



SESAME HERBICIDE RESEARCH SUMMARY

January 2009

One of the major objectives of the American Sesame Growers Association (ASGA) is develop herbicides for use in sesame. This is a summary of the research that is in more detail in Review of Herbicide Research on Sesame (*Sesamum indicum* L.) available on www.sesamegrowers.org. The detailed document will be updated annually as more information is gathered while this document will be updated more frequently.

Presently in the US there are only three herbicides labeled for sesame:

- RT3 (glyphosate) is a burn down herbicide and can be applied before, during, or after planting. Broadcast must be done before the crop emerges. Wiper applicators or hooded sprayers can be used between the rows after the crop has been established.
- Select Max and Arrow (clethodim) are grass herbicides and can be sprayed at all stages except during flowering.

There are many variants of the word preemergence as it pertains to herbicide usage in the world literature. In this paper the terms and abbreviations have been standardized as follows:

- Herbicides applied preplant with no incorporation (PREPLANT)
- Herbicides applied preplant incorporated (PPI)
- Preemergence (PRE) – Herbicides applied after planting and before weed or crop emergence.
- Postemergence (POST) – There are two types of herbicide application: over the top (OTT) of sesame and directed (DIR) at the base of the sesame. There is a POST DIR where the herbicide is sprayed between the rows and does not touch the sesame, but unless specified, all the POST DIR research discussed below implies spraying on to the base of sesame.

A review of sesame herbicide information from 21 countries has shown that there are 15 herbicides that are used in commercial sesame fields for weed control somewhere in the world. Some of these herbicides are out of production in the US. There are 5 additional herbicides that have potential for use in commercial fields but need more research. Table 1 shows the active ingredients of these 20 herbicides with the most common name in the US sesame growing area.

Table 1. Potential herbicides that can be used in sesame in the US.

	Commercial fields	Potential use
PRE	Alachlor (Intro) Diuron (Direx) Diuron and linuron (field mix) Fluchloralin (Basalin) Fluometuron (Cotoran) Glyphosate (Roundup) Linuron (Linex) Metobromuron (Patoran) Metobromuron + Metolachlor (Galex) S-Metolachlor (Dual Magnum) Pendimethalin (Prowl) Trifluralin (Treflan)	Diuron + linuron (Layby Pro)
POST over the top	Clethodim (Select) Diuron (Direx) Fluazifop-P (Fusilade) Haloxifop (Verdict) Sethoxydim (Poast)	Alachlor (Intro) Fluometuron (Cotoran) Pendimethalin (Prowl) S-Metolachlor (Dual Magnum)
POST directed¹	Diuron (Direx) Glyphosate ² (Roundup, RT3)	Diuron + linuron (Layby Pro) Flumioxazin (Valor) Fluometuron (Cotoran) Glufosinate (Ignite) Linuron (Linex) Prometryn (Caparol)
Harvest Aid	Diquat (Reglone) Glyphosate (Roundup)	Carfentrazone-ethyl (Aim) Glufosinate (Ignite)

¹ Initial testing indicates that the stage of the sesame, the height of the plant, and the height of application are critical and need more testing.

² Only between rows (not directed on stems of sesame) or in a wiper application.

ASGA is supporting research to determine the best herbicides to use in the US. The results from 2007 ASGA supported research can be found on www.sesamegrowers.org. In 2008, research is being done by James Grichar of Texas AgriLife Research, and Peter Dotray of Texas Tech University and Texas AgriLife Research. The research is as follows:

- PRE treatments to include (carfentrazone-ethyl), Cotoran (fluometuron), Direx (diuron), Dual Magnum (S-metolachlor), Lorox/Linex (linuron), Layby Pro (linuron plus diuron), Milo-Pro (propazine), and Pursuit (imazethapyr).
- POST over the top treatments to include, Direx (diuron), Caparol (prometryn), Cotoran (fluometuron), Layby Pro (linuron plus Diuron), Milo-Pro (propazine), Pursuit (imazethapyr), Stinger (clopyralid), and Valor (flumioxazin) with and without a surfactant.
- POST directed treatments to include Aim (carfentrazone-ethyl), Caparol (prometryn), Direx (Diuron), ET (pyraflufen-ethyl), Gramoxone (paraquat), Ignite (glufosinate), Layby Pro (linuron plus Diuron), Linex/Lorox (linuron), Milo-Pro (propazine), Roundup/Durango (glyphosate), and Valor (flumioxazin). In addition, the herbicides with residual PRE action (Caparol, Direx, Layby Pro, Linex/Lorox, Milo-Pro, and Valor) will be mixed with Roundup/Durango.
- Harvest aid treatments to include Aim (carfentrazone-ethyl), Ignite (glufosinate), Reglone (diquat), and Roundup/Durango (glyphosate).

ASGA has been exchanging information with Luis Lanfranconi and Agustin Calderoni of Argentina who are doing sesame herbicide research in the alternate season. Research results from the US conducted from 2004 through 2006 were used to design the 2007 Argentina research while results of the 2007 Argentina studies were incorporated into the 2007 US research effort. Research efforts during the 2008 growing season have followed the same pattern. In 2009, Argentina is conducting POST OTT and DIR testing only. They feel that mixing diuron and linuron is a good PRE for them and they are not searching for other solutions at this time.

On the www.sesamegrowers.org site, there is a Review of Herbicide Research on Sesame section, which covers research done in 21 countries on PRE and POST herbicides. The document, which is arranged by active ingredient and then by the country of research and the year of publication/research within each country, summarizes the research efforts. The plan is to keep updating this summary and the review document as more research is done or as more previous research is located. If you have any additional research, please send this information to D. Ray Langham, ASGA, 4308 Centergate, San Antonio, Texas 78217 or email rlangham@texas.net.

Table 2 shows the herbicides that are included in the Review of Herbicide Research on Sesame section by active ingredient and also includes the trade name(s) of each herbicide. The same information is in Table 3 in inhibitor family order and in Table 4 in trade name order. In the evaluation the following abbreviations are used:

- Com = commercial (used commercially in at least one country)
- Pot = potential (potential to use commercially)
- Sel = selective to sesame (does not damage sesame)
- SSel = somewhat selective to sesame (some damage to sesame, but helps)
- Mix = mixed results
- Tox = toxic (substantial reduction of production)
- STox = somewhat toxic (enough reduction that probably cannot be used)
- Effec = effective as a harvest aid
- Not eff = not effective as a harvest aid

Table 2. Summary of herbicides used in sesame research in active ingredient order

Active ingredient	Trade name	PRE	OTT	DIR	HA	Mode of action
2,4D-B	Butyrac	Tox	Tox			Synthetic auxin
Acifluorfen	Blazer		Tox			PPG or Protox
Alachlor	Alanox, Alar, Intrro, Lasso, Lazo	Com	Pot			Mitosis
Allidochlor (CDAA)	Randox	Mix				xx Not in 9th edition

Active ingredient	Trade name	PRE	OTT	DIR	HA	Mode of action
Ametryn	Gesapax	Tox				Photosystem II
Amiprophosmethyl	Bay-NTN 6867	Tox				xx Not in 9th edition
Asulam	MB-9057	SSel				Dihydropteroate synthetase
Atrazine	Aatrex	Tox	Tox			Photosystem II
Benefin	Balan	Tox				Mitosis
Benfuresate	Cyperal	Tox				xx Not in 9th edition
Bensulide	Prefar	Sel				Fatty acid and lipid
Bentazon	Adagio, Basagran, Bendioxide, Entry, Lea		Tox			Photosystem II
Bifenox	Modown		Tox			PPG or Protox
Bromoxynil	Buctril, Weedex		Tox			Photosystem II
Carbuthioate	R-120001	STox				xx Not in 9th edition
Carfentrazone-ethyl	Aim			Stox	Pot	PPG or Protox
Chloramben	Amiben	Mix				xx Not in 9th edition
Chlorimuron-ethyl	Classic		Tox			ALS or AHAS
Chloroxuron	Tenoran	Tox				xx Not in 9th edition
Chlorpropham (CIPC)	Chloro-IPC, Furloe	Mix				xx Not in 9th edition
Chlorsulfuron	Glean	Mix				ALS or AHAS
Chlorsulfuron + Metsulfuron	Finesse	Mix				ALS or AHAS
Chorthal-dimethyl	Dacthal, Prothal, Shamrox	STox				xx Not in 9th edition
Clethodim	Arrow, Select Max		Com			ACCCase
Clomazone	Command	Tox				Carotenoid synthesis
Clopyralid	Lontrel, Stinger		Tox			Synthetic auxin
Cloransulam-methyl	FirstRate	Tox	Tox			ALS or AHAS
Dicamba	Clarity		Tox			Synthetic auxin
Dichlobenil	Casoron	Tox				Cellulose
Dichlormate		SSel				xx Not in 9th edition
Diclofop	Hoelin	NER				ACCCase
Diclosulam	Spider, Strongarm	Tox	Tox			ALS or AHAS
Diethylal	Antor	SSel				xx Not in 9th edition
Diethylacetanilide	C-10725	SSel				xx Not in 9th edition
Diflufenican	Brodal	STox	Tox			Carotenoid synthesis
Diflufenzopyr	Distinct		Tox			Auxin transport
Dimethenamid	Frontier	Mix				Mitosis
Dinitramine	Cobex	Tox				xx Not in 9th edition
Dinoseb	Premerge	Tox				xx Not in 9th edition
Diphenamid	Dymid, Enide	Sel	Sel			Mitosis
Diquat	Reglone				Effec	Photosystem I
Diuron	Direx, Diurol, Diuron, Karmex	Com	Com	Com		Photosystem II
Diuron + linuron	Layby Pro	Com	Tox	Pot		Photosystem II
DSMA	DSMA		STox			Nucleic acid or non-descript

Active ingredient	Trade name	PRE	OTT	DIR	HA	Mode of action
Endothall	Accelerate	Tox	Tox			Not classified
EPTC	Eptam	Mix				Fatty acid and lipid
Ethalfuralin	Curbit, Sonalan	Mix				Mitosis
Fenoxaprop	Whip	NER				ACCCase
Fenoxaprop-P + fluazifop-P	Fusion					ACCCase
Fluazifop-P	Fusilade		Com			ACCCase
Fluazifop-P + fenoxaprop-P	Fusion					ACCCase
Fluchloralin	Basalin	Com				xx Not in 9th edition
Flufenacet	Radius	Tox				Mitosis
Flufenacet + metribuzin	Axiom, Domain	Tox				Mitosis + Photosystem II
Flumetsulam	Preside	Tox	Tox			ALS or AHAS
Flumioxazin	Broadstar, Chateau, Sumisoya, Valor	Tox	STox	Mix		PPG or Protox
Fluometuron	Cotoran, Lanex	Com	Pot	Pot		Photosystem II
Fluorodifen	Preforan	Tox				xx Not in 9th edition
Fomesafen	Flex, Reflex		Mix			PPG or Protox
Foramsulfuron + iodosulfuron	Equip		Tox			ALS or AHAS
Glufosinate	Basta, Finale, Ignite, Liberty, Rely			Pot	Effec	Glutamine synthetase
Glyphosate	Buccaneer, Durango, Roundup, RT3, Touchdown	Com	Tox	Mix	Effec	EPSP
Haloxifop	Verdict		Sel			ACCCase
Imazamox	Beyond					ALS or AHAS
Imazapic	Cadre	Tox	Tox			ALS or AHAS
Imazethapyr	Pursuit	SSel	Tox			ALS or AHAS
Iodosulfuron + foramsulfuron	Equip		Tox			ALS or AHAS
Isopropalin	Paarlan	Tox				xx Not in 9th edition
Lactofen	Cobra		Tox	STox		PPG or Protox
Linuron	Afalon, Linex, Lorox, Linorox, Teliron	Com		Sel		Photosystem II
Linuron + diuron	Layby Pro	Com	Tox	Pot		Photosystem II
Mesotrione	Callisto		Tox			Carotenoid synthesis
Methazole	Probe	Mix				xx Not in 9th edition
Methibenzuron	Tribunil		SSel			Photosystem II
Metobromuron	Patoran	Com				xx Not in 9th edition
Metobromuron + metolachlor	Galex	Com				xx Not in 9th edition
Metolachlor	Dual	Com				Mitosis
Metolachlor + Metobromuron	Galex	Com				Mitosis + ?
Metribuzin	Lexone, Sencor, Sencorex	Tox				Photosystem II
Metribuzin + flufenacet	Axiom, Domain	Tox				Photosystem II + mitosis

Active ingredient	Trade name	PRE	OTT	DIR	HA	Mode of action
Metsulfuron-methyl	Ally	Mix				ALS or AHAS
Metsulfuron + Chlorsulfuron	Finesse	Mix				ALS or AHAS
Monolinuron	Afessin	Mix				Photosystem II
Monuron	Monurex, Telvar	Sel				xx Not in 9th edition
MSMA	MSMA		STox			Nucleic acid or non-descript
Napropamide	Devrinol, Pamid	Mix				Mitosis
Naptalam (NPA)	Alanap	Tox	Tox			Auxin transport
Nicosulfuron	Accent	Mix	Tox			ALS or AHAS
Nitralin	Planavin	Mix				xx Not in 9th edition
Nitrofen		Tox				xx Not in 9th edition
Norea	Herban	Mix				xx Not in 9th edition
Norflurazon	Solicam, Zorial	Tox				Carotenoid biosynthesis
Oxadiazon	Ronstar	SSel	STox			PPG or Protox
Oxasulfuron	Dynam, GCA		Tox			xx Not in 9th edition
Oxyfluorfen	Goal	SSel	Tox			PPG or Protox
Paraquat	Gramoxone, Gramoxone Inteon, Parazone		Stox	Stox	Effec	Photosystem I
Pebulate	Tillam	SSel				Fatty acid and lipid
Pendimethalin	Herbadox, Prowl, Stomp	Com	Sel			Mitosis
Perfluidone	Destun	Sel				xx Not in 9th edition
Phenmediphan	Betanal		Tox			Photosystem II
Proatryne		Sel				xx Not in 9th edition
Profluralin	Agriflan, Pregard	Sel				xx Not in 9th edition
Prometryn	Caparol, Gesagard	Tox	Tox	Sel		Photosystem II
Prometryn + trifloxysulfuron	Suprend			Tox		Photosystem II + ALS or AHAS
Pronamide	Kerb	Tox				Mitosis
Propachlor	Ramrod	Sel				Mitosis
Propanil	Stam-F-34	SSel				Photosystem II
Propazine	Milogard, Milocep, Milo-Pro	Mix	Tox	Sel		xx Not in 9th edition
Prosulfuron	Exceed, Peak	Mix	Tox			ALS or AHAS
Pyraflufen-ethyl	Ecopart, ET		Stox	Sel	Not eff	PPG or Protox
Pyridate	Lentagram, Tough		Mix			Photosystem II
Pyrithiobac-sodium	Staple	Tox	Tox	Tox		ALS or AHAS
Rimsulfuron	Matrix	Sel	Tox			ALS or AHAS
Sesone	Crag	Mix				xx Not in 9th edition
Sethoxydim	Poast, Sertin		Com			ACCCase
Simazine	Princep	Tox				Photosystem II
Sirmate		NER				xx Not in 9th edition
S-Metolachlor	Allfire, Dual Magnum, Medal	Com	Pot			Mitosis
Sufentrazone	Authority, Spartan	Tox				PPG or Protox
Sulfonamide	Python	Mix				xx Not in 9th edition

Active ingredient	Trade name	PRE	OTT	DIR	HA	Mode of action
Thiobencarb	Bolero	Tox				Fatty acid and lipid
Triasulfuron	Amber	Mix				ALS or AHAS
Trifloxysulfuron	Envoke	Mix	Tox	Tox		ALS or AHAS
Trifloxysulfuron + prometryn	Suprend			Tox		ALS or AHAS + Photosystem II
Trifluralin	Treflan, Agriflan	Com	STox			Mitosis
Vernolate	Vernam	Tox				Fatty acid and lipid

The following is a more detailed summary of this research by active ingredient. The summary provides initial data and observations on herbicides used in ASGA sponsored research in 2007/2008. Many of the active ingredients listed below are no longer used in the US (Not in Herbicide Handbook – 9th edition), but the information is included in order to stimulate the minds of researchers as to what new chemicals should be tested. According to the introduction to the Herbicide Handbook, some herbicides were not included because they were not recommended to the committee to include in the new addition. It is known that propazine is an old herbicide that is making a comeback in the US and is not in the 9th edition.

2,4-DB (Butyrac)

- PRE summary: Reduces the germination substantially.
- POST summary:
 - *Over the top*: Toxic to sesame with severe stunting and substantial yield loss, but does not kill the sesame. Is highly volatile and drift can affect sesame when used in adjacent fields.
 - *POST directed*: No known research.

Aciflourfen (Blazer)

- PRE summary: No known research.
- POST summary:
 - *Over the top*: Toxic to sesame in all but one test with substantial yield reduction. In the one test where yield was higher, there was considerable weed pressure in check.
 - *POST directed*: No known research. Informal tests show that the acifluorfen does not damage the sesame; however, more research needs to be done before using.

Alachlor (Lasso, Alanox, Alar, Intro, Lazo)

- Sesame use: Used in foreign commercial fields as PRE by itself or in combination with other herbicides. Most widely used herbicide for sesame. No US label.
- PRE summary: Selective to sesame and provides good weed control. In the US, use of alachlor decreased with the increase of the related herbicide metolachlor. With recent increased use in the US, alachlor may be included in ASGA sponsored US research in 2009.
- POST summary:
 - *Over the top*: No known research, but farmers have applied it without an apparent effect on the sesame to provide residual weed control
 - *POST directed*: No known research. Logically there is not reason that it could not be used to add residual control even though it will not kill germinated weeds.

Allidochlor - CDAA (Radox)

- PRE summary: At low rates was non-toxic; at higher rates caused chlorosis and stand reductions.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Ametryn (Gesapax)

- PRE summary: Toxic to sesame with close to no germination.
- POST summary: No known research.

Amiprofosmethyl (Bay-NTN 6867)

- PRE summary: Toxic to sesame by substantially reducing vigor and stands.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Asulam (MB-9057)

- PRE summary: Somewhat selective to sesame, but poor weed control.
- POST summary: No known research.

Atrazine (Aatrex, Gesaprim)

- PRE summary: Residues from previous crops can be toxic to sesame.
- POST summary:
 - *Over the top*: Toxic to sesame. Reduces the production substantially, but does not kill the sesame.
 - *POST directed*: No known research.

Benfin (Balan)

- PRE summary: Toxic to sesame.
- POST summary: No known research.

Benfuresate (Cyperal)

- PRE summary: Higher rates toxic to sesame.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Bensulide (Prefar)

- PRE summary: Selective to sesame but erratic grass and broadleaf control.
- POST summary: No known research.

Bentazon (Adagio, Basagran, Bendioxide, Entry, Leader, Pledge)

- PRE summary: No known research.
- POST summary:
 - *Over the top*: Toxic to sesame. There is a substantial reduction in yield, population, and vigor, but did not kill the sesame.
 - *POST directed*: No known research.

Bifenox (Modown)

- PRE summary: No known research.
- POST summary:
 - *Over the top*: Toxic to sesame, almost totally wiped out the sesame.
 - *POST directed*: No known research.

Bromoxynil (Buctril, Weedex)

- PRE summary: No known research.
- POST summary:
 - *Over the top*: Toxic to sesame in all but one test with substantial yield reduction. In the one test where yield was higher, there was considerable weed pressure in check. In a commercial use, stunted the sesame and the weeds, but the weeds recovered first.
 - *POST directed*: No known research.

Carbothioate (R-12001)

- PRE summary: Toxic to sesame, but did not kill sesame.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Carfentrazone-ethyl (Aim)

- PRE summary: No known research. Growers using carfentrazone to kill Roundup Ready cotton prior to planting sesame have not had a problem, but one grower who applied it the day before sesame emergence wiped out the sesame stand. It is hypothesized that the shoots were close enough to the surface to have absorbed the herbicide.
- POST summary:
 - *Over the top*: No known research.
 - *POST directed*: In US testing selective to sesame with minor reduction in yield in 2007, but somewhat toxic in one test in 2008. Needs more research before using in farmer fields. May not continue in research because does not offer residual control.
- Harvest aid summary: In 2005/2006 US testing, carfentrazone did not accelerate drydown of the sesame. In foreign use, carfentrazone was mixed with glyphosate to help killing morningglory. When used at low rates, it did help, but when used at higher rates, the glyphosate did not dry down the sesame. It was hypothesized that at higher rates the carfentrazone killed the leaves and stems so quick that the absorbed glyphosate did not have a chance to translocate to the roots.

Chloramben (Amiben)

- PRE summary: Mixed results with some rates selective and others toxic to sesame, and erratic weed control.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Chlorimuron-ethyl (Classic)

- PRE summary: No known research
- POST summary:
 - *Over the top*: Toxic to sesame with substantial production reduction, but did not kill the sesame.
 - *POST directed*: No known research.

Chloroxuron (Tenoran)

- PRE summary: Toxic to sesame, but did not kill sesame.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Chlorpropham – CIPC (Furloe, Chlor-IPC)

- PRE summary: Mixed results with some tests toxic to sesame and others selective to sesame.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Chlorsulfuron (Glean)

- PRE summary: No known research, but mixed results in planting sesame after herbicide used in previous cereal crop.
- POST summary: No known research.

Chlorsulfuron plus metsulfuron (Finesse)

- PRE summary: No known research, but mixed results in planting sesame after herbicide used in previous cereal crop. In one field in 2008 in Oklahoma, the sesame germinated and had a good stand, but within 7 days the whole stand was lost.
- POST summary: No known research.

Chorthal-dimethyl – DCPA (Dacthal, Prothal, Shamrox)

- PRE summary: Toxic to sesame except at low rates.

- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Clethodim (Select Max, Arrow)

- Sesame use: Used in foreign commercial fields as POST. US label for Select Max and Arrow. The herbicide can be sprayed at all stages except during flowering.
- PRE summary: No known research.
- POST summary:
 - *Over the top*: Selective to sesame and good grass control. With the increased use of glyphosate, tanks and hoses must be thoroughly cleaned to prevent glyphosate residues being applied with the clethodim. There is severe damage when there are even slight glyphosate residues still in the tank. Several farmers have commented that clethodim is the best tank cleaner they have used.
 - *POST directed*: No known research, but logically if the grass weeds are short, a POST directed application would allow contact with the small weeds in the seed line which are protected by the sesame plants from an over the top application.

Clomazone (Command)

- PRE summary: Toxic to sesame, but does not prevent all germination.
- POST summary: No known research.

Clopyralid (Lontrel, Stinger)

- PRE summary: Initial results in Australia indicate potential use at low rates.
- POST summary:
 - *Over the top*: In 2008 US testing, clopyralid twisted the sesame and led to semi-sterility. Visually, it appears there will be a substantial yield reduction. On the other hand, clopyralid is very effective against cockle bur and sunflowers which can totally destroy a stand of sesame with zero yield. It is doubtful additional research will be done in 2009.
 - *POST directed*: No known research.

Cloransulam-methyl (FirstRate)

- PRE summary: Toxic to sesame with substantial reductions in stand and yield and severe injury.
- POST summary:
 - *Over the top*: Toxic to sesame with severe injury and reduction in yield, but did not kill the sesame.
 - *POST directed*: No known research.

Dicamba (Clarity)

- PRE summary: No known research.
- POST summary:
 - *Over the top*: Toxic to sesame with severe yield reduction, but did not kill the sesame.
 - *POST directed*: No known research.

Dichlobenil (Casoron)

- PRE summary: Toxic to sesame.
- POST summary: No known research.

Dichlormate

- PRE summary: Somewhat selective but not as good as other treatments.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Diclofop (Hoelin, HOE 23408)

- PRE summary: Difficult to evaluate because only research was mixed with methazole which can be toxic.
- POST summary: No known research.

Diclosulam (Spider, Strongarm)

- PRE summary: Toxic to sesame with severe stand reduction.
- POST summary:
 - *Over the top*: Toxic to sesame with substantial production reduction and severe injury, but did not kill the sesame.
 - *POST directed*: No known research.

Diethatyl (Antor, H-22234)

- PRE summary: Selective to sesame and good weed control, but only one experiment.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Diethylacetanilide (C-10725)

- PRE summary: Somewhat selective to sesame, but poor weed control.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Diflufenican (Brodal)

- PRE summary: Somewhat toxic to sesame and not as good as other herbicides.
- POST summary:
 - *Over the top*: Toxic to sesame with substantial injury, but the sesame did recover at the end.
 - *POST directed*: No known research.

Diflufenzopyr (Distinct)

- PRE summary: No known research
- POST summary:
 - *Over the top*: Toxic to sesame with substantial production reduction, but did not kill the sesame.
 - *POST directed*: No known research.

Dimethenamid (Frontier)

- PRE summary: Mixed results with good results for two years and almost complete kill in another year.
- POST summary: No known research.

Dinitramine (Cobex)

- PRE summary: Toxic to sesame.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Dinoseb (Premerge)

- PRE summary: Toxic to sesame by reducing the stand substantially.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Diphenamid (Dymid, Enide)

- PRE summary: Selective to sesame in most research, but other treatments were better.
- POST summary:
 - *Over the top*: Selective to sesame with minor reduction in yield, stand, and vigor.
 - *POST directed*: No known research.

- Out of production in US

Diuron (Direx, Diurol, Diuron, Karmex)

- Sesame use: Used in foreign commercial fields as PRE and POST. In the US, good potential as PRE, POST over the top, and POST directed. No US label.
- PRE summary: Selective to sesame and provides good weed control. In 2007 US testing, diuron was selective to sesame with minimal stand reduction and no yield reduction. At double rates, there was some discoloration. In 2008 US testing, visual results confirm 2007 results. Needs a US label before using in farmer fields. Future testing will include mixes with S-metolachlor.
- POST summary:
 - *Over the top*: Is somewhat selective to sesame and has good weed control, but most foreign commercial applications are made between the rows. There was some initial discoloration, but the plants recovered. In 2007/2008 US testing, diuron is selective to sesame. There were some yellow splotches that did not appear to damage the plants and there was no yield reduction. Spraying has been done at the juvenile stage. Initial testing of spraying during flowering showed some height reduction and there was a slight yield loss. Testing in 2009 will focus on time of spraying experiments. Needs more research before using in farmer fields.
 - *POST directed*: In 2007/2008 US testing, there was substantial reduction in yield when used in conjunction with glyphosate. When used by itself in 2008, visual results indicate that diuron is selective to sesame. Testing in 2009 will focus on time of spraying experiments. Needs more research before using in farmer fields.

Diuron plus linuron (Layby Pro)

- Sesame use: Argentina testing mixes the herbicides vice using the premix Layby Pro, and uses the combination in commercial fields. In the US, good potential as PRE and POST directed. No US label.
- PRE summary: Selective to sesame and provides good weed control. In 2007 US testing, Layby Pro was selective to sesame with minimal stand reduction and no yield reduction. In 2008 US testing, visual results confirm 2007 results. Needs a US label before using in farmer fields. No plans for further testing
- POST summary:
 - *Over the top*: In 2008 Argentina and US testing, toxic to sesame.
 - *POST directed*: In 2007/2008 US testing, there was substantial reduction in yield when used in conjunction with glyphosate. When used by itself in 2008, visual results indicate that Layby Pro is selective to sesame. Testing in 2009 will focus on time of spraying experiments. Needs more research before using in farmer fields.

Diquat (Reglone)

- Sesame use: Commercial use in Australia and Venezuela discontinued because of lower yields when using shattering sesame varieties. In US has potential when used with non-dehiscent varieties. No US label, but in the IR4 program.
- PRE summary: No known research.
- POST summary: No known research.
- Harvest aid summary: In 2005 through 2008 US testing, initial results indicate that reglone may be a good herbicide to accelerate sesame drydown and kill existing weeds. Acts faster than other harvest aids. Further testing is needed before applying for a US label and using in farmer fields. Diquat is in the IR4 program to use as a harvest aid.

Endothal (Accelerate)

- PRE summary: Toxic to sesame with slight to severe stunting, but did not kill sesame.
- POST summary:
 - *Over the top*: Toxic to sesame with severe stunting, but did not kill the sesame.
 - *POST directed*: No known research.

EPTC (Eptam)

- PRE summary: Mixed results with selectivity and toxicity to sesame under different conditions.
- POST summary: No known research.

Ethalfuralin (Curbit, Sonalan)

- PRE summary: Mixed results because significant reduced plant height and plant populations and yet yields compared to a weedy check were higher. Had good grass control but erratic broadleaf control.
- POST summary: No known research.

Fenoxaprop-P- (Whip)

- PRE summary: Not effective in sesame.
- POST summary: No known research.

Fenoxaprop-P plus fluazifop-P (Fusion)

- PRE summary: No known research.
- POST summary: No known research. Anecdotal data with no check area as a comparison has shown no damage to sesame.

Fluazifop-P (Fusilade)

- Sesame use: Used in foreign commercial fields as a POST. No label in US.
- PRE summary: No known research.
- POST summary:
 - *Over the top*: Selective to sesame and good grass control. If there were a US label, Fusilade would be used extensively.
 - *POST directed*: No known research, but logically if the grass weeds are short, a POST directed application would allow contact with the small weeds in the seed line which are protected by the sesame plants from an over the top application.

Fluazifop-P plus fenoxaprop-P (Fusion). See fenoxaprop plus fluazifop-P.

Fluchloralin (Basalin)

- Sesame use: Used in foreign commercial fields as a PPI and PRE. No label in US.
- PRE summary: Selective to sesame and good weed control.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Flufenacet (Radius)

- PRE summary: Toxic to sesame with severe reduction in stand and yield and too much injury.
- POST summary: No known research.

Flufenacet plus metribuzin (Axiom, Domain)

- PRE summary: Toxic to sesame with severe reduction in stand and yield and too much injury.
- POST summary: No known research.

Flumetsulam (Preside)

- PRE summary: Toxic to sesame, but does not kill all the sesame.
- POST summary:
 - *Over the top*: Toxic to sesame with complete kill.
 - *POST directed*: No known research.

Flumioxazin (Valor, Sumisoya, Broadstar, Chateau)

- Sesame use: Potential to use POST directed. No US label.
- PRE summary: Toxic to sesame with severe reduction in stand and yield and too much injury.

- **POST summary:**
 - *Over the top:* In Argentina and 2007/2008 US testing, have had mixed initial results. Toxic to sesame when used with a surfactant. Somewhat toxic to sesame (injured but recovers) when used without a surfactant, but does not control existing weeds as well. In Argentina when compared to the weedy check, there was an improvement to yield because of the residual weed control. It is doubtful that a farmer would use flumioxazin as a POST OTT with so much visual damage even without the surfactant, but needs more research because of the excellent residual weed control, particularly on morningglory. In further testing in 2009.
 - *POST directed:* In 2007/2008 US testing, in combination with glyphosate was toxic to sesame in two locations with severe yield reduction, while was somewhat selective to sesame in two other locations. With the potential damage, doubtful that would be used in conjunction with glyphosate. In 2008 US testing by itself, flumioxazin was selective to sesame. Needs more research before using in farmer fields. In further testing in 2009.

Fluometuron (Cotoran, Kotoran, Lanex)

- **Sesame use:** Used in foreign commercial fields as a PRE. Potential to use POST over the top and POST directed. No US label.
- **PRE summary:** Selective to sesame, but there are other herbicides that were judged better. In 2008 US testing, was toxic to sesame, but only tested in one location. Needs further testing in 2009 since it is used commercially in other parts of the world.
- **POST summary:**
 - *Over the top:* In 2007 US testing, fluometuron was selective to sesame with some yellow splotches and no yield reduction. In 2008 US testing, visual ratings show no damage other than the discoloration. Testing was only done on the Caprock, and additional testing will be necessary in other locations prior to considering a label for the US. In further testing in 2009.
 - *POST directed:* In 2008 US testing, in combination with glyphosate was toxic to sesame. Doubtful that would be used in conjunction with glyphosate. In 2008 US testing by itself, Cotoran was selective to sesame, but there has only been one test in one location. Needs more research before using in farmer fields. In further testing in 2009.

Fluorodifen (Preforan)

- **PRE summary:** Toxic to sesame with substantial damage to sesame seedlings.
- **POST summary:** No known research.
- Not in Herbicide Handbook – 9th edition

Fomesafen (Flex, Reflex)

- **PRE summary:** No known research. May be tested in 2009.
- **POST summary:**
 - *Over the top:* Mixed results in that it is toxic to sesame in reducing yield, but in one test in weedy conditions can improve yield over weedy check. Too risky to use.
 - *POST directed:* No known research. May be tested in 2009.

Foramsulfuron plus iodosulfuron (Equip)

- **PRE summary:** No known research.
- **POST summary:**
 - *Over the top:* Toxic to sesame with almost complete kill.
 - *POST directed:* No known research.

Glufosinate (Liberty, Finale, Rely, Ignite, Basta)

- **Sesame use:** Potential use as POST directed. No US label.
- **PRE summary:** No known research.
- **POST summary:**
 - *Over the top:* No known research.
 - *POST directed:* In 2007 US testing, there was burning of the sesame leaves that came in contact with the herbicide, but the plants recovered, and there was minimum yield reduction.

In 2008 US testing, visual ratings confirm the 2007 results. Needs more research before using in farmer fields. Only drawback is that it does not provide residual control. In further testing in 2009. With the erratic behavior of glyphosate used in combination with other herbicides, 2009 testing may combine glufosinate with herbicides such as diuron, linuron, flumioxazin, fluometuron, and/or prometryn. It would be helpful to have a contact herbicide mixed with an herbicide that provides residual weed control.

- Harvest aid summary: In 2005 through 2008 US testing, initial results indicate that glufosinate may be a good herbicide to accelerate sesame drydown and kill existing weeds. Needs a US label before using in farmer fields. Additional testing in 2009 will be done on timing of application and rates.

Glyphosate (Roundup, RT3, Touchdown, Buccaneer, Durango)

- Sesame use: Used in foreign commercial fields PREPLANT or PRE as a burndown for existing weeds. US label for RT3. RT3 can be applied before, during, or after planting. Broadcast must be done before the crop emerges. Wiper applicators or hooded sprayers can be used between the rows after the crop has been established.
- PRE summary: No known research to verify there is no damage; however, no differences have been seen in areas that have been sprayed or double sprayed next to an area that has not been sprayed. Even a light drift can stop the plants from setting capsules for 1-5 node pairs and reduces the diameter of the stem. Once the plants do start setting capsules again, the stem is weak and may bend over from the weight of the new capsules. The affected plants will continue flowering longer than the rest of the field and delay drydown for harvest.
- POST summary:
 - *Over the top*: Toxic to sesame. Will kill the sesame and drift from adjacent field applications can stunt the sesame severely.
 - *POST directed*: Directed in the center between the rows has selective to the sesame and has been effective on controlling existing weeds. However, does not have any residual control. Has been used successfully extensively in wiper applications to control pigweed. In 2005 through 2008 US testing, damage from spraying on the stem depended on the height of the plant, the height of the application on the plant, and whether the sesame was under stress. When under stress, there is little to no damage, but when the sesame is growing without any stress, glyphosate is toxic to sesame – can completely destroy a stand. No additional testing will be done other than perhaps using glyphosate as a control. It is interesting that in combination with other herbicides, there is a “safening” effect with less damage to the sesame.
- Harvest aid summary: In 2005 through 2008 US testing, results indicate that glyphosate is a good herbicide to accelerate sesame drydown and kill existing weeds. It takes a bit longer to dry the sesame than diquat or glufosinate, but there is a more thorough termination than with other herbicides. Needs a US label before using in farmer fields. Additional testing in 2009 will be done on timing of application and rates.

Haloxypop (Verdict)

- Sesame use: Used in foreign commercial fields as a POST. No US label.
- PRE summary: No known research.
- POST summary:
 - *Over the top*: No known research, but foreign farmers and researchers report using it without a problem.
 - *POST directed*: No known research, but logically if the grass weeds are short, a POST directed application would allow contact with the small weeds in the seed line which are protected by the sesame plants from an over the top application.

Imazamox (Beyond)

- PRE summary: No known research. No experience with using this product in wheat prior to planting sesame. However, Beyond label specifies 9-26 month rotation for broadleaves that are not Cleafield®.

- POST summary: No known research.

Imazapic (Cadre)

- PRE summary: No known research, but in carry over from a peanut application there was close to zero germination.
- POST summary:
 - *Over the top*: Toxic to sesame with stunting and substantial yield reduction.
 - *POST directed*: No known research. Not included in testing because of rotational restrictions.

Imazethapyr (Pursuit)

- PRE summary: Somewhat selective in that it reduces stand and plant height, but at a low rate it increased yield over a weedy check.
- POST summary:
 - *Over the top*: Toxic to sesame with substantial stunting and yield reduction; however, in one test, outyielded the weedy check. In 2008 US testing, destroyed the sesame. Too risky to use.
 - *POST directed*: In 2008 US testing, destroyed the sesame. Will not be included in further testing because of rotational restrictions.

Iodosulfuron plus foramsulfuron (Equip). See foramsulfuron plus iodosulfuron.

Isopropalin (Paarlan, EL-179)

- PRE summary: Toxic to sesame with reductions in stand and medium injury.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Lactofen (Cobra)

- PRE summary: No known research.
- POST summary:
 - *Over the top*: Toxic to sesame with substantial yield reduction, but did not kill the sesame.
 - *POST directed*: In 2007 US testing there was some reduction in yield. There were dark marks on stem at level of application. Will not be in further testing because there are other better herbicides.

Linuron (Afalon, Linex, Linurex, Lorox)

- Sesame use: Used in foreign commercial fields as PRE. Good potential as POST directed. No label in US.
- PRE summary: Selective to sesame and good weed control. In 2007/2008 US testing, linuron was selective to sesame. However, at this point, no US label will be pursued because the combination with diuron is as selective to the sesame, and the combination controls a wider spectrum of weeds.
- POST summary:
 - *Over the top*: No known research. However, it is hypothesized that it is toxic to sesame because of toxic results from using linuron in combination with diuron (see diuron plus linuron results). Since diuron is selective to sesame, it is assumed that the toxicity is from the linuron.
 - *POST directed*: In 2008 US testing, linuron in combination with glyphosate was toxic in one location and selective in another. However, the toxicity in the one location was severe enough to not continue testing the combination. In 2007/2008 US testing by itself, linuron was selective to sesame. However, at this point, no US label will be pursued because the combination with diuron is as selective to the sesame, and the combination controls a wider spectrum of weeds.

Linuron plus diuron (Layby Pro) – See diuron plus linuron.

Mesotrione (Callisto)

- PRE summary: No known research.
- POST summary:
 - *Over the top*: Toxic to sesame with total kill in one test. In another test, substantial production reduction, but did not kill the sesame.
 - *POST directed*: No known research.

Methazole (Probe)

- PRE summary: Mixed results with selective in one year and toxic in the next at the same rates.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Methibenzuron (Tribunil)

- PRE summary: No known research.
- POST summary:
 - *Over the top*: Somewhat selective in that there is stunting but the plants recover to yield close to the check.
 - *POST directed*: No known research.

Metobromuron (Patoran)

- PRE summary: Selective to sesame, particularly when mixed with Galex.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Metobromuron plus metolachlor (Galex)

- Sesame use: Used in foreign commercial fields as PRE. No US label.
- PRE summary: Selective to sesame.
- POST summary: No known research.
- Out of production in US

Metolachlor (Dual, Allfire). See S-metolachlor.

Metolachlor plus metobromuron (Galex). See metobromuron plus metolachlor.

Metribuzin (Sencor, Sencorex, Lexone)

- PRE summary: Toxic to sesame with substantial reduction in yield and stand.
- POST summary: No known research.

Metribuzin plus Flufenacet (Axiom, Domain). See flufenacet plus metribuzin.

Metsulfuron-methyl (Ally)

- PRE summary: No known research, but mixed results in planting sesame after herbicide used in previous cereal crop.
- POST summary: No known research.

Metsulfuron plus chlorsulfuron (Finesse). See Chlorsulfuron plus metsulfuron.

Monolinuron (Afesin)

- PRE summary: Somewhat selective to sesame at lower rates and toxic at higher rates.
- POST summary: No known research.

Monuron (Monurex, Telvar)

- PRE summary: Selective to sesame with good weed control.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Napropamide (Devrinol, Pamid)

- PRE summary: Selective to sesame as a PRE at a low rate, but toxic as a PPI or at a higher rate.
- POST summary: No known research.

Naptalam – NPA (Alanap)

- PRE summary: Toxic to sesame.
- POST summary:
 - *Over the top*: Toxic to sesame with severe stunting, but the sesame recovered in one test.
 - *POST directed*: No known research.

Nicosulfuron (Accent)

- PRE summary: No known research, but mixed results in planting sesame after herbicide used in previous cereal crop.
- POST summary:
 - *Over the top*: Toxic to sesame with substantial production reduction, but did not kill the sesame.
 - *POST directed*: No known research.

Nitralin (Planavin)

- PRE summary: Mixed results with selective in one test and toxic in another.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Nitrofen (TOK E-25)

- PRE summary: Toxic to sesame.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Norea (Herban)

- PRE summary: Mixed results with selective at low rates, and toxic at higher rates.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Norflurazon (Zorial, Solicam)

- PRE summary: Toxic to sesame with substantial stand reduction and injury.
- POST summary: No known research.

Oxadiazon (Ronstar)

- PRE summary: Somewhat selective to sesame in that there is stand reduction, but the plants recover well at the end. Not as good as other treatments.
- POST summary:
 - *Over the top*: Without a surfactant, somewhat toxic initially, but the plants recovered well. In 2007 US testing, oxadiazon was toxic to sesame in early (1-3 weeks after planting) applications, but it was somewhat toxic later in the cycle (4-5 weeks). However, there is enough damage that no further testing will be done.
 - *POST directed*: No known research.

Oxasulfuron (GCA, Dynam)

- PRE summary: No known research.
- POST summary:
 - *Over the top*: Toxic to sesame with substantial reduction in production.
 - *POST directed*: No known research.
- Not in Herbicide Handbook – 9th edition

Oxyfluorfen (Goal)

- PRE summary: Somewhat selective to sesame and good weed control, but other treatments were better.
- POST summary:
 - *Over the top*: Toxic to sesame with substantial production reduction, but did not kill the sesame.
 - *POST directed*: No known research.

Paraquat (Gramoxone)

- Sesame use: Potential use as a POST directed to control weeds, but will not provide residual control.
- PRE summary: No known research.
- POST summary:
 - *Over the top*: Burns the leaves, but the yield is close to the check at the end.
 - *POST directed*: In 2007/2008 US testing, paraquat burned the leaves, but the yield was close to the check at the end. However, in a windy situation, there is enough drift on to the upper portion of the plant that there can be a substantial yield reduction. No further testing will be done because it is risky and does not provide any residual weed control.
- Harvest aid summary: In 2005/2006 US testing, paraquat dried the sesame at about the same rate as diquat (Reglone). Since the manufacturer would support use of diquat in the IR4 program and not support paraquat, no additional testing has been done.

Pebulate (Tillam)

- PRE summary: Somewhat selective to sesame and good weed control, but other treatments were better
- POST summary: No known research.

Pendimethalin (Prowl, Stomp. Prowl H2O, Herbadox, and Pendimax do not require PPI)

- Sesame use: Used in foreign commercial fields as PPI and POST. No label in US.
- PRE summary: Mixed results – selective to sesame and very good weed control, but can be toxic to sesame in some cases. The method of incorporation is important in that pendimethalin is selective to sesame when the seed line is below the herbicide, and the herbicide does not move down to the root zone at the seedling stage. Have not done much research using new products that do not require PPI. See the use of sesame after failed out cotton under trifluralin. Prowl H2O is replacing the use of trifluralin in cotton, and the results of applying pendimethalin 60 or more days prior to planting sesame may prove effective in controlling weeds such as Texas panicum.
- POST summary:
 - *Over the top*: No known research, but some farmers apply it to provide residual control of grasses.
 - *POST directed*: No known research.

Perfluidone (Destun)

- PRE summary: Selective to sesame but poor weed control.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Phenmedipham (Betanal)

- PRE summary: No known research.
- POST summary:
 - *Over the top*: Toxic to sesame.
 - *POST directed*: No known research.

Proatryne

- PRE summary: Somewhat selective to sesame and good weed control, but there were better treatments.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Profluralin (Pregard)

- PRE summary: Somewhat selective to sesame and good weed control, but there were better treatments.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Prometryn (Caparol, Gesagard, Suprend)

- Sesame use: Potential use as POST directed. No US label.
- PRE summary: Toxic to sesame in most conditions with severe stand reduction. Has good weed control when the hot zone is cleared from the seed line so that the sesame can emerge.
- POST summary:
 - *Over the top*: Toxic to sesame ranging from complete kill to reduction of yield and some injury.
 - *POST directed*: In 2007/2008 US testing was toxic to sesame when used in combination with glyphosate in 3 of 4 locations. Will not be further tested in combination because of the risk. In 2008 US testing by itself, prometryn is selective to sesame and provides good residual control of weeds that are a problem in the US sesame growing areas. With only one year of testing, will need further testing in 2009, but prometryn may be the number one candidate for a POST directed US label.

Pronamide (Kerb)

- PRE summary: Toxic to sesame with severe reduction in stands and very bad injury.
- POST summary: No known research.

Propachlor (Ramrod)

- PRE summary: Selective to sesame with good weed control, but limited research.
- POST summary: No known research.

Propanil (Stam-F34)

- PRE summary: Somewhat selective to sesame with effective weed control, but limited research.
- POST summary: No known research.

Propazine (Milocep, Milogard, Milo-Pro)

- PRE summary: In 2007/2008 US testing, propazine was toxic to sesame.
- POST summary:
 - *Over the top*: In 2007/2008 US testing, propazine was toxic to sesame.
 - *POST directed*: In 2008 US testing, propazine in combination with glyphosate was toxic to sesame. By itself, propazine appears to be selective to sesame. More testing will be required, but should be continued because propazine is effective against morningglory.
- Not in Herbicide Handbook – 9th edition, but is in use in the US for sorghum.

Prosulfuron (Exceed, Peak)

- PRE summary: No known research, but mixed results in planting sesame after herbicide used in previous cereal crop.
- POST summary:
 - *Over the top*: Toxic to sesame with substantial production reduction, but did not kill the sesame.
 - *POST directed*: No known research.

Pyraflufen-ethyl (Ecopart, ET)

- PRE summary: No known research.
- POST summary:
 - *Over the top*: Somewhat toxic to sesame with initial injury, but the plants recovered at the end. Mixed on weed control.
 - *POST directed*: In 2007/2008 US testing, selective to sesame with no visual damage, but there are slight reductions in yield. There will be no further testing since it does not provide residual control. May be tested in combination with other POSTDIR herbicides that do provide residual control.
- Harvest aid summary: In 2005/2006 US testing, pyraflufen ethyl did not accelerate drydown of the sesame.

Pyridate (Lentagran, Tough)

- PRE summary: No known research.
- POST summary:
 - *Over the top*: Mixed results with toxic at high rates and somewhat selective at lower rates. Too risky to use.
 - *POST directed*: No known research.

Pyriithiobac-sodium (Staple)

- PRE summary: Toxic to sesame with severe reduction in stands, yield, and considerable injury.
- POST summary:
 - *Over the top*: Toxic to sesame with substantial injury and reduction in yield, but did not kill the sesame.
 - *POST directed*: In 2006/2007 US testing was toxic to sesame with substantial injury and reduction in yield, but did not kill the sesame. No further testing will be done.

Rimsulfuron (Matrix)

- PRE summary: Selective to sesame, but limited research. Further testing is warranted.
- POST summary:
 - *Over the top*: Toxic to sesame with substantial production reduction, but did not kill the sesame. In one test there was an increase in yield compared to a weedy check.
 - *POST directed*: No known research.

S-metolachlor (Dual Magnum, Medal).

- Sesame use: Used in foreign commercial fields as PREPLANT or PRE. No label in US but has been included in the IR4 program.
- PRE summary: Selective to sesame and good weed control. In 2007/2008 US and Argentina testing, has been selective to sesame with some stand reduction but minimal yield reduction. Sesame is generally planted at high seeding rates because it is a small vegetable sized seed being planted under large seeded field conditions. The plants then self-thin. Thus a small stand reduction does not affect yield and may even increase yield. There are two known tests where there was stand and yield reduction. Of the tens of thousands of acres planted using Dual Magnum, there has been only one replant (which was successful). In rains, the moisture activates the herbicide and moves it into the soil. In light rains it does not move it enough to stop the seedling from emerging. In heavy rains it moves below the seed or is diluted enough to still allow the seedling to emerge. In the two cases with greater stand reduction, it is hypothesized that moisture moved the herbicide around the seed as the shoot was emerging. In both cases the sesame was planted using a non-recommended technique – the first was as a PPI and the second was planting dry and watering up. In both tests, there was still a commercially viable yield. S-metolachlor is very effective against pigweed which is the main weed problem in US sesame. A US label would lead to widespread use.
- POST summary:
 - *Over the top*: Can be applied over the top without any effect on sesame; however, will not control germinated weeds – only provides residual effect for new flushes of weeds.

- *POST directed*: No known research, but should work.

Sesone (Crag)

- PRE summary: At low rates selective to sesame, and at higher rates toxic to sesame.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Sethoxydim (Poast, Sertin)

- Sesame use: Used in foreign commercial fields as a POST. No label in US.
- PRE summary: No known research.
- POST summary:
 - *Over the top*: Selective to sesame and good grass control. If there were a US label, Poast would be used extensively.
 - *POST directed*: No known research, but logically if the grass weeds are short, a POST directed application would allow contact with the small weeds in the seed line which are protected by the sesame plants from an over the top application.

Simazine (Princep)

- PRE summary: Toxic to sesame with severe injury.
- POST summary: No known research.

Sirmate

- PRE summary: Was not as good as other treatments.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Sulfentrazone (Authority)

- PRE summary: Toxic to sesame with close to zero stand.
- POST summary: No known research.

Sulfonamide (Python)

- PRE summary: Selective at lower rates, but toxic at higher rates.
- POST summary: No known research.
- Not in Herbicide Handbook – 9th edition

Thiobencarb (Bolero)

- PRE summary: Toxic to sesame with substantial stand reduction and less vigor than other treatments.
- POST summary: No known research.

Triasulfuron (Amber)

- PRE summary: No known research, but mixed results in planting sesame after herbicide used in previous cereal crop.
- POST summary: No known research.

Trifloxysulfuron (Envoke)

- PRE summary: No known research, but mixed results in planting sesame after herbicide used in previous cereal crop.
- POST summary:
 - *Over the top*: Toxic to sesame with almost complete kill.
 - *POST directed*: Shows stunting, but recovers and had little reduction in yield. In further testing in 2007.

Trifluralin (Treflan, Agriflan. Treflan TR-10 does not require PPI)

- Sesame use: Used in foreign commercial fields as PPI and POST. No label in US.

- **PRE summary:** Mixed results – selective to sesame and very good weed control, but can be toxic to sesame in some cases. The method of incorporation is important in that trifluralin is selective to sesame when the seed line is below the herbicide, and the herbicide does not move down to the root zone at the seedling stage. Over 100,000 acres of sesame have been planted after failed out cotton when trifluralin was applied 60 or more days before planting the sesame. Have not done much research using new products that do not require PPI.
- **POST summary:**
 - *Over the top:* Somewhat toxic to sesame delaying flowering and reduced yield substantially when chemigated at the seedling stage. It is hypothesized that the water took the chemical to the root zone where there was extensive root pruning. It may be if sprayed over the top at a later stage, it would provide residual control and would cause less damage to the sesame. However, that assumes that there would be no rain that would replicate the chemigation treatment.
 - *POST directed:* No known research.

Vernolate (Vernam)

- **PRE summary:** Toxic to sesame.
- **POST summary:** No known research.

Table 3 shows the herbicides that are included in the Review of Herbicide Research on Sesame in inhibitor family order. Most of the herbicides have many other trade names, but this report only uses the trade names used in the research reports and common names in the US sesame growing areas. In the evaluation the following abbreviations are used:

- Com = commercial (used commercially in at least one country)
- Pot = potential (potential to use commercially)
- Sel = selective to sesame (does not damage sesame)
- SSel = somewhat selective to sesame (some damage to sesame, but helps)
- Mix = mixed results
- Tox = toxic (substantial reduction of production)
- STox = somewhat toxic (enough reduction that probably cannot be used)
- Effec = effective as a harvest aid
- Not eff = not effective as a harvest aid

Table 3. Summary of herbicides used in sesame research in mode of action order.

Active ingredient	Trade name	PRE	OTT	DIR	HA	Mode of action
Clethodim	Arrow, Select Max		Com			ACCCase
Diclofop	Hoelin	NER				ACCCase
Fenoxaprop	Whip	NER				ACCCase
Fenoxaprop-P + fluazifop-P	Fusion					ACCCase
Fluazifop-P	Fusilade		Com			ACCCase
Haloxyfop	Verdict		Sel			ACCCase
Sethoxydim	Poast, Sertin		Com			ACCCase
Chlorimuron-ethyl	Classic		Tox			ALS or AHAS
Chlorsulfuron	Glean	Mix				ALS or AHAS
Chlorsulfuron + Metsulfuron	Finesse	Mix				ALS or AHAS
Cloransulam-methyl	FirstRate	Tox	Tox			ALS or AHAS
Diclosulam	Spider, Strongarm	Tox	Tox			ALS or AHAS
Flumetsulam	Preside	Tox	Tox			ALS or AHAS

Active ingredient	Trade name	PRE	OTT	DIR	HA	Mode of action
Foramsulfuron + iodosulfuron	Equip		Tox			ALS or AHAS
Imazamox	Beyond					ALS or AHAS
Imazapic	Cadre	Tox	Tox			ALS or AHAS
Imazethapyr	Pursuit	SSel	Tox			ALS or AHAS
Metsulfuron-methyl	Ally	Mix				ALS or AHAS
Nicosulfuron	Accent	Mix	Tox			ALS or AHAS
Prosulfuron	Exceed, Peak	Mix	Tox			ALS or AHAS
Pyrithiobac-sodium	Staple	Tox	Tox	Tox		ALS or AHAS
Rimsulfuron	Matrix	Sel	Tox			ALS or AHAS
Triasulfuron	Amber	Mix				ALS or AHAS
Trifloxysulfuron	Envoke	Mix	Tox	Tox		ALS or AHAS
Trifloxysulfuron + prometryn	Suprend			Tox		ALS or AHAS + Photosystem II
Diflufenzopyr	Distinct		Tox			Auxin transport
Naptalam (NPA)	Alanap	Tox	Tox			Auxin transport
Norflurazon	Solicam, Zorial	Tox				Carotenoid biosynthesis
Clomazone	Command	Tox				Carotenoid synthesis
Diflufenican	Brodal	STox	Tox			Carotenoid synthesis
Mesotrione	Callisto		Tox			Carotenoid synthesis
Dichlobenil	Casoron	Tox				Cellulose
Asulam	MB-9057	SSel				Dihydropteroate synthetase
Glyphosate	Buccaneer, Durango, Roundup, RT3, Touchdown	Com	Tox	Mix	Effec	EPSP
Bensulide	Prefar	Sel				Fatty acid and lipid
EPTC	Eptam	Mix				Fatty acid and lipid
Pebulate	Tillam	SSel				Fatty acid and lipid
Thiobencarb	Bolero	Tox				Fatty acid and lipid
Vernolate	Vernam	Tox				Fatty acid and lipid
Glufosinate	Basta, Finale, Ignite, Liberty, Rely			Pot	Effec	Glutamine synthetase
Alachlor	Alanox, Alar, Intro, Lasso, Lazo	Com	Pot			Mitosis
Benefin	Balan	Tox				Mitosis
Dimethenamid	Frontier	Mix				Mitosis
Diphenamid	Dymid, Enide	Sel	Sel			Mitosis
Ethalfuralin	Curbit, Sonalan	Mix				Mitosis
Flufenacet	Radius	Tox				Mitosis
Metolachlor	Dual	Com				Mitosis
Napropamide	Devrinol, Pamid	Mix				Mitosis
Pendimethalin	Herbadox, Prowl, Stomp	Com	Sel			Mitosis
Pronamide	Kerb	Tox				Mitosis
Propachlor	Ramrod	Sel				Mitosis
S-Metolachlor	Allfire, Dual Magnum, Medal	Com	Pot			Mitosis
Trifluralin	Treflan, Agriflan	Com	STox			Mitosis

Active ingredient	Trade name	PRE	OTT	DIR	HA	Mode of action
Metolachor + Metobromuron	Galex	Com				Mitosis + ?
Flufenacet + metribuzin	Axiom, Domain	Tox				Mitosis + Photosystem II
Endothall	Accelerate	Tox	Tox			Not classified
DSMA	DSMA		STox			Nucleic acid or non-descript
MSMA	MSMA		STox			Nucleic acid or non-descript
Diquat	Reglone				Effec	Photosystem I
Paraquat	Gramoxone, Parazone		Stox	Stox	Effec	Photosystem I
Ametryn	Gesapax	Tox				Photosystem II
Atrazine	Aatrex	Tox	Tox			Photosystem II
Bentazon	Adagio, Basagran, Bendioxide, Entry, Lea		Tox			Photosystem II
Bromoxynil	Buctril, Weedex		Tox			Photosystem II
Diuron	Direx, Diurol, Diuron, Karmex	Com	Com	Com		Photosystem II
Diuron + linuron	Layby Pro	Com	Tox	Pot		Photosystem II
Fluometuron	Cotoran, Lanex	Com	Pot	Pot		Photosystem II
Linuron	Afalon, Linex, Lorox, Linorox, Teliron	Com		Sel		Photosystem II
Methibenzuron	Tribunil		SSel			Photosystem II
Metribuzin	Lexone, Sencor, Sencorex	Tox				Photosystem II
Monolinuron	Afesin	Mix				Photosystem II
Phenmediphan	Betanal		Tox			Photosystem II
Prometryn	Caparol, Gesagard	Tox	Tox	Sel		Photosystem II
Propanil	Stam-F-34	SSel				Photosystem II
Pyridate	Lentagram, Tough		Mix			Photosystem II
Simazine	Princep	Tox				Photosystem II
Prometryn + trifloxysulfuron	Suprend			Tox		Photosystem II + ALS or AHAS
Metribuzin + flufenacet	Axiom, Domain	Tox				Photosystem II + mitosis
Acifluorfen	Blazer		Tox			PPG or Protox
Bifenox	Modown		Tox			PPG or Protox
Carfentrazone-ethyl	Aim			Stox	Pot	PPG or Protox
Flumioxazin	Broadstar, Chateau, Sumisoya, Valor	Tox	STox	Mix		PPG or Protox
Fomesafen	Flex, Reflex		Mix			PPG or Protox
Lactofen	Cobra		Tox	STox		PPG or Protox
Oxadiazon	Ronstar	SSel	STox			PPG or Protox
Oxyfluorfen	Goal	SSel	Tox			PPG or Protox
Pyraflufen-ethyl	Ecopart, ET		Stox	Sel	Not eff	PPG or Protox
Sufentrazone	Authority, Spartan	Tox				PPG or Protox
Clopyralid	Lontrel, Stinger		Tox			Synthetic auxin

Active ingredient	Trade name	PRE	OTT	DIR	HA	Mode of action
Dicamba	Clarity		Tox			Synthetic auxin
2,4D-B	Butyrac	Tox	Tox			Synthetic auxin
Allidochlor (CDAA)	Radox	Mix				xx Not in 9th edition
Amiprophosmethyl	Bay-NTN 6867	Tox				xx Not in 9th edition
Benfuresate	Cyperal	Tox				xx Not in 9th edition
Carbuthioate	R-120001	STox				xx Not in 9th edition
Chloramben	Amiben	Mix				xx Not in 9th edition
Chloroxuron	Tenoran	Tox				xx Not in 9th edition
Chlorpropham (CIPC)	Chloro-IPC, Furloe	Mix				xx Not in 9th edition
Chorthal-dimethyl	Dacthal, Prothal, Shamrox	STox				xx Not in 9th edition
Dichlormate		SSel				xx Not in 9th edition
Diethylal	Antor	SSel				xx Not in 9th edition
Diethylacetanilide	C-10725	SSel				xx Not in 9th edition
Dinitramine	Cobex	Tox				xx Not in 9th edition
Dinoseb	Premerge	Tox				xx Not in 9th edition
Fluchloralin	Basalin	Com				xx Not in 9th edition
Fluorodifen	Preforan	Tox				xx Not in 9th edition
Isopropalin	Paarlan	Tox				xx Not in 9th edition
Methazole	Probe	Mix				xx Not in 9th edition
Metobromuron	Patoran	Com				xx Not in 9th edition
Metobromuron + metolachor	Galex	Com				xx Not in 9th edition
Monuron	Monurex, Telvar	Sel				xx Not in 9th edition
Nitralin	Planavin	Mix				xx Not in 9th edition
Nitrofen		Tox				xx Not in 9th edition
Norea	Herban	Mix				xx Not in 9th edition
Oxasulfuron	Dynam, GCA		Tox			xx Not in 9th edition
Perfluidone	Destun	Sel				xx Not in 9th edition
Proatryne		Sel				xx Not in 9th edition
Profluralin	Agriflan, Pregard	Sel				xx Not in 9th edition
Propazine	Milogard, Milocep, Milo-Pro	Mix	Tox	Sel		xx Not in 9th edition
Sesone	Crag	Mix				xx Not in 9th edition
Sirmate		NER				xx Not in 9th edition
Sulfonamide	Python	Mix				xx Not in 9th edition

Table 4 shows the herbicides that are included in the Review of Herbicide Research on Sesame in trade number order. Most of the herbicides have many other trade names, but this report only uses the trade names used in the research reports and common names in the US sesame growing areas. In the evaluation the following abbreviations are used:

- Com = commercial (used commercially in at least one country)
- Pot = potential (potential to use commercially)
- Sel = selective to sesame (does not damage sesame)
- SSel = somewhat selective to sesame (some damage to sesame, but helps)
- Mix = mixed results
- Tox = toxic (substantial reduction of production)

Use only herbicides approved and tested in your area

- STox = somewhat toxic (enough reduction that probably cannot be used)
- Effec = effective as a harvest aid
- Not eff = not effective as a harvest aid

Table 4. Summary of herbicides used in sesame research in trade name order.

Active ingredient	Trade name	PRE	OTT	DIR	HA	Mode of action
Atrazine	Aatrex	Tox	Tox			Photosystem II
Endothall	Accelerate	Tox	Tox			Not classified
Nicosulfuron	Accent	Mix	Tox			ALS or AHAS
Bentazon	Adagio		Tox			Photosystem II
Linuron	Afalon	Com		Sel		Photosystem II
Monolinuron	Afesin	Mix				Photosystem II
Profluralin	Agriflan	Sel				xx Not in 9th edition
Trifluralin	Agriflan	Com	STox			Mitosis
Carfentrazone-ethyl	Aim			Stox	Pot	PPG or Protox
Naptalam (NPA)	Alanap	Tox	Tox			Auxin transport
Alachlor	Alanox	Com	Pot			Mitosis
Alachlor	Alar	Com	Pot			Mitosis
S-Metolachlor	Allfire	Com	Pot			Mitosis
Metsulfuron-methyl	Ally	Mix				ALS or AHAS
Triasulfuron	Amber	Mix				ALS or AHAS
Chloramben	Amiben	Mix				xx Not in 9th edition
Diethatyl	Antor	SSel				xx Not in 9th edition
Clethodim	Arrow		Com			ACCCase
Sufentrazone	Authority	Tox				PPG or Protox
Flufenacet + metribuzin	Axiom	Tox				Mitosis + Photosystem II
Benefin	Balan	Tox				Mitosis
Bentazon	Basagran		Tox			Photosystem II
Fluchloralin	Basalin	Com				xx Not in 9th edition
Glufosinate	Basta			Pot	Effec	Glutamine synthetase
Amiprofosmethyl	Bay-NTN 6867	Tox				xx Not in 9th edition
Bentazon	Bendioxide		Tox			Photosystem II
Phenmediphan	Betanal		Tox			Photosystem II
Imazamox	Beyond					ALS or AHAS
Acifluorfen	Blazer		Tox			PPG or Protox
Thiobencarb	Bolero	Tox				Fatty acid and lipid
Flumioxazin	Broadstar	Tox	STox	Mix		PPG or Protox
Diflufenican	Brodal	STox	Tox			Carotenoid synthesis
Glyphosate	Buccaneer	Com	Tox	Mix	Effec	EPSP
Bromoxynil	Buctril		Tox			Photosystem II
2,4D-B	Butyrac	Tox	Tox			Synthetic auxin
Diethylacetanilide	C-10725	SSel				xx Not in 9th edition
Imazapic	Cadre	Tox	Tox			ALS or AHAS
Mesotrione	Callisto		Tox			Carotenoid synthesis
Prometryn	Caparol	Tox	Tox	Sel		Photosystem II
Dichlobenil	Casoron	Tox				Cellulose

Active ingredient	Trade name	PRE	OTT	DIR	HA	Mode of action
Flumioxazin	Chateau	Tox	STox	Mix		PPG or Protox
Chlorpropham (CIPC)	Chloro-IPC	Mix				xx Not in 9th edition
Dicamba	Clarity		Tox			Synthetic auxin
Chlorimuron	Classic		Tox			
Dinitramine	Cobex	Tox				xx Not in 9th edition
Lactofen	Cobra		Tox	STox		PPG or Protox
Clomazone	Command	Tox				Carotenoid synthesis
Fluometuron	Cotoran	Com	Pot	Pot		Photosystem II
Sesone	Crag	Mix				xx Not in 9th edition
Ethalfuralin	Curbit	Mix				Mitosis
Benfuresate	Cyperal	Tox				xx Not in 9th edition
Chorthal-dimethyl	Dacthal	STox				xx Not in 9th edition
Perfluidone	Destun	Sel				xx Not in 9th edition
Napropamide	Devrinol	Mix				Mitosis
Diuron	Direx	Com	Com	Com		Photosystem II
Diflufenzopyr	Distinct		Tox			Auxin transport
Diuron	Diurol	Com	Com	Com		Photosystem II
Diuron	Diuron	Com	Com	Com		Photosystem II
Flufenacet + metribuzin	Domain	Tox				Mitosis + Photosystem II
DSMA	DSMA		STox			Nucleic acid or non-descript
Metolachlor	Dual	Com				Mitosis
S-Metolachlor	Dual Magnum	Com	Pot			Mitosis
Glyphosate	Durango	Com	Tox	Mix	Effec	EPSP
Diphenamid	Dymid	Sel	Sel			Mitosis
Oxasulfuron	Dynam		Tox			xx Not in 9th edition
Pyraflufen-ethyl	Ecopart		STox	Sel	Not eff	PPG or Protox
Diphenamid	Enide	Sel	Sel			Mitosis
Bentazon	Entry		Tox			Photosystem II
Trifloxysulfuron	Envoke	Mix	Tox	Tox		ALS or AHAS
EPTC	Eptam	Mix				Fatty acid and lipid
Foramsulfuron + iodosulfuron	Equip		Tox			ALS or AHAS
Pyraflufen-ethyl	ET		Stox	Sel	Not eff	PPG or Protox
Prosulfuron	Exceed	Mix	Tox			ALS or AHAS
Glufosinate	Finale			Pot	Effec	Glutamine synthetase
Chlorsulfuron + Metsulfuron	Finesse	Mix				ALS or AHAS
Cloransulam-methyl	FirstRate	Tox	Tox			ALS or AHAS
Fomesafen	Flex		Mix			PPG or Protox
Dimethenamid	Frontier	Mix				Mitosis
Chlorpropham (CIPC)	Furloe	Mix				xx Not in 9th edition
Fluazifop-P	Fusilade		Com			ACCCase
Fenoxaprop + fluazifop-P	Fusion					

Active ingredient	Trade name	PRE	OTT	DIR	HA	Mode of action
Metobromuron + metolachlor	Galex	Com				xx Not in 9th edition
Oxasulfuron	GCA		Tox			xx Not in 9th edition
Prometryn	Gesagard	Tox	Tox	Sel		Photosystem II
Ametryn	Gesapax	Tox				Photosystem II
Chlorsulfuron	Glean	Mix				ALS or AHAS
Oxyfluorfen	Goal	SSel	Tox			PPG or Prottox
Paraquat	Gramoxone Inteon		Stox	Stox	Effec	Photosystem I
Pendimethalin	Herbadox	Com	Sel			Mitosis
Norea	Herban	Mix				xx Not in 9th edition
Diclofop	Hoelin	NER				ACCCase
Glufosinate	Ignite			Pot	Effec	Glutamine synthetase
Alachlor	Intrro	Com	Pot			Mitosis
Diuron	Karmex	Com	Com	Com		Photosystem II
Pronamide	Kerb	Tox				Mitosis
Fluometuron	Lanex	Com	Pot	Pot		Photosystem II
Alachlor	Lasso	Com	Pot			Mitosis
Diuron + linuron	Layby Pro	Com	Tox	Pot		Photosystem II
Alachlor	Lazo	Com	Pot			Mitosis
Bentazon	Leader		Tox			Photosystem II
Pyridate	Lentagram		Mix			Photosystem II
Metribuzin	Lexone	Tox				Photosystem II
Glufosinate	Liberty			Pot	Effec	Glutamine synthetase
Linuron	Linex	Com		Sel		Photosystem II
Linuron	Linorox	Com		Sel		Photosystem II
Clopyralid	Lontrel		Tox			Synthetic auxin
Linuron	Lorox	Com		Sel		Photosystem II
Rimsulfuron	Matrix	Sel	Tox			ALS or AHAS
Asulam	MB-9057	SSel				Dihydropteroate synthetase
S-Metolachlor	Medal	Com	Pot			Mitosis
Propazine	Milocep	Mix	Tox	Sel		xx Not in 9th edition
Propazine	Milogard	Mix	Tox	Sel		xx Not in 9th edition
Propazine	Milo-Pro	Mix	Tox	Sel		xx Not in 9th edition
Bifenox	Modown		Tox			PPG or Prottox
Monuron	Monurex	Sel				xx Not in 9th edition
MSMA	MSMA		STox			Nucleic acid or non-descript
Isopropalin	Paarlan	Tox				xx Not in 9th edition
Napropamide	Pamid	Mix				Mitosis
Paraquat	Parazone		Stox	Stox	Effec	Photosystem I
Metobromuron	Patoran	Com				xx Not in 9th edition
Prosulfuron	Peak	Mix	Tox			ALS or AHAS
Nitralin	Planavin	Mix				xx Not in 9th edition
Bentazon	Pledge		Tox			Photosystem II
Sethoxydim	Poast		Com			ACCCase
Bensulide	Prefar	Sel				Fatty acid and lipid

Active ingredient	Trade name	PRE	OTT	DIR	HA	Mode of action
Fluorodifen	Preforan	Tox				xx Not in 9th edition
Profluralin	Pregard	Sel				xx Not in 9th edition
Dinoseb	Premerge	Tox				xx Not in 9th edition
Flumetsulam	Preside	Tox	Tox			ALS or AHAS
Simazine	Princep	Tox				Photosystem II
Methazole	Probe	Mix				xx Not in 9th edition
Chorthal-dimethyl	Prothal	STox				xx Not in 9th edition
Pendimethalin	Prowl	Com	Sel			Mitosis
Imazethapyr	Pursuit	SSel	Tox			ALS or AHAS
Sulfonamide	Python	Mix				xx Not in 9th edition
Carbuthioate	R-120001	STox				xx Not in 9th edition
Flufenacet	Radius	Tox				Mitosis
Propachlor	Ramrod	Sel				Mitosis
Allidochlor (CDAA)	Radox	Mix				xx Not in 9th edition
Fomesafen	Reflex		Mix			PPG or Protox
Diquat	Reglone				Effec	Photosystem I
Glufosinate	Rely			Pot	Effec	Glutamine synthetase
Oxadiazon	Ronstar	SSel	STox			PPG or Protox
Glyphosate	Roundup	Com	Tox	Mix	Effec	EPSP
Glyphosate	RT3	Com	Tox	Mix	Effec	EPSP
Clethodim	Select Max		Com			ACCCase
Metribuzin	Sencor	Tox				Photosystem II
Metribuzin	Sencorex	Tox				Photosystem II
Sethoxydim	Sertin		Com			ACCCase
Chorthal-dimethyl	Shamrox	STox				xx Not in 9th edition
Norflurazon	Solicam	Tox				Carotenoid biosynthesis
Ethalfuralin	Sonalan	Mix				Mitosis
Sufentrazone	Spartan	Tox				PPG or Protox
Diclosulam	Spider	Tox	Tox			ALS or AHAS
Propanil	Stam-F-34	SSel				Photosystem II
Pyriithiobac-sodium	Staple	Tox	Tox	Tox		ALS or AHAS
Clopyralid	Stinger		Tox			Synthetic auxin
Pendimethalin	Stomp	Com	Sel			Mitosis
Diclosulam	Strongarm	Tox	Tox			ALS or AHAS
Flumioxazin	Sumisoya	Tox	STox	Mix		PPG or Protox
Trifloxysulfuron + prometryn	Suprend			Tox		ALS or AHAS + Photosystem II
Linuron	Teliron	Com		Sel		Photosystem II
Monuron	Telvar	Sel				xx Not in 9th edition
Chloroxuron	Tenoran	Tox				xx Not in 9th edition
Pebulate	Tillam	SSel				Fatty acid and lipid
Glyphosate	Touchdown	Com	Tox	Mix	Effec	EPSP
Pyridate	Tough		Mix			Photosystem II
Trifluralin	Treflan	Com	STox			Mitosis
Methibenzuron	Tribunil		SSel			Photosystem II
Flumioxazin	Valor	Tox	STox	Mix		PPG or Protox

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Active ingredient	Trade name	PRE	OTT	DIR	HA	Mode of action
Haloxypop	Verdict		Sel			ACCCase
Vernolate	Vernam	Tox				Fatty acid and lipid
Bromoxynil	Weedex		Tox			Photosystem II
Fenoxaprop	Whip	NER				ACCCase
Norflurazon	Zorial	Tox				Carotenoid biosynthesis