture.
- Plant seed at a depth of 1.0–1.5 inches.

  Deeper planting of 2.0+ inches can result in emergence issues and spindly seedlings.

- Seed treatments can provide early season disease and insect control, in addition to incorporating safeners for the use of Group 15 herbicides like MOCCASIN™ II Plus.

  Ask your Alta Seeds or UPL representative about VERTIX™ Seed Treatment options.

FERTILITY

- Sorghum is responsive to fertilization, especially nitrogen.
- Conduct a pre-plant soil test to determine the fertility status of your field.
- Base your additions of nitrogen, potassium, phosphorus and other nutrients on the results of your soil test and targeted yield for that environment.
- Incorporate immobile nutrients like phosphorus via tillage or subsurface placement to increase use efficiency.
- Mobile nutrients like nitrogen should also be incorporated via tillage, subsurface placement, rainfall or irrigation to enhance their use efficiency and availability.
- A general rule for nitrogen is 2 lbs of actual N per acre per 100 lbs of yield goal.
- When side-dressing nitrogen mid-season, apply by the time sorghum reaches the 5-leaf stage to ensure adequate availability during peak periods of growth.
- Foliar applications of iron can aid in combating iron chlorosis, which can be a significant problem especially on low iron soils with pH ≥ 7.8.

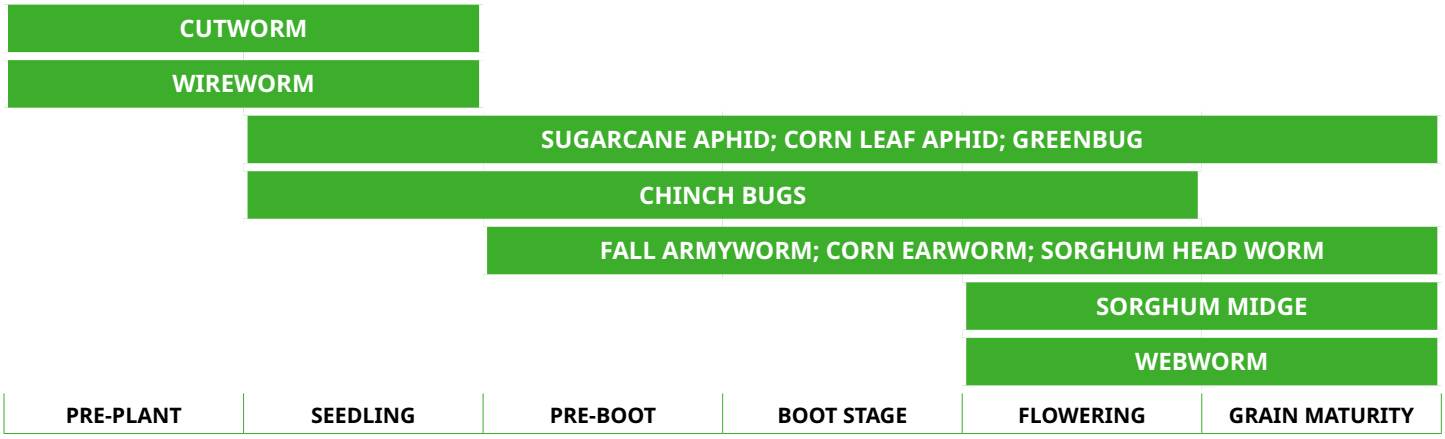
  Always consult labels and local resources when mixing iron with herbicides, as iron can reduce the efficacy of certain herbicides.

PRODUCTION BASICS

INSECT MANAGEMENT

- Crop rotation, residue and alternative host management, hybrid selection, seed treatments, planting date, fertilization and irrigation can all play a part in management of damaging insects.
- Regular scouting of fields is key to monitoring insect activity and recognizing treatment thresholds.
- Common insects of economic importance include but are not limited to cutworms, wireworms, sugarcane aphids, corn leaf aphids, greenbugs, chinch bugs, midge, sorghum headworm complex (corn earworms and fall armyworms) and webworms.
- A variety of insecticides targeting particular insects are available for sorghum.
- LAMBDA-CY® Insecticide from UPL offers control of a variety of damaging insects including but not limited to midge, cutworms, sorghum headworms, webworms and chinch bug.

RELATIVE GROWTH STAGE AND CORRESPONDING INSECT ACTIVITY



igrowth BASICS

- The world's first commercial herbicide-resistant technology for sorghum sold by Alta Seeds.
- Contains a non-GMO imidazolinone-tolerance technology, which allows farmers to spray IMIFLEX Herbicide for pre- or post-emergence control of grass and broadleaf weeds.
- IMIFLEX Herbicide is the only imidazolinone herbicide certified for use with **igrowth** sorghum.
- **igrowth** has been released in several international markets and is now fully available in the United States.
- The non-GMO nature of **igrowth** combined with the friendly environmental profile of IMIFLEX Herbicide means no export or feeding restrictions for **igrowth** sorghum treated with IMIFLEX Herbicide.
- **igrowth** exhibits excellent crop safety with IMIFLEX Herbicide.
- Contact your local Alta Seeds dealer to learn more about the hybrids available in your region.

igrowth®

CONVENTIONAL

igrowth and IMIFLEX

TECHNICAL INFORMATION

Sorghum growers now have an easy way to get the most value from their sorghum acres. IMIFLEX™ Herbicide is the only IMI herbicide certified for use in the innovative, non-GMO **igrowth®** sorghum production system. Broad-spectrum and residual IMIFLEX controls even the toughest grass and broadleaf weeds in **igrowth** sorghum, helping realize the full potential of your sorghum acres. IMIFLEX Herbicide is also flexible, as it can be used pre- or post-emergence in conservation and in conventional tillage production systems.

ACTIVE INGREDIENT

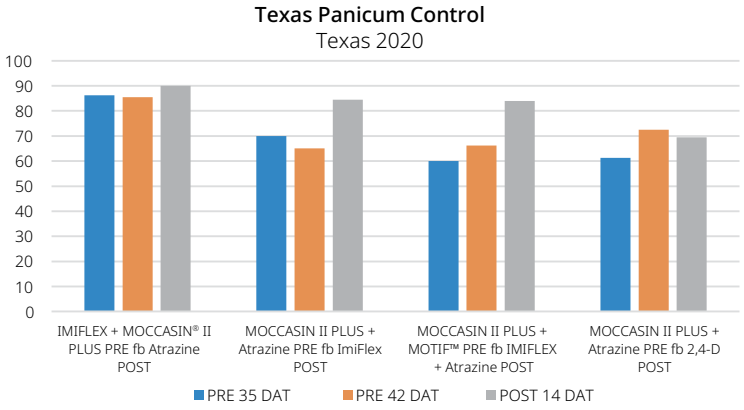
Ammonium salt of imazamox

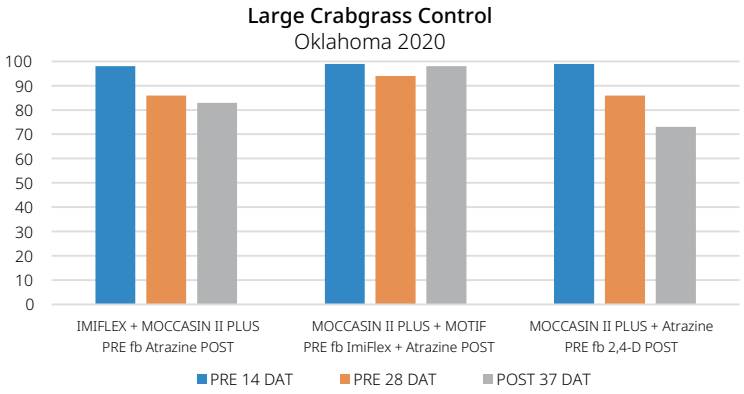
MODE OF ACTION

Group 2, ALS inhibitor

FEATURES & BENEFITS

- Broad-spectrum systemic herbicide for use in sorghum containing the Alta Seeds® **igrowth** tolerance technology
- Excellent crop safety with **igrowth** sorghum.
- Consistent performance across geographical regions.
- Flexible application timing can be used pre- or post-emergence.
- Long-lasting control of hard-to-kill grassy weeds including Texas panicum, crabgrass and foxtail.
- Compatibility with traditional sorghum herbicide programs.
- 0-day pre-harvest interval and no grazing or feed restrictions.





RATES AND TIMING

WEED TIMING	RATE/ACRE
PRE-EMERGENT Apply IMIFLEX Herbicide before or after **igrowth** sorghum planting but prior to weed germination.	**6–9 fl oz/acre** At these rates, 1 gallon of IMIFLEX Herbicide will treat 14.2–21.3 acres of **igrowth** sorghum.
POST-EMERGENT Apply IMIFLEX Herbicide as an early post-emergent when weeds are actively growing and before weeds exceed a height of 3 inches.	**6 fl oz/acre** At this rate, 1 gallon of IMIFLEX Herbicide will treat 21.3 acres of **igrowth** sorghum.

ROTATIONAL INTERVALS

CROPS	MONTHS
Clearfield crops, soybeans	Anytime
Alfalfa, wheat (non-Clearfield)	3
Corn	8.5
Cotton	9
Sorghum (all types, including igrowth)	18
Canola (non-Clearfield)	26

Note: Refer to IMIFLEX label for complete list of other rotational crops.

APPLICATION GUIDE

WEEDS CONTROLLED

GRASS WEEDS

Barnyardgrass
Bluegrass, annual[1]
Broadleaf signalgrass
Corn, volunteer[2]
Crabgrass (large, smooth)
Crowfootgrass
Foxtail (giant, green, yellow)
Goosegrass[1]
Jointed goatgrass
Lovegrass
Millet (wild, proso)
Oat, wild
Panicum (wild, Texas[1])
Quackgrass[1]
Rye (feral, cereal)
Ryegrass, Italian
Wheat, volunteer[2]

SEDGES

Nutsedge (purple[1], yellow[1])

BROADLEAF WEEDS

Bindweed, field (seedling)
Bindweed, hedge (seedling)
Cocklebur, common
Dandelion[1]
Dock, curly[1]
Kochia[3]
Jimsonweed
Lambsquarters, common
Mallow, venice
Morning glory spp.
Mustard spp.
Nightshade species
Pigweed spp.[3]
Puncturevine
Purslane, common
Ragweed (common[3], giant[3])
Smartweed spp.
Spurge, prostrate
Sunflower
Thistle (Canada[1], Russian)
Velvetleaf

[1]Suppression only.
[2]Except imidazolinone-resistant varieties/hybrids.
[3]Control of light-to-moderate populations of ALS-susceptible biotypes only.

APPLICATION NOTES

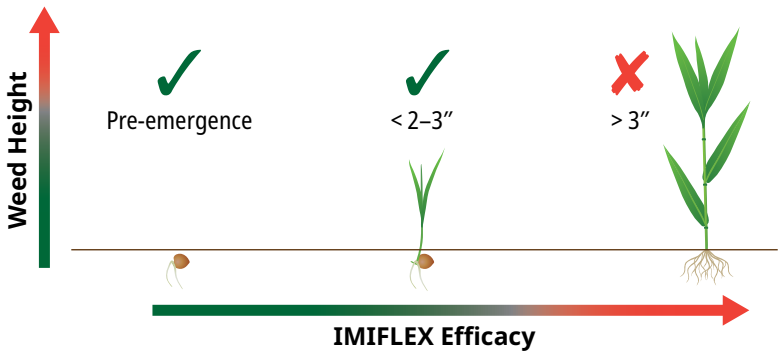
- Only 1 application of IMIFLEX Herbicide to **igrowth** sorghum per year.
- Maximum use rate of 9 fl oz/A pre-emergence and 6 fl oz/A post-emergence.
- Only apply IMIFLEX Herbicide to sorghum hybrids designated as having the **igrowth** trait.
- IMIFLEX Herbicide has no pre-harvest interval or feeding/grazing restrictions.

PRE-EMERGENCE APPLICATIONS

- Use normal burndown and/or tillage operations prior to planting.
- Apply IMIFLEX Herbicide before or after **igrowth** sorghum planting but prior to weed germination.
- Apply in combination with other pre-emergence herbicides, such as MOCCASIN™ and MOTIF®.
- Activate pre-emergence activity of IMIFLEX Herbicide with rainfall or irrigation.
- Follow with a normal post-emergence herbicide program.

POST-EMERGENCE APPLICATIONS

- Use a strong pre-emergence program that contains products such as MOCCASIN and MOTIF.
- Apply IMIFLEX Herbicide early post-emergence when weeds are actively growing and before weeds exceed a height of 3 inches OR 21–28 days after the pre-emergence program is applied, whichever comes first.
- Apply IMIFLEX Herbicide in combination with atrazine.
- Target applications to weeds in conditions where they are actively growing, warm night and daytime temperatures. Performance can be less than optimal when weeds are stressed.
- Use a strong adjuvant package or COC, MSO or NIS in addition to a nitrogen source.
- Apply prior to sorghum exceeding 20″ in height.
- Follow with a normal post-emergence herbicide program.



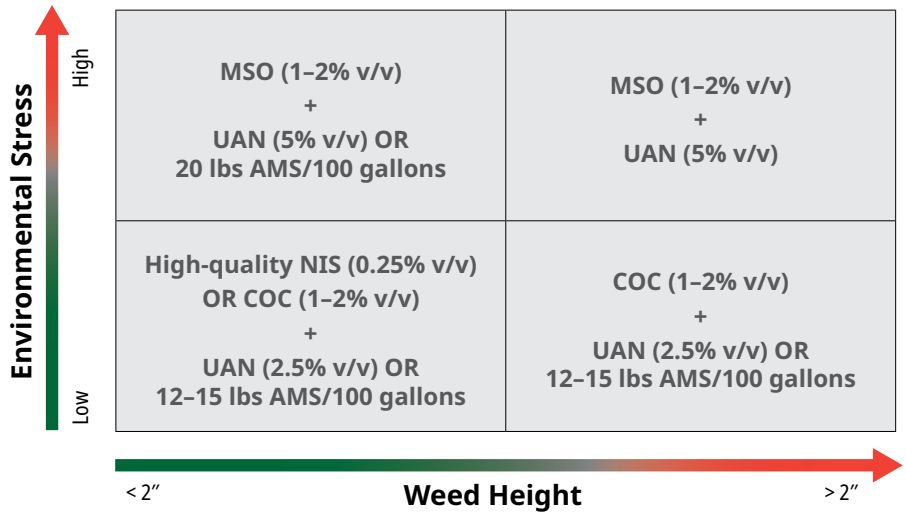
ADJUVANTS

- Adjuvants are necessary to optimize the performance of IMIFLEX Herbicide.
- Apply IMIFLEX Herbicide with a COC, MSO or NIS, all in combination with a nitrogen source.
- MSO and higher rates of the respective nitrogen source are advised when weeds are under temperature or moisture stress.
- If applying IMIFLEX Herbicide with 2,4-D or dicamba, use NIS in place of COC or MSO.
- Ensure adjuvants fall within label guidelines of all tank-mix partners.
- UPL recommends the use of CPDA-certified adjuvants, whenever possible. These adjuvants are certified to meet industry standards for quality and performance.

IMIFLEX ADJUVANT RECOMMENDATIONS

<table>
<tr><td colspan="3">Use one of the following oil-based adjuvants or NIS AND one of the following nitrogen fertilizer sources with post-emergent applications of IMIFLEX Herbicide.</td></tr>
<tr><td>COC (1 – 2% v/v),
MSO (1 – 2% v/v),
or HSOC (0.5% v/v)

MSO is advised when weeds are under moisture or temperature stress.</td><td>OR</td><td>NIS (0.25% v/v) containing at least 80% active ingredient</td></tr>
<tr><td colspan="3">AND</td></tr>
<tr><td>28% UAN, 32% UAN, liquid AMS or 10-34-0 at 2.5% v/v</td><td>OR</td><td>12–15 pounds/100 gallons of spray-grade AMS</td></tr>
<tr><td colspan="3">When targeting weeds under moisture or temperature stress, use higher nitrogen fertilizer rates (UAN at 5% v/v or 20 pounds AMS/100 gallons spray solution).</td></tr>
<tr><td colspan="2">Weeds < 2”
COC (1–2% v/v) or NIS (0.25% v/v) + UAN (2.5% v/v) or MS (12–15 pounds/100 gallons)</td><td>Weeds > 2”
MSO (1–2% v/v) + UAN (2.5% v/v)</td></tr>
<tr><td colspan="3">Weeds under moisture or temperature stress regardless of size
MSO (1–2% v/v) + UAN (5% v/v)</td></tr>
</table>



APPLICATION GUIDE

TANK-MIXING

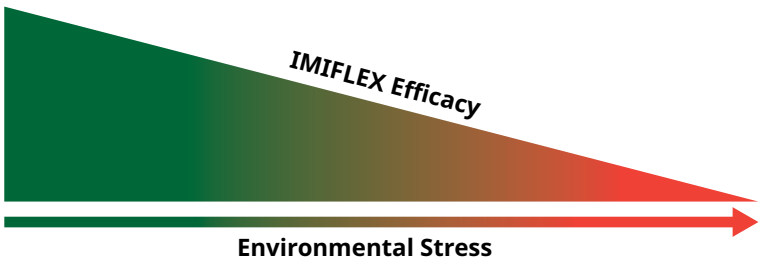
- Tank-mixing optimizes IMIFLEX Herbicide performance.
- Whether IMIFLEX Herbicide is used pre-emergence or post-emergence, a Group 15 herbicide in the program will optimize IMIFLEX performance — ensure sorghum seed is safened when using a Group 15 herbicide.
- IMIFLEX Herbicide and a Group 15 chemistry such as MOCCASIN™ II Plus provide superior pre-emergent grass control.
- Combinations of IMIFLEX Herbicide and MOTIF or atrazine achieve high levels of pre-emergent broadleaf weed control.
- Comprehensive pre-emergent programs of IMIFLEX + MOCCASIN II Plus + MOTIF achieve high rates of control for grass and broadleaf weeds.
- Post-emergent applications of IMIFLEX + atrazine are most effective when preceded by a robust pre-emergent herbicide program.
- Do not tank-mix IMIFLEX Herbicide with Huskie®, Ally®, Peak®, or carbamate and organophosphate insecticides.
- MOTIF is not labeled for use in forage sorghum.

WEATHER

- IMIFLEX Herbicide performance is optimized during weather conditions in which weeds are actively growing.
- Weeds experiencing stress can be less responsive to IMIFLEX Herbicide applications.
- Cool temperatures, < 50 °F, and temperatures outside of the threshold for active plant growth can slow weed response to IMIFLEX Herbicide.
- Weeds experiencing drought or heat stress may have thicker cuticles, resulting in less herbicide absorption.
- Use robust adjuvant packages when targeting weeds growing under stressful conditions.
- Rainfall or irrigation is needed to activate the residual soil activity of IMIFLEX Herbicide.

KEYS FOR APPLICATIONS TO WEEDS UNDER STRESS

- Use a robust adjuvant package — MSO at 1–2% v/v and UAN at 5% v/v OR AMS at 17 lbs/100 gallons.
- Apply IMIFLEX Herbicide in at least 15 GPA by ground, or 5 GPA by air.
- Apply IMIFLEX Herbicide early in the morning when temperatures are cool and weeds are not showing signs of heat stress.
- When temperatures drop below 50 °F, give weeds 1–2 days to recover from cold temperature stress before application.
- However, monitor weed size and apply prior to 2–3″ in height.
- In hot and dry conditions, use larger droplets and carrier volume to reduce effects of spray solution evaporation.
- In dry conditions, cultivation 7–10 days after a post-emergence application can enhance weed control and activation of IMIFLEX Herbicide residual.



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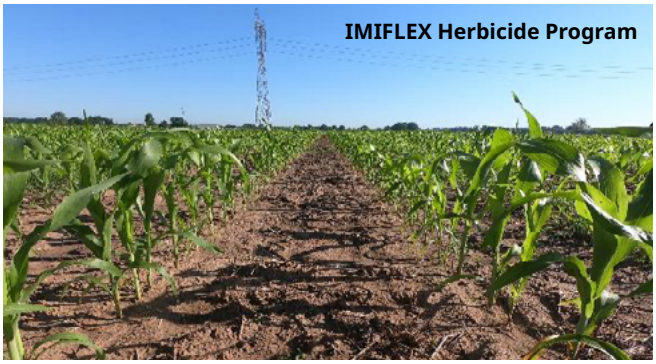

MIXING INSTRUCTIONS

1. Fill spray tank ½ to ¾ full with clean water.
2. Add soluble-packet products and thoroughly mix.
3. Add WP (wettable powder), DG (dispersible granule), DF (dry flowable) or liquid flowable formulations not in soluble packets.
4. Add IMIFLEX Herbicide and thoroughly mix.
5. Add other aqueous solution products.
6. Add EC (emulsifiable concentrate) products.
7. Add surfactant or crop oil to the spray tank.
8. Add nitrogen fertilizer solution.
9. While agitating, fill the remainder of the tank with water.

GROUND APPLICATIONS

- Apply IMIFLEX Herbicide by ground in 10 or more gallons of water per acre.
- Higher GPA results in more thorough coverage and increased herbicide uptake.
- Spray at 20–40 PSI.
- For minimum- or no-till crops, apply IMIFLEX Herbicide in a minimum of 20 GPA.

AERIAL APPLICATIONS

- Apply IMIFLEX Herbicide by air in 5 or more gallons of water per acre.
- Higher GPA results in more thorough coverage and increased herbicide uptake.
- Adjuvant and nitrogen source are essential for optimum performance.

STEWARDSHIP

- Pollen-mediated gene flow from **igrowth** sorghum to weedy relatives, including johnsongrass and shattercane, may contribute to the development of resistance to ALS herbicides in these biotypes.
- Plant into fields where emerged weeds have been controlled by tillage or non-selective herbicides, including glyphosate.
- Manage shattercane and johnsongrass growth in road ditches, fence rows and nearby places so their flowering does not coincide with the **igrowth** sorghum flowering.
- Do not use IMIFLEX Herbicide on sorghum in fields known to have ALS-resistant shattercane or johnsongrass.
- Do not make more than 1 application/year of IMIFLEX Herbicide.
- Always follow label instructions on rates, adjuvants and best management practices.
- In the year following the planting of **igrowth** sorghum, rotate to a crop in that field which allows for non-ALS inhibitor herbicides to be used to manage weeds targeted with IMIFLEX Herbicide.
- Do not apply IMIFLEX Herbicide to **igrowth** sorghum that is taller than 20 inches.
- Do not plant sorghum for 18 months in fields where **igrowth** was used.

HERBICIDE PROGRAM RECOMMENDATIONS

igrowth GRAIN SORGHUM

OPTION	FOCUS	PRE	POST
BEST	Pre-emergent control of grass and broadleaf weeds	**IMIFLEX (9 fl oz) + MOCCASIN II Plus (1.33 pt) + MOTIF (6 fl oz)**	**Atrazine (1 qt)**
BETTER	Pre-emergent control of grass weeds	**IMIFLEX (9 fl oz) + MOCCASIN II Plus (1.33 pt)**	**Atrazine (1 qt) + broadleaf A.I.**
GOOD	Pre-emergent control of broadleaf weeds	**IMIFLEX (9 fl oz) + MOTIF (6 fl oz) OR MOCCASIN II Plus (1. 33 pt)**	**Normal broadleaf program**
PLANNED POST	Post-emergent control of grass weeds	**MOCCASIN II Plus (1.33 pt) + MOTIF (6 fl oz)**	**IMIFLEX (6 fl oz) + atrazine (1 qt)**

NOTES

- Always read and follow label instructions for all products and pesticides.
- Continue with normal burndown/field preparation practices prior to applications of pre-emergence programs.
- MOTIF is not labeled for use in grain sorghum south of Interstate 20 and east of U.S. Highway 277 in Texas. In these areas, replace MOTIF with atrazine or Sharpen®.
- MOTIF is not labeled for use in forage sorghum — refer to the following section for herbicide program recommendations in forage sorghum.
- MOCCASIN II Plus rates vary by soil type — refer to the product label for rates appropriate for your soil type.

igrowth FORAGE SORGHUM

OPTION	FOCUS	PRE	POST
BEST	Pre-emergent control of grass and broadleaf weeds	**IMIFLEX (9 fl oz) + MOCCASIN II Plus (1.33 pt) + atrazine (1 qt)**	**Atrazine (1 qt) or broadleaf program**
BETTER	Pre-emergent control of grass weeds	**IMIFLEX (9 fl oz) + MOCCASIN II Plus (1.33 pt)**	**Atrazine (1 qt) + broadleaf A.I.**
PLANNED POST	Post-emergent control of grass weeds	**MOCCASIN II PLUS (1.33 pt) + atrazine (1 qt)**	**IMIFLEX (6 fl oz) + atrazine (1 qt)**

NOTES

- Always read and follow label instructions for all products and pesticides.
- Continue with normal burndown/field preparation practices prior to applications of pre-emergence herbicide programs.
- MOCCASIN II Plus rates vary by soil type — refer to the product label for rates appropriate for your soil type.
- IMIFLEX Herbicide features a 0-day pre-harvest interval and no grazing or feeding restrictions.