

Weed Management in Texas Cotton



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Tables for timing herbicide applications

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Disclaimer

The suggestions contained herein are based primarily on herbicide labels and research conducted by the Texas A&M AgriLife Extension Service and Texas A&M AgriLife Research. The information is for educational purposes only. The use of product names is not intended as an endorsement of the product or of a specific manufacturer, nor is there any implication that other formulations containing the same active chemical are not equally effective.

Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by Texas A&M AgriLife Extension Service is implied. Product names are included solely to help readers find the herbicides suggested.

This publication is no substitute for the herbicide product labels. It is intended to serve only as a guide for controlling weeds in cotton. Because labeled rates and restrictions change constantly, consult the label before using the product.

Using an integrated strategy that combines cultural, mechanical, and chemical methods can help you manage weeds in cotton effectively, economically, and with little harm to the environment.

The choice of practices to use depends on the weed species being targeted, the infestation level, the crop growth stage, herbicide tolerance traits, the presence of herbicide-resistant weeds, and other crop management practices.

Cultural and mechanical weed control

- ◆ Remove low or spotty infestations of weeds by spot cultivation to prevent spreading weed rhizomes, roots, or seed. This is particularly important for perennial weeds because they propagate by seed and root tissue.
- ◆ Before planting, use mechanical tillage to remove initial weed flushes; this practice can eliminate or at least reduce continued infestation.
- ◆ When plowing perennial weeds, take care to avoid spreading plant parts to other areas of the field.
- ◆ To prevent the spread of weeds to other areas, clean tillage and harvesting equipment thoroughly before moving from one field to the next, and require it of the custom harvesters before they enter your fields.
- ◆ Use weed-free planting seed to prevent weed infestations in the rows as well as the introduction of new weed species or herbicide-resistant weeds.
- ◆ Rotate to crops that physically outcompete certain weeds, causing them to gradually decline.

- ◆ During the growing season, consider using herbicides with different mechanisms of action (site of action) to help prevent herbicide-resistant weeds from developing (Table 7).

Early-season weed management is critical to preserving yields, especially in cotton. Because cotton is a perennial, it devotes much of its early-season energy to its root system and less energy to shoot growth. Along with wide row spacing, this slow early-season shoot growth makes cotton less able to compete with early-season weeds.

Preplant burndown (PPB), preplant incorporated (PPI), and preemergence (PRE) herbicides help suppress early-season weed densities. Residual herbicides provide extra flexibility when timing postemergence applications. Applying PPB, PPI, and PREs also provides opportunities to rotate herbicides, which will help manage herbicide-resistant weeds and prevent them from developing.

Herbicide-resistant weed control

To manage herbicide-resistant weeds, implement the measures listed above, and add these:

- ◆ Combine herbicide use with mechanical, cultural, or biological methods.
- ◆ Rotate or mix herbicides with different mechanisms of action (Table 7) within a season.
- ◆ Where feasible, rotate crops, which will allow for rotating herbicides.
- ◆ Scout fields regularly for resistant weeds, and control the weed escapes before they produce seed.

Table 1. Preplant burndown weed management options

Henbit, seedling dock	Caparol 4L 1.2–1.6 pt (prometryn)	Fall or winter, either preemergence or postemergence when winter weeds are small	Use in the Gulf Coast and Blackland Prairie regions only. For best results, apply before weed emergence. If henbit has emerged but is less than 4–6 in. tall, add a surfactant or emulsifiable oil. This is for winter weed control only; additional herbicides will be needed to control spring and summer weeds.
Annual and perennial broadleaf weeds	Clarity 8 fl oz (dicamba)	Fall or winter when weeds are 2–4 leaf stage and rosettes are less than 2 in. across	Do not apply in regions that average less than 25 in. of precipitation/yr. Plant cotton only after at least 1 in. rainfall or overhead irrigation and 21 days after application.
Henbit, horseweed, shepherd's purse	Envoke 0.10 oz (trifloxysulfuron)	Early preplant	Labeled in Texas east of I-35. In western Texas, refer to the label for specific label restrictions. Apply alone or in tank mixture for residual control or suppression with at least 90 days before planting cotton. See label for tank mix options.
Annual broadleaf weeds	Firstshot 0.5–0.8 oz/a (thifensulfuron-methyl (25%) plus tribenuron (25%))	Postemergence to weeds before planting	Allow 30 days after application before planting cotton. Allow 37 days on sands, loamy sands, sandy loams, and high pH soils (>7.9) before planting. May be tank-mixed with other herbicides to control additional weeds.
Henbit, sunflower; see label	Glyphosate products 1 pt–1 qt (glyphosate)	Postemergence to weeds before planting	Allow at least 2 weeks after application before tillage. If glyphosate-resistant weeds are present, add a tank mix partner to control emerged weeds and to provide residual weed control.
Selected broadleaf weeds; see label	Goal 2XL 1–2 pt (oxyfluorfen)	Preemergence or postemergence to weeds	Some residual weed control may be expected. Apply to weed seedlings not exceeding 4 true leaves. Work fallow beds thoroughly to at least 2.5 in. deep before planting. Do not apply within 7 days before planting. If these requirements are not met, stand and/or vigor may be reduced. Postemergence applications require 20 gal/A of water by ground or 10 gal/A of water aurally.
Emerged annual broadleaf weeds and grasses and topkill suppression of perennials	Gramoxone Inteon 2.5–4.0 pt (paraquat)	Before planting, by ground application to weeds and grasses 1–6 in. tall	Before planting, prepare land to allow maximum weed and grass emergence before treatment. Seed with minimum soil disturbance. Weeds and grasses emerging after application will not be controlled. This is a restricted-use herbicide. Apply in at least 10 gal water/A by ground plus 1 qt nonionic surfactant per 100 gal spray solution or 1 gal crop oil concentrate per 100 gal spray solution. At lower spray volumes, use a drift control or spray deposition additive. Check label for tank mix options.

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Table 1 continued

Many annual broadleaf weeds; see label	LeadOff 1.5 oz (thifensulfuron-methyl (16.7%) plus rimsulfuron (16.7%))	Postemergence at least 30 days before planting	Add nonionic surfactant to spray mixture. Multiple tank mix partners are labeled. See label for more information.
Many annual broadleaf weeds and some annual grasses; see label	Liberty 280 SL 22–43 oz (glufosinate-ammonium)	Application may be made in fallow fields, postharvest, before planting or before emergence of cotton	See label for specific rates, weeds controlled, and tank mix options. Apply in 15 gal/A of water minimum by ground or at least 10 gal aerially. Do not apply if rain is expected within 4 hours after application. Season-total application may not exceed 72 or 87 oz/A, depending on initial application rate. Warm, humid weather and bright sunlight improve performance. Make sequential applications at least 10–14 days apart.
Many annual broadleaf and grass weeds; see label for weed-specific rates	Roundup WeatherMax 11–32 oz (glyphosate)	Before emergence of cotton unless glyphosate-tolerant cotton varieties are planted	Apply when weeds are growing vigorously and 6 in. or less tall. See label for specific rate and weed heights. Do not apply by ground when winds are gusty or more than 10 mph. For aerial applications, do not apply during inversion conditions when winds are gusty or under other conditions that will allow drift. Do not store, mix, or spray in galvanized or unlined steel tanks (except stainless steel). Do not mix with any residual pesticide. Allow 3 days before tillage. Roundup WeatherMax has no soil activity. For johnsongrass burndown, apply 11 oz/A before johnsongrass is 12 in. tall. Wait 3 days before tillage. To improve performance, add 8.5–17 lb ammonium sulfate per 100 gal water.
Perennials: bermudagrass, bindweed, Texas blueweed, johnsongrass, silverleaf nightshade, nutsedge (yellow and purple)	Roundup WeatherMax 11–32 oz (glyphosate); see label for rate of specific weeds	Before planting or after harvest	Apply when weeds are actively growing and have reached the early head or early bud growth stage. See label for exact growth stage, rate, and water carrier volume per acre. If weeds have been mowed or tilled, do not treat until regrowth has reached the recommended stage. Allow 7 or more days after application before tillage. Do not graze treated cotton fields or feed forage to livestock within 8 weeks of application.
Annual and perennial grasses, broadleaves, and sedges; see label	Sequence 2.5–3.5 pt (glyphosate + S-metolachlor)	Postemergence to weeds, before emergence of crop	Do not use on sand or loamy soils. Maximum of 2.5 pt on sandy loams and 3.5 pt on medium and fine soils. No replant restrictions for cotton. If heavy rainfall occurs immediately after planting, crop injury may occur, especially where poor drainage occurs or the seed furrow was not closed. Does not control emerged glyphosate-resistant weeds.

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Table 1 continued

Selected broadleaf weeds	Sharpen 1.0 fl oz (saflufenacil)	Postemergence to actively growing weeds	Use the recommended adjuvants for maximum efficacy, including MSO (1%v/v) + AMS or UAN. Plant cotton only after 42 days and 1 in. of rainfall or irrigation. In areas with less than 25 in. annual rainfall, the 42-day preplant interval is required after the 1 in. rainfall or irrigation. Do not apply to sandy soils with less than 1.5% organic matter. Commonly used as a tank mix partner with glyphosate to broaden weed spectrum in West Texas.
Annual and perennial broadleaf weeds	2,4-D (6 lb ai/gal) 0.66-2.66 pt (2,4-D)	Rates of 0.66–1.66 pt for annual weeds and higher rates for perennial weeds	Wait at least 30 days after the application and at least 1 in. rainfall or irrigation within a 24 hr period.
Annual and perennial grasses, broadleaves and sedges; see label	Touchdown Total 12–48 oz or Touchdown Hi-Tech 12–48 oz (glyphosate)	Postemergence to annual weeds; before emergence of crop	See label for tank mix options for perennial weed control. Many tank mix partners can be added to provide residual weed control. For improved control, use a spray solution of ammonium sulfate at 8.5–17 lb/100 gal. Does not control glyphosate-resistant weeds.
Selected weeds; see label	Valor SX 1–3 oz (fall burndown and residual with labeled burndown herbicide (flumioxazin)	Preemergence or postemergence to weeds before planting with residual control	If weeds are emerged, include a postemergence tank mix partner. In conventional tillage, at least 30 days must pass and 1 in. rainfall or overhead irrigation must occur between application and planting. No-till or strip-tillage fields require at least 21 days and 1 in. rainfall or irrigation between application and planting. See label for specific weeds, rates, and treatment intervals. Include a crop oil concentrate or methylated seed oil.

Table 2. Preplant incorporated weed management options

Weeds controlled	Product Rate/A (Herbicide name)	Time to apply	Remarks
Many annual grasses and small-seeded broadleaf weeds; see label for weed-specific rates	Prowl 3.3EC 1.2–4.8 pt (pendimethalin)	Immediately before planting or up to 140 days before planting	Incorporate as soon as possible and no later than 7 days after application 1–2 in. deep with a disk harrow, bed conditioner, PTO-driven tiller, cultivator, or rolling cultivator. If crop loss occurs, cotton or soybeans may be replanted. Other crops can be rotated with cotton the following year. Do not feed forage or graze livestock in treated cotton fields. Winter wheat or barley can be planted in the fall 4 months after application. Prowl may be applied at 2.4–4.8 pt/A and incorporated up to 60 days before planting to suppress rhizome johnsongrass.
See label for list of grasses and broadleaf species controlled or suppressed	ProwlH2O 1–4 pt (pendimethalin)	Up to 60 days before planting and incorporate	Apply up to 60 days before planting and incorporate uniformly in 1–2 in. of soil surface by rainfall, sprinkler irrigation, or mechanical incorporation. Non-uniform incorporation may result in reduced herbicide efficacy. Two-pass incorporation should result in more consistent efficacy. Do not feed forage or graze livestock in treated fields. Not recommended for soils with more than 3% organic matter. See label for more information.
Many annual grasses and small-seeded broadleaf weeds; see label for weed-specific rates	Treflan4L 1.0–2.5 pt (trifluralin) TreflanHFP 1.0–2.5 pt (trifluralin); several other trifluralins are available; see label for specifics	Oct 15–Dec 31; any time after Jan 1 preplant or preemergence	For best results, incorporate with a disk or power incorporator within 24 hours after application. Ground may be left flat or bedded over winter. If land is left flat, take care during spring bedding operations to prevent turning up untreated soil. Do not apply in fall to soils that are wet, in poor condition, or subject to flooding. Do not plant sorghum or oats for 12 months after application unless 25 in. or more of irrigation and/or rainfall was used to produce the crop. If less than 20 in. of irrigation and/or rainfall was received, do not plant either crop for 18 months. On the High Plains, do not plant sorghum until May 15. Cotton, guar, peanuts, southern peas, soybeans, sunflowers, and some vegetables may be replanted after Treflan in the same or following year. Incorporate with double disk, power incorporator, field cultivator, rolling cultivator, or bed conditioner. The first incorporation should occur within 24 hours after application. Make a second pass with ground-driven equipment. Rolling cultivators and bed conditioners should be used only on coarse- to medium-textured soils. In Brazoria, Calhoun, Chambers, Fort Bend, Galveston, Harris, Jackson, Jefferson, Liberty, Matagorda, Orange, Victoria, Waller and Wharton Counties, rates of 1.5–3.0 pt (4L) can be used. Do not use on any crop grown in Pecos or Reeves Counties. Band or broadcast with a properly calibrated granular applicator.
Many annual grasses and broadleaf weeds; see label for weed-specific rates	Treflan TR-10 5–20 lb (trifluralin)	See supplemental label for remarks on preplant and preemergence applications	For use in conservation tillage cotton. See supplemental label. May be applied in fall, in spring before or at planting, after planting but before crop emergence. Do not use on any crop grown in Pecos or Reeves Counties. Band or broadcast with properly calibrated granular applicator.

Table 3. Preemergence weed management options

Weeds controlled	Product Rate/A (herbicide name)	Time to apply	Remarks
Many annual broadleaf weeds and a few annual grasses; see label for weed-specific rates	Caparol 4L 1.6–4.8 pt (prometryn) Several other prometryn products are available	Preemergence	Do not use on sand or loamy sand. Rainfall or irrigation is needed after application to obtain good weed control. Avoid broadcast applications to cotton planted in furrows more than 2 in. deep. Band applications should be no wider than the bottom of furrows. Cotton may be replanted through treated soil. Do not retreat. If Caparol is applied only as a single preemergence treatment during the season, several vegetables and oats, winter barley, wheat, or rye may be planted. However, the small grains cannot be used for food or feed. Do not use on glandless cotton varieties, as the crop will be injured. Consult individual product labels for recommendations and precautions.
Annual grasses and broadleaf weeds	Command 1.33–2.66 pt (clomazone)	Preemergence	Disulfoton or phorate organophosphate insecticides must be applied in-furrow with the seed at planting time with at least 0.75 lb ai as a crop safener, or cotton injury will occur. Injury may be observed on sandy soils. Off-site movement of the Command can cause foliar whitening of some plants. Avoid spraying within 300 ft of desirable plants.
Many annual grasses and broadleaf weeds; see label for weed-specific rates	Cotoran 4L 2.0–4.0 pt (fluometuron)	Preemergence or at planting after a preplant-incorporated application of Prowl or Treflan	The herbicidal activity of fluometuron may be delayed or reduced during dry weather. Do not plant crops other than cotton within 6 months of the last application. West Texas: Do not use on sand, loamy sand, or fine sandy loam soils nor on cotton planted in furrows. Do not feed foliage from treated fields or gin trash to livestock. A suspendibility agent may be necessary.
Many annual grasses and some small-seeded broadleaf weeds	Dual Magnum or Dual II Magnum 1.0–1.33 pt (S-metolachlor) other S-metalachlor products are available	Preplant incorporated or preemergence	Do not apply on sand or loamy sand soils. Do not apply to furrow-planted cotton. Apply preemergence or incorporate no more than 1 in. deep before, at, or after planting. Plant cotton at least 1 in. deep on fine soils and 1.5 in. deep on medium or coarse soils. For best control of yellow nutsedge, apply preplant incorporated.

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Table 3 continued

Weeds controlled	Product Rate/A (herbicide name)	Time to apply	Remarks
Many annual grasses and broadleaf weeds; see label for weed-specific rates	Karmex 80DF 1.0–2.75 lb (diuron) or Direx 4L 0.8–2.2 qt (diuron) Other diuron products available include Drexel Diuron 4L or 80W and Riverside Diuron 80DF; see labels for recommendations and precautions	Preemergence	Use on sandy loam or heavier soils. Do not apply to sand or loamy-sand soils. Do not use with furrow-planted cotton. Cotton may be replanted through treated band, or rework beds before planting. Do not retreat if banded preemergence; any crop can be planted after 4 months. If broadcast or banded preemergence, then followed by postemergence application, only cotton, soybeans, corn, or grain sorghum can be planted the next spring. Do not replant areas to crops other than corn or cotton within 4 months following band treatment or within 6 months after broadcast treatment, as injury to subsequent crops may result. Do not replant to any other crop within 1 year after application. See label for application-specific instructions. Do not use on soils containing less than 1.0% organic matter. Do not use in preplant or preemergence where soil-applied organophosphate insecticides are used because of the potential for severe cotton injury and possible stand loss. Do not allow livestock to graze treated land.
Annual grasses and small seeded broadleaf weeds	Prowl (3.8 lb ai/gal) 2–3 pt (pendimethalin)	Preemergence	Surface applications are most effective when adequate rainfall or overhead irrigation is received. BASF recommends shallow cultivation if soil crusting or compaction occurs. If adequate rainfall or irrigation does not occur, a shallow tillage is recommended to incorporate and activate the herbicide.
Grasses and small seeded broadleaf weeds	Sequence 2.5-3.5 pt (glyphosate + s-metolachlor)	Preplant or preemergence	Do not use preplant or preemergence on sand or loamy soils. Do not exceed 2.5 pt/A on sandy loam soils or 3.5 pt/A on medium and fine soils. Do not use in Gaines County. If heavy rainfall occurs soon after application, crop injury may occur, especially where water stands or where seeding slit was not properly closed. Do not exceed 2.5 pt/A on sandy loam soils. Do not exceed 3.5 pt/A on medium to fine soils.
Selected broadleaf weeds such as pigweed spp., lanceleaf sage, Venice mallow; see label for weed-specific rates	Staple LX 1.3–2.1 fl oz (pyrithiobac)	Preemergence	Do not apply to sandy or loamy sand soils. Staple LX can be combined with diuron, flumeturon, or prometryn products for expanded weed control. See the Staple LX label for more information. Observe crop rotation restrictions. Do not apply more than 2.1 fl oz preemergence. Do not apply preemergence aerially.
Many annual grasses and some small-seeded broadleaf weeds	Warrant 1.25-2.0 qt/a (acetochlor)	Preemergence	See label for appropriate rate based on soil type. Broadcast apply and do not incorporate. Crop injury may occur under cool conditions and saturated soils. Do not exceed 4 qt/A for the season.

Table 4. Postemergence over-the-top weed management options

Weeds controlled	Product, Rate/A, (herbicide name)	Time to apply	Remarks
Many annual and perennial grasses only including barnyardgrass, bermudagrass, large crabgrass, johnsongrass, junglerice, Texas millet	Assure II 0.88EC 5–12 oz (quizalofop)	Postemergence over the top of actively growing grasses	<p>Always add 1% v/v (4 qt per 100 gal spray solution) crop oil concentrate or 0.25% v/v (1 qt per 100 gal spray solution) of a nonionic surfactant. Do not cultivate treated grasses 7 days before or 7 days after herbicide application. Perennial grasses may require sequential applications. Consult label for recommendations specific to East and West Texas. Use at least 10 gpa carrier volume. Do not apply more than 18 oz of product per acre per season. May be tank mixed with glyphosate and many other herbicides.</p> <p>Assure II may be applied as a spot treatment by mixing 12 oz of product into 25 gal water or as a 0.375% solution. See label for more instructions.</p> <p>Do not apply within 80 days of harvest.</p>
Selected annual broadleaf weeds, including Palmer amaranth, common cocklebur, Venice mallow, morningglory, lanceleaf sage	Cotoran 4L 2.0–4.0 pt (fluometuron)	Postemergence when cotton is at least 3 in. tall and weeds less than 2 in.	<p>Add 1 qt of surfactant per 50 gal of spray mix. Apply as directed, semi-directed, or over-the-top spray. Use higher rate after weeds have emerged. Do not plant crops other than cotton within 6 months of last application. Do not feed foliage or gin trash to livestock. Cotoran may be combined with MSMA or DSMA for enhanced weed control to cotton from 3 in. tall to first bloom. See label for more information.</p> <p>West Texas: Do not use on sand, loamy-sand, or fine-sandy-loam soils.</p>
Selective control of grasses, sedges and broadleaf weeds, including Palmer amaranth, annual morningglory (red, ivyleaf)	Envoke 0.10–0.15 oz over-the-top 0.10–0.25 oz post-directed (trifloxysulfuron sodium)	Postemergence over-the-top when cotton has reached at least 5 true leaves	<p>See label for tank mix combinations.</p> <p>Can be applied either over-the-top or post-directed. Envoke can be tank mixed with MSMA, Cotoran, or glyphosate for hooded treatments. Do not exceed 0.4 oz Envoke per acre per season. Envoke is labeled for use in Texas cotton grown east of I-35. In western Texas, refer to the label for specific label restrictions.</p> <p>Consult label for rotational crop information.</p> <p>For use in Roundup-Ready Flex cotton: apply with approved Roundup formulations from the 5–12 leaf stage up to 60 days before harvest. Applications can be over-the-top or post-directed to ensure adequate coverage.</p> <p>Do not apply Envoke aerially.</p>

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Table 4 continued

Weeds controlled	Product, Rate/A, (herbicide name)	Time to apply	Remarks
Many annual and perennial grass weeds only, including barnyardgrass, bermudagrass, large crabgrass, johnsongrass, junglerice, Texas millet	Fusilade DX 2E 6–24 oz (fluazifop-p-butyl)	Postemergence when annual grasses are small; treat bermudagrass when no more than 3 in. tall or when runners are 6–12 in.; rhizome johnsongrass should be 12–18 in. tall and before the boot stage	Do not apply a total of more than 48 oz/A per season. Do not apply to cotton after boll set. Always add COC at 0.5-1% v/v or NIS at 0.25-0.5%v/v. Bermudagrass and rhizome johnsongrass may require two applications (see label). Higher rates or repeat applications are needed in West Texas on some grasses (see label). Where rainfall is adequate, soil residual may occur, which will suppress new flushes of annual grasses. Do not plant rotational crops other than cotton or soybeans within 60 days after application. Avoid drift to grass-type crops. Do not apply if rainfall is expected within 1 hour. Cultivation from 7 days before until 7 days after application may reduce control. Cultivation after 7 days will often help grass control. When grasses are drought stressed, control will be reduced. Do not use whirl chamber or flood-type nozzle tips that produce large droplets. Fusilade DX may be applied as a spot treatment, using a 0.5% solution (0.5 qt per 25 gal water). Add 1/2 pt of nonionic surfactant to this 25-gal mixture.
Many annual and perennial grass weeds, including barnyardgrass, bermudagrass, large crabgrass, johnsongrass, junglerice, Texas millet	Fusion 6–12 oz (Fluazifop-p-butyl + fenoxaprop-p-ethyl)	Postemergence over the top of cotton to actively growing grasses	Do not apply more than 24 oz per acre of Fusion to the same crop per year. Always add COC at 0.5–1% v/v or NIS at 0.25–0.5%v/v. Do not apply to cotton after boll set. Do not plant grass crops such as corn, sorghum, or wheat within 60 days of last Fusion application. Avoid application to stressed weeds. May be tank mixed with glyphosate. Fusion may be applied as a spot treatment using a 0.5 percent solution (1 pt in 25 gal water). Add 8 oz of a nonionic surfactant to this mixture.
Many grasses and broadleaf weeds, including devil's-claw, RR volunteer cotton, pigweeds Use only on glufosinate-tolerant crops	Liberty 280 SL 22–29 oz (glufosinate-ammonium)	Apply over the top of Liberty Link (glufosinate tolerant) cotton only; may be applied through hoods to non-Liberty-tolerant cotton, being careful to avoid contact with cotton plants	Use only on glufosinate-tolerant crops. Consult label for specific weeds and weed heights and tank mix combinations. Efficacy is increased with actively growing weeds. Use at least 15 gal/A carrier volume. Add ammonium sulfate to increase consistency of efficacy.
Many annual and perennial grasses only including barnyardgrass, bermudagrass, large crabgrass, johnsongrass, junglerice, Texas millet	Poast Plus 1E 12–48 oz (sethoxydim)	Postemergence over the top of actively growing grasses; see label for stages of various grasses	Do not apply more than 7.5 pt/A in one season. Bermudagrass and rhizome johnsongrass may require two applications (see label). Do not apply to grasses under stress such as lack of moisture or herbicide injury, or control will be unsatisfactory. Cultivation no sooner than 7 days after application may aid season-long control. See label for rates for various grasses and growth stages. Do not cultivate within 5 days before or 7 days after treatment. Poast Plus may be applied as a spot or small area treatment using a 1–1.5% solution (1.0 to 1.5 gal. Poast Plus per 100 gal spray solution). See label for more information.

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Table 4 continued

Weeds controlled	Product, Rate/A, (herbicide name)	Time to apply	Remarks
Many grasses and broadleaf weeds, including Palmer amaranth, woollyleaf bur-sage, common cocklebur, devil's-claw, Venice mallow, annual morningglories, silver-leaf nightshade, puncturevine, lanceleaf sage, sunflower; sup-presses some perennial weeds	Roundup WeatherMax Up to 1 qt/A (glyphosate + surfactant)	Postemergence over-the-top of cotton from ground cracking to 7 days before harvest	Use only in glyphosate-tolerant cotton varieties. Do not apply Roundup WeatherMax over the top beyond first bloom cotton grown for seed. Do not exceed 32 oz/A for ground application. Maximum in-crop applications of Roundup WeatherMax, from ground cracking to 60% open bolls, cannot exceed 4.0 qt/A. Total Roundup WeatherMax applied from 60% open bolls to 7 days, before to harvest may not exceed 44 fl oz per acre. Up to 22 oz/A by air. Does not control glyphosate-resistant weeds.
Many annual and perennial grasses only, including barnyardgrass, bermudagrass, large crabgrass, johnsongrass, junglerice, Texas millet	Select 2EC Annual grasses 6–16 oz (clethodim) Select Max (0.97 lb ai/gal) 9–32 oz (clethodim)	Postemergence over the top of actively growing grasses. Treat rhizome johnsongrass from 12–18 in. tall; treat bermudagrass up to 3 in. tall or up to 6-in. runners	Always use COC at 1.0 qt/A or 1% v/v. Do not apply a broadleaf herbicide within 1 day after Select 2 EC applications or reduced grass control may result. Do not cultivate treated grasses 7 days before or after herbicide application. Perennial grasses may require sequential applications. Consult label for recommendations specific to East and West Texas. Select may be applied as a spot treatment by mixing 8 oz into 25 gal water for a 0.25 percent solution.
Broad spectrum of annual and perennial weeds, including Palmer amaranth, kochia preemergence, Russian thistle, activity on grasses and small seeded broadleaf	Sequence 2.5–2.75 pt (glyphosate) + (S-metolachlor)	Postemergence up to 10 leaf stage on glyphosate tolerant cotton and post-directed	Apply over-the-top in glyphosate-tolerant cotton varieties from cotyledon to 10 leaf stage. Do not exceed 2.5 pt/A in a single application on cotton with less than 5 leaves. Apply up to 2.75 pt/A from 5-10 leaf cotton. Do not use if cotton plants are under stress caused by drought, insects, diseases, or cultivation. Necrotic lesions may occur on leaves under stressed crop conditions. Do not harvest cotton within 100 days of a post-directed application. Do not include Ammonium Sulfate in postemergence applications. Effective option in no-till or reduced tillage. Do not use in Gaines County. Does not control emerged glyphosate-resistant weeds

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Table 4 continued

Weeds controlled	Product, Rate/A, (herbicide name)	Time to apply	Remarks
Many annual broadleaf weeds including Palmer amaranth, annual morningglory; see label for weed-specific rates	Staple LX 2.6–3.8 fl oz (pyrithiobac sodium)	Postemergence to most weeds when they are 1–4 in. tall; see label for specific weed, timing, and application rates	<p>Primarily a broadleaf weed herbicide but can be tank-mixed with MSMA, DSMA, or Assure II for grass control. Staple LX has soil residual activity for preemergence control of some weeds. Do not mix with metolachlor herbicides because crop injury may result. Do not tank mix with malathion containing insecticides. Leaves may yellow and/or leaf crinkle temporarily. Apply with at least 10 gpa and increase from 20–40 gpa under heavy weed pressure.</p> <p>Do not exceed 3.8 fl oz in any single postemergence application. Add nonionic surfactant or crop oil concentrate.</p> <p>Do not apply more than 3.2 fl oz per acre per year of Staple LX in areas west of Highway 83 in Texas. Do not apply more than 5.1 fl oz per acre per year in all other areas. Staple LX may be applied postemergence over-the-top with to Roundup-Ready Flex cotton until 60 days before harvest.</p>
Many grasses and broadleaf weeds, similar to Touchdown Total	Touchdown Hi-Tech 10–20 fl oz (glyphosate)	Postemergence over-the-top of cotton to actively growing weeds	<p>Use only on cotton tolerant to glyphosate. Apply a maximum of 40 fl oz from ground cracking to 4-leaf stage (quarter-sized 5th) with no more than 20 fl oz in any single application. Apply no more than 40 fl oz/season by precision, post-directed, or hooded application methods between the 5-leaf stage and layby, with no more than 20 fl oz for any single application by these methods.</p> <p>See label for tank mix options.</p> <p>Does not control glyphosate-resistant weeds.</p>
Many grasses and broadleaf weeds including Palmer amaranth, woollyleaf bursage (lakeweed), common cocklebur, devil's-claw, Venice mallow, annual morningglories, silverleaf nightshade, puncturevine, lanceleaf sage, sunflower; suppresses some perennial weeds	Touchdown Total 12–24 fl oz (glyphosate)	Postemergence over-the-top of cotton to actively growing weeds	<p>Use only on cotton tolerant to glyphosate. Make postemergence applications from ground cracking until the 4-leaf stage of cotton at a maximum of 48 fl oz/A per season with no more than 24 fl oz/A in any single application. Apply no more than 48 fl oz/season by precision, post-directed, or hooded application methods between the 5-leaf stage and layby. Apply no more than 24 fl oz per single application.</p> <p>See label for tank mix options.</p> <p>Does not control glyphosate-resistant weeds.</p>
Preemergence activity on many unemerged annual grasses and broadleaf weeds, including Palmer amaranth, kochia, Russian thistle	Warrant 1.25–2 qt (acetachlor)	Postemergence to cotton but before weeds emerging; cotton should be completely emerged but before first bloom	<p>This product only has preemergence activity on weeds. If weeds are emerged, add a postemergence herbicide to Warrant. Apply when cotton is small, or direct spray to the soil surface to optimize weed control. Optimum timing and rate is 2–3 leaf cotton and before weed emergence at a rate of 1.5 qt/A. Rain or irrigation is needed to activate the herbicide. If no rain or irrigation occurs in 10 days, use shallow incorporation. Do not tank mix with fertilizer, because crop injury may result.</p>

Table 5. Post-directed or hooded weed management options

Annual grasses and broadleaves including cocklebur, devil's-claw, gumweed, common lambsquarters, morningglory, pie melon, pigweed	Caparol 4L 1.6–3.2 pt/A (prometryn)	Postemergence as a directed spray when cotton is at least 12 in. tall and weeds are less than 2 in. tall	Omit surfactant if no weeds are present at treatment time. In the High Plains, 1.6–2.4 pt/A of Caparol 4L is sufficient. Do not use in the Rio Grande Valley. See Caparol preemergence for rotational crop suggestions. Do not apply when cotton is under stress. Apply in 25 gal water + 1 pt of surfactant per acre.
Many annual broadleaf weeds, including small Palmer amaranth, devil's-claw; see label for weed-specific rates	Cobra 2E 12.5 oz (lactofen)	Postemergence directed only: cotton must be 6–8 in. tall, or apply at layby	Use as a directed spray only; use equipment designed to keep spray off cotton foliage while maintaining weed coverage. Keep spraying pressure at 20–30 PSI to reduce potential for spray mist getting on cotton foliage. Susceptibility of individual weeds varies; therefore, consult label for specific application recommendations regarding stage of growth. Pigweeds must be small to obtain adequate postemergence control. Cobra may be used in combination with MSMA, Bladex, and Karmex to help control certain weeds. Consult specific product labels for recommendations and precautions. See label for layby tank mixes.
Annual grasses and many seedlings including cocklebur, devil's-claw, gumweed, lambsquarters, morningglory, common pie melon, pigweed; see label for weed-specific rates	Direx 4L 0.4–0.6 qt (diuron) or Karmex 80DF 0.25–0.5 lb (diuron)	Postemergence directed spray after cotton is 6–12 in. tall, as needed, up to 2 applications	Spray young, actively growing weeds less than 2 in. tall. Provides residual control of many weeds. Apply to cotton plants over 12 in. tall, and avoid contact with cotton leaves. Any crop may be planted 4 months after the last application. If multiple applications are made, see label for rotational crops. Direx or Karmex may be combined with MSMA or DSMA for enhanced weed control. Apply in 25 gal water + 1 pt surfactant per acre. See label for weed and rate specifics.
Many annual grasses and broadleaf weeds including cocklebur, devil's-claw, gumweed, lambsquarters, morningglory, common pie melon, pigweed; soil residual activity on many weeds	Goal 2 XL 1–2 pt (oxyfluorfen)	Postemergence as a directed spray to succulent weeds in 2- to 3-leaf stage can usually be controlled at the low rate. Apply to cotton 6–8 in. tall.	Cotton should be at least 6–8 in. tall, or severe crop injury may occur. Precision ground spray equipment with fenders or shields should be used to avoid contact with cotton foliage. Apply at 20 gpa carrier volume. Add 2–4 pt nonionic surfactant per 100 gal spray solution. Two flat fan nozzles on each side of the row are suggested. May be tank mixed with MSMA or Karmex.
Many annual grasses and broadleaf weeds, including cocklebur, devil's-claw, gumweed, lambsquarters, morningglory, common pie melon, pigweed; soil residual activity on many weeds	Linex (4lb ai/gal) 1–3 pt (linuron)	Postemergence as a directed spray; weeds should be no more than 2 in. tall	Cotton should be at least 12 in. tall for the 1.0 pt/A rate. When cotton is at least 18 in. tall, the 1–1.5 pt/A rate may be used. When cotton is at least 20 in. tall, a single application may be made at a rate of 2–3 pt/a. Add 1 pt/25 gal of spray mixture to control emerged weeds.

Table 5 continued

Woollyleaf bursage (lakeseed), cocklebur, johnsongrass, nutsedge, puncturevine, ragweed, sandbur, some annual grasses	MSMA 1.0–1.25 pt of 6 lb/gal product	Postemergence directed, only after cotton is 3 in. tall and before first bloom	Apply as directed spray after cotton is 3 in. tall but before first bloom. Make a second application if necessary. Apply to small broadleaves and grasses. Most effective at 80–90°F. Do not graze treated fields or feed foliage. Phytotoxic properties are quickly inactivated on contact with the soil.
Preemergence activity on many annual grasses and small-seeded broadleaf weeds; postemergence control of broadleaf and some grass weeds	Prefix 2–2.33 pt/a (s-metolachlor + fomesafen)	Postemergence directed, only after cotton is 6 in. tall	Avoid contact with foliage and non-barked parts of the cotton plant. Apply when broadleaf weeds have 2–4 true leaves in at least 10 gpa carrier volume. Surfactant should be added. Do not add liquid nitrogen fertilizer. May be tankmixed with other herbicides to broaden weed spectrum. Do not apply within 80 days of harvest. Do not exceed 2.33 pt/A for the entire season.
Preemergence activity on many annual grasses and small-seeded broadleaf weeds	Prowl H2O 1.0–4.0 pt (pendimethalin)	Over the top or as a directed spray to provide soil residual activity	Rate of 1–3 pt on conventional or minimum till, 2–4 pt on no-till. Apply directly to the soil between the rows as a directed spray after the last normal cultivation. Check label for maximum labeled rates for given soil types. Glyphosate products may be tank mixed and applied to glyphosate tolerant cotton. May be tank mixed with Liberty and applied to Liberty tolerant cotton varieties.
Many annual and perennial grasses and broadleaf weeds	Roundup WeatherMax See label for weed control rates. (glyphosate + surfactant)	Apply after sufficient bolls have developed to produce the desired yield of cotton; applications before then can reduce yield	Applications of up to 44 oz product may be made over-the-top after 20% boll crack. Allow at least 7 days between application and harvest. Application volume of 10–20 gal water by ground or 3–15 gal water by air.
Selected broadleaf weeds, grasses, sedges	Suprend 1.0–1.5 lb (prometryn + trifloxysulfuron sodium)	Postemergence directed on weeds less than 6 in. tall	Apply when cotton is at least 6 in. tall. Use only in picker and Pima cotton varieties. Do not use in the Rio Grande Valley. Apply post-directed or under hoods to minimize crop injury. Cotton may be replanted 30 or more days after Suprend application if not more than 1.0 lb of Suprend has been applied or 14 or more days after the first significant rainfall (0.5 in) after Suprend application. Suprend is labeled only for Texas cotton grown east of I-35. Do not exceed 2.7 lb/A of Suprend per season. Do not apply Suprend within 60 days of harvest. See the label for more specific information.

continued on next page

Table 5 continued

Preemergence activity on many annual grasses and small-seeded broadleaf weeds	Treflan HFP 1.0–2.0 pt (trifluralin) or Treflan 4EC 1.0–2.0 pt (trifluralin)	Directed application from 4 true-leaf stage until layby up to but not less than 90 days before harvest	Drop nozzles are suggested if cotton foliage prevents uniform coverage of soil surface. Maximum must not exceed 4 pt/A within the same crop year (fall, spring, and layby applications).
Many annual broadleaf weeds; soil residual activity on many weeds	Valor SX 1–2 oz/A (flumioxazin)	Postemergence directed spray through a hood or shielded sprayer to actively growing weeds	Apply only to cotton that has reached at least 6 in. for hooded applications. Layby applications may be made when cotton is at least 16 inches tall. Valor SX application must be directed toward the lower 2 in. of bark to avoid crop injury. Do not till after application or reduced weed control will result. Do not make a sequential application of Valor SX within 30 days of first Valor application. See the label for further instructions. Apply in 10 gal water/acre minimum. Use only NIS.
Annual grasses, sedges, and annual broadleaf weeds	Zidua 0.75-2.1 oz/a (pyroxasulfone)	Directed spray between rows from 5 leaf to beginning bloom	Do not use on coarse soils. The rate depends on the soil. See label for specific rates. A hooded or shielded sprayer is recommended. Will provide control of only weeds germinating after application. Emerged weeds will not be controlled. At least ½ inch of rainfall or irrigation is required to activate the herbicide. Avoid contact with cotton leaves.

Table 6. Wick or wiper applicator weed management options

Weeds controlled	Product Product rate/A broadcast (Herbicide name)	Time to apply	Remarks
Many annual and perennial grasses and broadleaf weeds	Roundup WeatherMax 33–75% solution (glyphosate + surfactant)	When weeds are at least 6 in. above the crop; results improve when more of the weed is exposed; do not wipe any closer than 2 in. above desirable vegetation, as injury may result	Some wick applicators may require a less-concentrated solution. Keep wiper surface clean. Weeds not contacted by the herbicide will not be affected. Do not operate at speeds greater than 5 mph. As weed density increases, reduce speed. Wiping a second time in opposite directions may improve control. Do not use wiper when weeds are wet. Repeat treatment may be necessary. Oversaturation of wiper may cause dripping which will injure crop. Mix only enough solution for 1 day's operation. Drain and flush with water after using applicators.

Table 7. Herbicides, formulations, group numbers, and mechanisms of action. Rotating or mixing herbicides with different mechanisms of action can delay the development of herbicide-resistant weeds. To determine the labeled herbicide's mechanism of action, see the Mechanism of action or Group number column.

Product	Active ingredient(s)	Group number ¹	Mechanism of action
Aim EC	carfentrazone (22.3%); 2 lb ai/gal	14	PPG oxidase
Aim EW	carfentrazone (21.3%); 1.9 lb ai/gal	14	PPG oxidase
Assure II	quizalofop (10.3%); 0.88 lb ai/gal	2	ACCase
Caparol	prometryn (44.4%); 4 lb ai/gal	5	Photosystem II inhibitor
Clethodim 2E	clethodim (26.4%); 2 lb ai/gal	1	ACCase
Cobra	lactofen (24%); 2 lb ai/gal	14	PPG oxidase
Command 3ME	clomazone (31.1%); 3 lb ai/gal	13	Carotenoid biosynthesis inhibitor
Cotoran	fluometuron (41.7%); 4 lb ai/gal	7	Photosystem II inhibitor
Cotton Pro	prometryn (44.0%); 4 lb ai/gal	5	Photosystem II inhibitor
Direx	diuron (40.0%); 4 lb ai/gal	7	Photosystem II inhibitor
Dual II Magnum	s-metolachlor (82.4%); 7.64 lb ai/gal	15	Long chain fatty acid inhibitor
Dual Magnum	s-metolachlor (83.7%); 7.62 lb ai/gal	15	Long chain fatty acid inhibitor
Envoke	trifloxysulfuron (75.0%)	2	ALS inhibitor
Firstshot	thifensulfuron-methyl (25%)	2	ALS inhibitor
	tribenuron (25%)	2	ALS inhibitor
Flexstar GT 3.5	fomesafen (5.88%); 0.56 lb ai/gal	14	PPG oxidase
	glyphosate (22.4%)	9	EPSP
Flexstar GT	fomesafen (6.72%); 0.66 lb ai/gal	14	PPG oxidase
	glyphosate (25.6%); 2.63 lb ae/gal	9	EPSP
Flexstar	fomesafen (22.1%); 1.88 lb ai/gal	14	PPG oxidase
Fusilade DX	fluazifop (24.5%); 2 lb ai/gal	1	ACCase
Fusion	fluazifop (24.15%); 2 lb ai/gal	1	ACCase
	fenoxaprop (6.76%); 0.56 lb ai/gal	1	ACCase
Goal 2X	oxyfluorfen (22.3%); 2 lb ai/gal	14	PPG oxidase
GoalTender	oxyfluorfen (41.0%); 4 lb ai/gal	14	PPG oxidase
Gramoxone Inteon	paraquat (30.1%); 2 lb/gal	22	Photosynthesis I diverter
LeadOff	thifensulfuron-methyl (16.7%)	2	ALS inhibitor
	rimsulfuron (16.7%)	2	ALS inhibitor

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Table 7 continued

Product	Active ingredient(s)	Group number ¹	Mechanism of action
Liberty	glufosinate (24.5%); 2.34 lb ai/gal	10	Glutamine synthetase inhibitor
Karmex DF	diuron (80%)	7	Photosynthesis II inhibitor
Layby Pro	linuron (20.3%)	7	Photosynthesis II inhibitor
	diuron (20.0%)	7	Photosynthesis II inhibitor
Linex 4L	linuron (40.6%); 4 lb ai/gal	7	Photosynthesis II inhibitor
MSMA Plus	MSMA (35.43%); 4 lb ai/gal	17	Unknown
MSMA	MSMA (51.0%); 6.6 lb ai/gal	17	Unknown
Poast Plus	sethoxydim (13.0%); 1 lb ai/gal	1	ACCase
Poast	sethoxydim (18.0%); 1.5 lb ai/gal	1	ACCase
Prefix	s-metolachlor (46%); 4.34 lb ai/gal	15	Long chain fatty acid inhibitor
	fomesafen (9.7%); 0.95 lb ai/gal	14	PPG oxidase
Prowl 3.3 EC	pendimethalin (37.4%); 3.3 lb ai/gal	3	Microtubule assembly inhibitor
Prowl H2O	pendimethalin (38.7%); 3.8 lb ai/gal	3	Microtubule assembly inhibitor
Reflex	fomesafen (22.8%); 2 lb ai/gal	14	PPG oxidase
Roundup WeatherMax	glyphosate (48.8%); 4.5 lb ae/gal	9	EPSP
Select 2EC	clethodim (26.4%); 2 lb ai/gal	1	ACCase
Select Max	clethodim (12.6%); 0.97 lb ai/gal	1	ACCase
Sequence	glyphosate (21.8%); 2.25 lb ae/gal	9	EPSP
	s-metolachlor (29.0%); 3 lb ai/gal	15	Long chain fatty acid inhibitor
Sharpen	saflufenacil (29.74%); 2.85 lb ai/gal	14	PPG oxidase
Staple LX	pyrithiobac (33.6%); 3.2 lb ai/gal	2	ALS inhibitor
Suprend	prometryn (79.3%)	5	Photosynthesis II inhibitor
	trifloxysulfuron (0.70%)	2	ALS inhibitor
Touchdown CT	glyphosate (36.5%); 4.17 lb ae/gal	9	EPSP
Touchdown HiTech	glyphosate (52.3%); 5 lb ae/gal	9	EPSP
Treflan HFP	trifluralin (43.0%); 4 lb ai/gal	3	Microtubule assembly inhibitor
Treflan TR-10	trifluralin (10.0%); 5 lb ai/50 lb bag	3	Microtubule assembly inhibitor
Valor SX	flumioxazin (51.0%); 51% ai	14	PPG oxidase
Warrant	acetochlor (33.0%); 3 lb ai/gal	15	Long chain fatty acid inhibitor

1: Herbicide group numbers from "Revised Classification of Herbicides by Site-of-Action for Weed Resistance Management Strategies," by C. A. Mallory-Smith and E. J. Retzinger. 2003. *Weed Technology* 17:605-619.



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