

INTRODUCTION

Weeds can reduce the quality and stand life of desirable plants in pastures and hayfields. Certain weed species can also be poisonous to livestock. Therefore, weed management is an imperative component of pasture management. Well-designed weed management begins with site preparation since, after planting the desired pasture species, weed control options can be limited depending on the species that are planted (Figure 1). Good pasture management throughout the life of the pasture is critical for the prevention and control of weed infestations.

Unless proper weed management has been employed during site preparation, weed problems during establishment or in established pastures are likely the result of poor management of the pasture species. Problems can result from forage species selection, fertilization, irrigation, and harvest or grazing methods. Well-managed pastures require fewer direct actions to manage weeds because healthy, well-established forage plants are more likely to prevent weed invasions. In some situations, however, herbicides are needed for weed control despite a producer's best pasture management efforts. In those situations, the quality of pastures can be substantially improved with a well-planned herbicide program. Therefore, weed management in permanent grass pastures requires a combination of cultural, mechanical, biological, and chemical tools that begins with site preparation and continues throughout the life of the pasture.



Figure 1. Yellow foxtail (*Setaria pumila*) infestation in tall fescue pasture.

WEED IDENTIFICATION

Because weed management techniques are often species-specific, the first step in weed management is to correctly identify weeds and keep a record of weeds present in the field. Weeds can be identified using resources such as weed identification books, websites, Cooperative Extension Service publications, Extension personnel, and crop consultants. In order to make sound management decisions, it is important to know the name of a weed, as well as its lifecycle and reproductive mode and capacity. Keep in mind that common names of plants can vary, or the same name may refer to multiple species. Cross-referencing weeds by their scientific names can help confirm their identities. Accurate information on the biology and lifecycle of the weeds can help growers apply weed management

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techniques more effectively, based on the susceptibility of the species to different control methods.

WEED SEEDBANK MANAGEMENT

The reserve of viable weed seeds in soil (hereafter referred to as the “seedbank”) is an important part of the weed community that should be considered in programs for pasture weed management. Seedbanks are problematic because they are sources of weed infestations, and they should be managed to help deplete them. It should be noted that depletion is not synonymous with elimination. The goal of weed seedbank management is to lessen the number of weed seeds present in soil, which is intrinsically tied to long-term population growth rates of annual weed species, to the efficacy of chemical control tactics, and to the success of cultural and mechanical approaches for weed control.

Weed seedbank depletion relies on two general strategies: 1) increase seedbank losses and 2) reduce seedbank inputs. To put these strategies into practice, consider the lifecycle of the targeted weed species, your individual resource conservation concerns, and the cropping system plan for the particular field. Any attempt to deplete weed seedbanks can benefit the overall suppression of weeds at a given site; however, seedbank depletion is more likely to produce satisfactory outcomes if it employs multiple tactics.

Increase seedbank losses

A practical method for targeting buried weed seeds is the “stale seedbed” approach, which is a set of successive practices that first stimulates weed seed germination through irrigation and then eliminates subsequent weed seedlings prior to pasture planting. Shallow tillage before irrigation can intensify the effects of stale seedbeds on weed seedbanks, especially if multiple stale seedbeds are sequentially implemented. Frequent irrigation and/or soil disturbance that takes place in repeated stale seedbeds may reduce the overall soil health and reduce some of the benefits of weed management. Growers must adopt a location-specific stale seedbed strategy that maintains soil quality and productivity while reducing weed seedbanks.

For stale seedbeds to effectively reduce seedbanks of problematic weed species, the interventions must occur during species-specific periods in

which seeds of targeted weed species can germinate. For example, problematic annual weeds, including spurred anoda (*Anoda cristata*), morningglory species (*Ipomoea* spp.), and Wright groundcherry (*Physalis acutifolia*), germinate during June, July, and August. Stale seedbed interventions are most effective against such summer annuals if made in the summer before pasture planting.

Reduce seedbank inputs

Foremost in weed seedbank management is to prevent deposits of weed seed in the soil. Seeds can enter soil from many sources, including resident plants, irrigation water, contaminated crop seed, manure-based fertilizers, vehicles, farm machinery, animals, and insects. Eliminating all sources of weed seed entry may not be practical, but there are some actions you can take. For example, seedbank deposits from resident weeds can be eliminated by controlling all weeds before they are able to reproduce. Seedbank deposits from contaminated crop seed can be eliminated by seeding pastures with high-quality, weed-free seed. Regularly washing vehicles and machinery can limit seedbank deposits from contaminated equipment.

Although weed seedbank management is generally regarded as a long-term approach for suppressing weeds, preventing large deposits to soil seedbanks can yield tangible results as early as the next growing season. For many annual weed species, a large proportion of a given year’s weed seedlings originates from the seeds produced the previous year; controlling annual weeds before they set seed can therefore reduce the potential weed population the following growing season.

CULTURAL METHODS

Species selection

Planting grass species that are not adapted to the respective environment can lead to encroachment by weeds and shorten the stand life. New Mexico has a wide range of climatic conditions due to vast differences in elevation and latitude, and very few species are well adapted throughout the state. Therefore, species selection must be based on location. More detailed information about adapted plant species for use in permanent irrigated pastures in New Mexico is given in NMSU Cooperative Extension

Circular 585, *Species Selection and Establishment for Irrigated Pastures in New Mexico* (http://aces.nmsu.edu/pubs/_circulars/CR585.pdf).

Grass species are usually classified based on their lifecycle into cool-season and warm-season species. Cool-season perennial species generally have their highest production in the spring, followed by a summer depression and another period of growth in the fall. On the other hand, warm-season grasses actively grow from after the last spring frost until a hard freeze in the fall, with peak production in mid-summer. During dormancy, which could be in summer or winter (depending on the lifecycle of the grass), weeds can inhabit the gaps in pastures that would otherwise be covered by stand canopy. This lack of productivity during the dormant season is one disadvantage to monoculture pastures.

If growers decide to use grass mixtures, simple mixtures of no more than three grasses are preferred over more complex mixtures because complex mixtures present several problems. Differences in requirements for cultural practices (harvest timing, fertility, irrigation, etc.), grazing management, and ability to compete for light, water, nutrients, and space make it difficult to maintain multiple healthy and competitive species in the stand. Additionally, animals might selectively graze more-palatable species and eliminate them from the stand. In either case, gaps in the stand eventually occur. Consequently, pre-mixed pasture blends are generally not recommended. A disadvantage for mixed-grass and grass-legume pastures is that a limited number of herbicides may be labeled for them; thus, management becomes even more critical to prevent weed infestation from the start.

Seed and plant stock selection

Use the best-quality seed or planting stock available to improve the chances of obtaining a good stand that can be productive for a long period and competitive against weeds. Read the seed label before purchasing seed and pay attention to weed seed content because a relatively weed-free field can be contaminated if seed containing weed seeds is sown. Be sure that no noxious weeds are listed on the label. For more information on the seed labels, consult NMSU Cooperative Extension Guide A-131, *Certified Seed* (http://aces.nmsu.edu/pubs/_a/A131.pdf).

Establishment

Land preparation

Proper land preparation is important for the establishment of an irrigated permanent grass pasture. The best weed control strategy begins with a weed-free seedbed (see *Weed Seedbank Management* section of this publication) assisted by a uniform stand of pasture plants that can quickly establish ground cover. Controlling existing weed populations that can interfere with establishment of desirable species or become a problem after establishment is the first step in land preparation, especially since rotating to a permanent pasture is a component of a farm-wide weed control program.

Planting

Seeding time is determined largely by the species being sown. Most warm-season species should be planted only after danger of frost has passed through early August, depending on location (check with local county Cooperative Extension or Natural Resources Conservation Service personnel for local recommendations). This allows sufficient time for the crop to establish a good root system before freezing temperatures occur. Cool-season grasses can be planted in spring or late summer; in New Mexico, however, spring plantings are generally discouraged mostly due to high irrigation requirements, lack of production in the seeding year, and increased weed pressure in the spring and early summer compared with late summer. Late summer or early autumn seedings need to be early enough to allow at least six to eight weeks for plants to become established before freezing temperatures. When planting pasture grasses, no-till seeding can be considered in order to reduce the threat of soil erosion during the establishment period, conserve moisture already present in the seedbed, and reduce weed seed germination by minimizing soil disturbance.

Completing establishment

Newly seeded pasture grasses should be allowed to reach the early heading stage before grazing or harvesting for the first time. Grazing or harvesting pastures for hay too soon can prevent complete establishment of healthy plants, thus allowing for weed encroachment. More detailed information about establishing adapted plant species for use

in permanent irrigated pastures in New Mexico is given in NMSU Cooperative Extension Circular 585, *Species Selection and Establishment for Irrigated Pastures in New Mexico* (http://aces.nmsu.edu/pubs/_circulars/CR585.pdf).

Irrigation

Irrigation is critical to nearly all moderate- to high-output crop production practices in New Mexico, and improved permanent grass pastures are no exception. As such, irrigation plays a critical role in weed management efforts in permanent pasture systems throughout the state. Proper irrigation is necessary not only for pasture establishment, plant growth, competitiveness, and stand longevity but also sustainability of the system in terms of water conservation.

Establishing and maintaining a strong, vigorous pasture is the first step in combating weeds and will go a long way toward preventing weed seed germination and competition. Improper irrigation practices can compromise the vigor of the pasture. Over-irrigation can lead to waterlogged soils, weed invasion, nutrient leaching, and unnecessary waste. Likewise, too few or mistimed irrigations can cause plant stress, inhibiting the desired pasture species' ability to compete with oftentimes more opportunistic and drought-hardy weeds. It is vital to know the water requirements of the pasture species and when during the lifecycle of the plant irrigations can be utilized most efficiently (i.e., seasonal distribution of growth). In addition, soil moisture monitoring is recommended for proper irrigation scheduling and for preventing waste. This should be done as much as possible; however, matching irrigations with plant demand may be difficult to control when operating within water district allocations, restrictions, and rotating deliveries that are common throughout the state.

Standing water, poor drainage, and excessive soil moisture are conducive to weed invasions into pastures. The anaerobic conditions that result from water ponding facilitate plant diseases and die-off, which create open areas in the pasture for weeds. Oftentimes, the weeds that proliferate in these areas are some of the more problematic weeds for grass pastures, such as foxtails, crabgrass and other grasses, and nutsedge (Figure 1). It is important to know where potentially problematic areas are in the field (slow-draining soil, low areas,

restrictive sub-soil layers) and either avoid them completely or take precautions prior to pasture establishment to amend the field for more uniform water flow and infiltration. In flood-irrigated systems where large amounts of water are applied at one time, standing water tends to be more of a problem than in sprinkler-irrigated systems. As such, laser leveling is recommended prior to planting pastures that will be irrigated through surface methods (e.g., flood irrigation).

Summer annual grassy weeds are shallow-rooted and are particularly favored by frequent irrigations, standing water, and wet soils. In contrast, perennial pasture grasses have extensive root systems and can extract water from depths of three to four feet. Ensuring that water is available at these depths will help plants survive dry spells and summer heat better than shallow watering alone and will increase pasture competitiveness. If water is available early in the growing season, deep irrigations that fill more of the soil profile may be beneficial before the onset of summer, particularly if winter precipitation is low. Also, it is important to know the drought and heat tolerance of the grasses being grown. Cool-season species, such as tall fescue and orchardgrass, are more sensitive to drought and high temperatures than warm-season grasses such as bermudagrass. It is especially important that cool-season pastures be adequately irrigated during the hot summer months to avoid weakened plants and open spaces in the field. Maintaining an appropriate stubble height (i.e., 3–4 inches minimum) to promote the health of pasture plants will also help protect them from heat damage. Applying irrigation only when plant growth is dense enough will reduce competition from weed seedlings since the dense pasture cover prevents the exposure of bare ground to sunlight.

Fertilization

Similar to irrigation, proper soil fertility and a balance of essential plant nutrients are critical to pasture health and competitiveness. A soil test is necessary to determine plant needs and should be conducted before planting the pasture and periodically throughout the growing season in subsequent years. Fertilization is not a remedy for pasture mismanagement caused by overgrazing or poor irrigation practices. Fertilizer applications to abused pastures with weak stands will only benefit

the weed base that is present. As with irrigation, applying fertilizer only when bare ground is not exposed to sunlight will minimize competition from weed seedlings.

Nitrogen (N) will likely be the most limiting nutrient in grass-based pasture systems. However, phosphorus (P) also can often be insufficiently available in the high-pH soils common in New Mexico. Most pasture grasses have a high N requirement and respond very favorably to N fertilizers. In general, response to P fertilizers is less predictable due to high soil pH; nevertheless, P fertilizer should be available to plants over the life of the stand and may be surface applied annually based on recommendations from the most recent soil test. Phosphorus fertility should be raised to recommended levels and monitored every couple of years for availability.

Timing of fertilizer applications is critical and should be such that the desirable pasture species benefit from the nutrient(s) applied and not the weeds. For example, if N fertilizer is applied to bermudagrass pasture too early in the spring and much ahead of green-up, early-emerging weeds will be able to take advantage of the N before the bermudagrass, and intense competition from the weeds may ensue. During pasture establishment, it is generally better to delay N applications until after the planted grass is growing well and can utilize it ahead of weeds. Producers should be familiar enough with their pasture species to know the most beneficial time to apply fertilizer for maximum return (i.e., match N application to greatest potential uptake). Cool-season species like tall fescue have a high N demand in the spring and again in the fall, whereas bermudagrass has its greatest demand only in summer. It is better to apply fertilizers in split applications throughout the year to match plant demand rather than one large N application at the beginning of the season. These split applications generally coincide with a regular cutting or 30-day grazing schedule. Nitrogen is highly mobile in the soil, and applications during periods of pasture dormancy or slow growth will only benefit opportunistic weeds and/or be leached from the rooting zone with heavy irrigations.

Applying N to cool-season grass pastures when soil moisture is adequate to prevent stress and then following the N application with an irrigation in lieu of anticipated precipitation, especially in late

fall, will increase productivity the following spring. This will also likely promote root growth going into winter for better competition against winter weeds and a healthier stand the next spring. If warm-season pastures are overseeded with a cool-season annual grass, N should be applied to promote growth from late autumn through spring.

Manures

While manure applications to crops and pastures can be beneficial as a source of organic matter and nutrients, be aware that manures can also be a source of weed seeds. Both grass and broadleaf weed seeds can survive the digestive systems of different classes of livestock. For example, seeds from pigweeds, lambsquarters, foxtails, and various mustards have all been found in dairy manures. The level of weed seed in the manure is a function of several factors: class of livestock, feed/pasture consumed, time since feeding, collection site, composting, etc. In general, composted manure contains fewer viable weed seeds, but composting will not eliminate all viable seed. Using previously composted manure or storing the manure on-site for a few months is recommended before application. Fields where manure has been applied should be monitored closely for the presence of both regionally common weeds and new weeds not previously found on the farm. Timely weed control should follow any new emergence from manured fields, especially if exotic, non-native weed species are found.

MECHANICAL/BIOLOGICAL METHODS

Grazing

In grass pastures, grazing should be initiated when the pastures are established and grasses are 6 to 12 inches tall, depending on plant species (bunch-type or upright species should be taller than creeping types). When cool-season grasses fall below 3 to 4 inches tall, there may not be enough leaf material to promote growth, eventually leading to weak, noncompetitive plants and possibly bare ground exposed to sunlight, all of which allow weed invasion. Not grazing intensively enough may allow any weeds that might be grazed to produce seed. In some cases, co-grazing different species of animals is beneficial for maximizing forage utilization and weed control, espe-

cially brush and some weeds that are less palatable to cattle. In pastures with heavy weed infestations that are being avoided by cattle, one sheep or goat can be added for each beef animal unit without affecting beef production per acre. For more detail, see NMSU Cooperative Extension Circular 586, *Grazing Systems and Management for Irrigated Pastures in New Mexico* (http://aces.nmsu.edu/pubs/_circulars/CR586.pdf).

Mowing

Timely mowing (clipping) of pastures not only optimizes forage production but can also help reduce weed pressure in pastures. Many annual weeds can be effectively suppressed/controlled and, more importantly, their seed production can be prevented by clipping off flowers. Care should be taken to not delay/inhibit regrowth of the desirable plants by cutting them too short. It is important to set the mower at the correct height, which could vary depending on the grass species present. Information on how a particular grass species grows and regrows could help with setting the optimal height. Dragging the pasture with a chain harrow after clipping will scatter the clippings, speed the breakdown of manure from grazing animals, and help prevent standing piles that can kill forage plants and leave dead spots in the field.

Harvesting the crop through hay or grazing when the field is too wet can lead to compacted areas in the field or can damage and weaken plants and make them less competitive, thereby giving weeds an advantage in highly trafficked areas. Compacted soils restrict root growth, take in water more slowly, and are poorly aerated. To the greatest extent possible, animals or equipment should be withheld from the pasture after irrigation or rain events until soils are dry enough to avoid compaction. In general, this is not as much of a concern in sandy soils as it is in finer-textured soils. For more on soil compaction, see NMSU Cooperative Extension Circular 672, *Understanding and Managing Soil Compaction in Agricultural Fields* (http://aces.nmsu.edu/pubs/_circulars/CR672.pdf).

Burning

In warm-season grass pastures, burning during the dormant period can control existing winter annual weeds and possibly seed of some summer annual weeds. Burning is also effective for removing se-

nesced plant material from the previous year that reduces forage quality, and may allow earlier spring green-up. Caution should be taken when burning in winter, especially because of low precipitation in many areas of New Mexico and since many native species in surrounding areas will also be dormant, which can increase the possibility of wildfire.

CHEMICAL METHODS

Herbicides utilize various functional groups (active ingredients) to impede the growth and development of weeds. A list of currently registered herbicides for permanent grass pastures and hayfields in New Mexico and some information regarding their use is given in Table 1. Successful chemical weed control requires the application of the correct type and quantity of herbicide(s) uniformly over the target area. This makes the application of herbicides a precision operation; accurate sprayer calibration is therefore very important since rates that are too high may injure the pasture grasses, and rates that are too low may not provide weed control and may even lead to herbicide-resistant weeds. It is also important to use the chemicals at a time when the pasture grasses are at their maximum tolerance and the weeds are at their maximum susceptibility to the herbicides. Several herbicides are registered for use on permanent grass pastures in New Mexico (Tables 1 and 2); however, many of the registered herbicides are species-specific. For example, pendimethalin (Prowl H₂O) is only registered for use on established bermudagrass and other perennial warm-season grasses and must not be used on cool-season grasses like tall fescue. In mixed-grass pastures, care must be taken to select the herbicides that are labeled for use on all species in the pasture to prevent injuries to desirable species.

The following terms describe the times at which herbicides may be applied. Unless otherwise specified, they refer to the stage of development of the weeds. All label instructions and precautions must be followed carefully. Many times, an herbicide's poor performance or nonperformance can be traced to improper use and failure to follow label directions.

Pre-emergence herbicides are generally applied to the soil prior to weed emergence for residual weed control. However, some herbicides, such as diuron (Direx 4L) and imazapic (Impose), have post-emergence activity that can control small

seedlings of certain weed species as well as provide residual weed control.

Post-emergence herbicides, such as clopyralid (Clean Slate), 2,4-D (2,4-D Amine-4), glyphosate (Roundup PowerMAX), imazapyr (Polaris), and carfentrazone-ethyl (Aim EC), are all applied after weed emergence. However, the method of application could vary depending on the herbicide (see Table 1 for more detail on each herbicide).

Tank Mixing

Tank mixing herbicides will provide broader weed control, and several premixed herbicides are available on the market (Table 2). Depending on the present weed species and their stage of development, tank mixing herbicides might be beneficial in pasture weed management. For example, Prowl H₂O may be tank mixed with post-emergence herbicides labeled for use in bermudagrass and other perennial warm-season grasses to not only control germinating weed seeds but also emerged weeds. However, it is important to follow the label directions when tank mixing because some herbicides may not be compatible with each other. If such herbicides are mixed, the efficacy of one or both chemicals in the mixture can be reduced or injuries to grass species may occur.

RENOVATION

Pasture renovation is renewing a pasture by introducing desired forage species into existing plant stands, and is occasionally required, especially when weeds dominate pastures and cause low yields of

low-quality forage. The specific weed problem and cause of infestation determine the degree of renovation necessary. When all desirable species have perished and only weeds are present, or if weeds are not manageable with herbicides or multispecies grazing, total renovation and reseeding of the entire field or the affected portion are usually required. If the stand has merely thinned and existing weeds can be controlled with herbicides, the pasture can be renovated by interseeding with desirable species using no-till seeding. For bermudagrass and other rhizomatous species, extensive tillage at the surface with a light nitrogen application and irrigation can promote growth into thin areas. In either case, growers must follow proper agronomic procedures to avoid the possibility of stand failure of the new seeding (see NMSU Cooperative Extension Circular 585, *Species Selection and Establishment for Irrigated Pastures in New Mexico*, available at http://aces.nmsu.edu/pubs/_circulars/CR585.pdf).



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Table 1. List of Herbicides Registered for Use on Permanent Grass Pastures and Hayfields in New Mexico¹		
Herbicide/WSSA Grouping²	Example of Trade Name³	Time of Application to Weeds
2,4-D/Group 4	2,4-D AMINE-4	Post-emergence
Remarks (2,4-D Amine-4): Will control broadleaf weeds; refer to the “weeds controlled” section of the label for a listing of susceptible weed species and weeds that may be only partially controlled. For best results, apply when weeds are small and growing actively before the bud stage. Do not use on bentgrass, alfalfa, clover, or other legumes. Do not use on newly seeded areas until the grass is well established. Do not apply more than 4 pints per acre per application, and no more than two applications per year. Read the label on feeding restrictions, required adjuvants, and maximum allowable application rate per season.		
Aminopyralid/Group 4	MILESTONE	Pre-emergence, Post-emergence
Remarks (Milestone): Will control broadleaf weeds and certain woody plants. Do not broadcast apply more than 7 fl oz per acre per year. Do not apply within the root zone of desirable trees. Can be applied in spring through fall to control broadleaf weeds prior to grass planting. However, after this application, the grass must be seeded as a dormant planting (late fall or early winter) or the following spring. Should not be applied after seeding and before grass establishment. Check the label (including the supplemental labels) of this product for restrictions (e.g., restrictions in <i>Hay or Manure Use</i>).		
Carfentrazone-ethyl/Group 14	AIM EC	Post-emergence
Remarks (Aim EC): Will control annual broadleaf weeds. Do not apply more than 2 fl oz per acre per application, and no more than 5.9 fl oz per acre per season. When applied alone, grazing and hay operations may proceed with no restrictions. Read the label for required adjuvants.		
Chlorsulfuron/Group 2	TELAR XP	Pre-emergence, Post-emergence
Remarks (Telar XP): Will control many broadleaf weeds. Annual weeds are controlled best when treated early in their lifecycle. For the control of perennial weeds, best results are obtained when weeds are treated in the bud to bloom or fall rosette stage. Telar is registered for use in many cool-season and warm-season grasses; however, the application rate could vary depending on the grass type. See the label for use rates. Forage grasses should be well established before applying this herbicide. Stressed grasses may be injured by Telar XP. There are no grazing or hay harvest restrictions for any livestock, including lactating animals, with application rates up to 1 1/3 oz per acre.		
Clopyralid/Group 4	CLEAN SLATE	Post-emergence
Remarks (Clean Slate): May be applied for control of broadleaf weeds. There are no grazing or haying restrictions for this product. Refer to the label for crop rotation restrictions. New grass seedlings may be injured to varying degrees until well established.		
Dicamba/Group 4	BANVEL	Post-emergence
Remarks (Banvel): Will control broadleaf weeds. Newly seeded grasses may be severely injured at application rates greater than 0.5 qt per acre. Established grasses growing under stress can exhibit various injury symptoms after application of Banvel. Bentgrass, carpetgrass, buffalograss, and St. Augustine grass may be injured at rates exceeding 0.5 qt per acre. Colonial bentgrasses are usually more tolerant than creeping types. Velvetgrasses are most easily injured. Refer to the label for specifics on grazing and harvest restrictions following treatment with Banvel.		
Diuron/Group 7	DIREX 4 L	Pre-emergence, Post-emergence
Remarks (Direx 4 L): May be applied for the control of grass and broadleaf weeds in bermudagrass pastures (newly sprigged only). Plant sprigs (stolons) 2 inches deep in a well-prepared seedbed. Do not treat areas where sprigs are planted less than 2 inches deep because crop injury may result. If bermudagrass has emerged at the time of treatment, temporary burn of exposed plant parts may occur. Do not graze or feed foliage from treated areas to livestock within 70 days of application. Refer to the label for soil limitations.		
Fluroxypyr/Group 4	VISTA	Post-emergence
Remarks (Vista): Will control several broadleaf weeds, including prickly pear cactus. Only weeds emerged at the time of application will be controlled. There are no grazing restrictions for livestock. Meat animals must be withdrawn from treated forage at least two days before slaughter. Please read the label (including the supplemental label) for other restrictions.		

¹ The list is current as of October 2013; however, labels change frequently, and the herbicide’s current label should be reviewed for the most recent conditions or restrictions before it is used. Read all labels carefully and comply with their site-use directions (e.g., pre-harvest interval, restricted-entry interval, registration). Some herbicides may be **restricted**, classified for use only by certified applicators, by either federal or state law. Products restricted by federal law are automatically restricted in the state. In addition to federally restricted herbicides, certain herbicides are restricted within New Mexico by state law (for further information, see www.nmda.nmsu.edu/pesticides/registration/). For the very latest label information on a given herbicide, contact the manufacturer, Extension service in your area, or the company or distributor that sells the product. Also, most chemical labels can be accessed at either www.greenbook.net or www.cdms.net.

² Herbicide groupings follow the Weed Science Society of America’s (WSSA) nationally accepted grouping. The grouping is based on the mechanisms of action of herbicides. For effective herbicide resistance management, it is imperative to rotate or mix the herbicides from different groups.

³ Other trade names of these active ingredients alone or in combination may be available on the market. Growers are advised to read the label of herbicides for selecting the correct rates based on the environmental conditions of their area. Refer to the label of each product for information regarding required adjuvants.

Table 1. List of Herbicides Registered for Use on Permanent Grass Pastures and Hayfields in New Mexico¹ (Cont.)		
Herbicide/WSSA Grouping²	Example of Trade Name³	Time of Application to Weeds
Glyphosate/Group 9	ROUNDUP POWERMAX	Post-emergence
Remarks (Roundup PowerMAX): This product may be applied for the control of emerged grass and broadleaf weeds prior to planting or emergence of forage grasses. May be applied in pastures as a spot treatment or over the top of desirable grasses using a wiper application to control tall weeds. For spot treatment or wiper application at rates above 2 qt of this product per acre, no more than 10% of the total pasture may be treated at any one time. Broadcast application can be made before the desirable perennial grasses break dormancy (injury will occur if perennial grasses are no longer dormant). Refer to the label for specifics on grazing and harvest restrictions following treatment.		
Imazapic/Group 2	IMPOSE	Pre-emergence, Post-emergence
Remarks (Impose): Will control winter and summer annual and perennial grasses, some broadleaves, and nutsedges in pastures and hay meadows. Annual weeds are best controlled pre-emergence up to small, actively growing plants. Do not apply to drought-stressed bermudagrass. Do not apply during transitions from dormancy to full green-up. Check the label for the list of tolerant grass species because this product may injure some grass species. Refer to the label for other restrictions.		
Imazapyr/Group 2	POLARIS	Pre-emergence, Post-emergence
Remarks (Polaris): Registered for spot treatment in grass pastures and rangeland. Will control several annual and perennial grasses and broadleaf weeds in addition to many brush and vine species. Although this product will provide residual control of labeled weeds, the post-emergence application of this product is the method of choice. Spot applications may not exceed more than 1/10 of the area to be grazed or cut for hay. Do not apply more than 48 fl oz per acre per year. Check the label of this product for grazing, harvest, and other use restrictions.		
MCPA/Group 4	MCPA AMINE 4	Post-emergence
Remarks (MCPA Amine 4): Will control broadleaf weeds in well-established pastures and rangeland. Do not exceed two applications or a maximum of 3 pints of this product per acre per year. Check the label for grazing, harvest, and application interval restrictions.		
Metsulfuron-methyl/Group 2	PATRIOT	Post-emergence
Remarks (Patriot): May be applied for the control of several broadleaf weeds. Do not apply this product in soils with a pH above 7.9 because extended soil residual activity could extend crop rotation interval beyond normal. May be applied to established native grasses, such as bluestems and gramas, and on other established pasture grasses such as bermudagrass, bluegrass, orchardgrass, brome grass, fescue, and timothy. Refer to the label for grass-specific precautions and timing of application. Do not apply more than 1 2/3 oz of this product per acre per year. There are no grazing or haying restrictions for this product.		
Pendimethalin/Group 3	PROWL H₂O	Pre-emergence
Remarks (Prowl H ₂ O): Will control most annual grasses and certain broadleaf weeds as they germinate. Prowl is registered for use in established bermudagrass and other perennial warm-season grasses, such as Bahiagrass, buffalograss, switchgrass, and others, when in winter dormancy. Do not exceed a cumulative total of 4.2 qt of Prowl H ₂ O per acre/season. Use of Prowl H ₂ O on rangeland is prohibited. Do not use on cool-season grasses. Check the label (including the supplemental label) of this product for other restrictions.		
Picloram/Group 4	TORDON 22K	Post-emergence
Remarks (Tordon 22K): Will control many broadleaf weeds, including troublesome perennial and woody weed species such as thistles, yellow starthistle, leafy spurge, knapweeds, field bindweed, rabbitbrush, and rush skeletonweed. Rates vary depending on weed species and density. Do not transfer livestock from treated grazing areas (or feeding of treated hay) onto sensitive broadleaf crop areas without first allowing 7 days of grazing on an untreated grass pastures (or feeding of untreated hay). Check the label for other use precautions and restrictions.		

¹ The list is current as of October 2013; however, labels change frequently, and the herbicide's current label should be reviewed for the most recent conditions or restrictions before it is used. Read all labels carefully and comply with their site-use directions (e.g., pre-harvest interval, restricted-entry interval, registration). Some herbicides may be **restricted**, classified for use only by certified applicators, by either federal or state law. Products restricted by federal law are automatically restricted in the state. In addition to federally restricted herbicides, certain herbicides are restricted within New Mexico by state law (for further information, see www.nmda.nmsu.edu/pesticides/registration/). For the very latest label information on a given herbicide, contact the manufacturer, Extension service in your area, or the company or distributor that sells the product. Also, most chemical labels can be accessed at either www.greenbook.net or www.cdms.net.

² Herbicide groupings follow the Weed Science Society of America's (WSSA) nationally accepted grouping. The grouping is based on the mechanisms of action of herbicides. For effective herbicide resistance management, it is imperative to rotate or mix the herbicides from different groups.

³ Other trade names of these active ingredients alone or in combination may be available on the market. Growers are advised to read the label of herbicides for selecting the correct rates based on the environmental conditions of their area. Refer to the label of each product for information regarding required adjuvants.

Table 1. List of Herbicides Registered for Use on Permanent Grass Pastures and Hayfields in New Mexico¹ (Cont.)		
Herbicide/WSSA Grouping²	Example of Trade Name³	Time of Application to Weeds
Quinclorac/Group 4	PARAMOUNT	Post-emergence with residual control
Remarks (Paramount): Will control several perennial broadleaf weeds and annual broadleaf and grass weeds. For best control of annual grasses, target application prior to tillering. Do not apply more than a total of 16 oz of Paramount per acre per year. There are no waiting period restrictions on grazing forage following the application of this product. Do not cut treated area for hay within 7 days after treatment. Check the label (including the supplemental label) of this product for other restrictions.		
Sulfosulfuron/Group 2	MAVERICK	Pre-emergence, Post-emergence
Remarks (Maverick): Will control or partially control Johnsongrass, purple and yellow nutsedges, and other weeds in well-established bermudagrass and bahiagrass pastures. Do not exceed two applications or a maximum of 2.66 oz of this product per acre per year. Check the label (including the supplemental label) of this product for restrictions.		
Tebuthiuron/Group 7	SPIKE 20P	Post-emergence surface treatment
Remarks (Spike 20P): Will control unwanted woody vegetation such as trees, shrubs, and vines. See the label for the application rate (application rates vary depending on the amount of precipitation). For activity, the herbicide must move by water into the root zone where it is absorbed by plants. A single application is normally effective for several years. May slightly and temporarily injure desirable grasses; applying herbicide when grasses are dormant can minimize injury. Do not apply on field crops, near desirable trees or shrubs, or to areas into which their roots may extend. Check the label of this product for grazing, harvest, and other use restrictions.		
Triasulfuron/Group 2	AMBER CUSTOM-PAK	Pre-emergence, Post-emergence
Remarks (Amber Custom-Pak): Will control certain broadleaf and grass weeds; refer to the “weeds controlled” section of the label for a listing of susceptible weed species and weeds that may be only partially controlled. Amber can be applied on established bermudagrass; big, little, and Old World bluestem; smooth bromegrass; buffalograss; sheep fescue; blue and sideoats grama; redtop; timothy; and bluebunch, crested, intermediate, and pubescent wheatgrass. Established stands of orchardgrass, red fescue, and ryegrass will likely be injured by this herbicide. The maximum total amount that can be applied in a calendar year is 0.84 oz per acre. Grazing may occur immediately following application; however, grass must not be cut for hay for at least 30 days after application.		
Triclopyr/Group 4	GARLON 3A	Post-emergence
Remarks (Garlon 3A): Will control woody plants and broadleaf weeds. Do not exceed 2/3 gallon of Garlon 3A per acre per growing season. Except for lactating dairy animals, there are no grazing restrictions following application. Do not allow lactating dairy animals to graze treated areas until the next growing season following application. Do not harvest hay for 14 days after application. During the season of application, withdraw livestock from grazing treated grass at least 3 days before slaughter.		
¹ The list is current as of October 2013; however, labels change frequently, and the herbicide’s current label should be reviewed for the most recent conditions or restrictions before it is used. Read all labels carefully and comply with their site-use directions (e.g., pre-harvest interval, restricted-entry interval, registration). Some herbicides may be restricted , classified for use only by certified applicators, by either federal or state law. Products restricted by federal law are automatically restricted in the state. In addition to federally restricted herbicides, certain herbicides are restricted within New Mexico by state law (for further information, see www.nmda.nmsu.edu/pesticides/registration/). For the very latest label information on a given herbicide, contact the manufacturer, Extension service in your area, or the company or distributor that sells the product. Also, most chemical labels can be accessed at either www.greenbook.net or www.cdms.net . ² Herbicide groupings follow the Weed Science Society of America’s (WSSA) nationally accepted grouping. The grouping is based on the mechanisms of action of herbicides. For effective herbicide resistance management, it is imperative to rotate or mix the herbicides from different groups. ³ Other trade names of these active ingredients alone or in combination may be available on the market. Growers are advised to read the label of herbicides for selecting the correct rates based on the environmental conditions of their area. Refer to the label of each product for information regarding required adjuvants.		

Table 2. Registered Herbicides for Use on Permanent Grass Pastures in New Mexico that Contain Two or More of the Active Ingredients Described in Table 1¹

Herbicide/WSSA Grouping ²	Trade Name ³
2,4-D; triclopyr Group 4	AQUASWEEP
Aminopyralid; triclopyr Group 4	CAPSTONE
Aminopyralid potassium; metsulfuron-methyl Groups 4 and 2	CHAPARRAL
Chlorsulfuron; metsulfuron-methyl Group 2	CIMARRON PLUS
2,4-D; clopyralid Group 4	CURTAIL
2,4-D; dicamba; fluroxypyr Group 4	E-2
2,4-D; aminopyralid Group 4	FOREFRONT R&P
2,4-D; picloram Group 4	GRAZON P+D
2,4-D; glyphosate Groups 4 and 9	LANDMASTER BW (AGRI STAR)
Fluroxypyr; triclopyr Group 4	PASTUREGARD
Dicamba; triasulfuron Groups 4 and 2	RAVE
Fluroxypyr; picloram Group 4	SURMOUNT
2,4-D; dicamba; picloram Group 4	TROOPER EXTRA

¹ The list is current as of October 2013; however, labels change frequently, and the herbicide's current label should be reviewed for the most recent conditions or restrictions before it is used. Read all labels carefully and comply with their site-use directions (e.g., pre-harvest interval, restricted-entry interval, registration). Some herbicides may be **restricted**, classified for use only by certified applicators, by either federal or state law. Products restricted by federal law are automatically restricted in the state. In addition to federally restricted herbicides, certain herbicides are restricted within New Mexico by state law (for further information, see www.nmda.nmsu.edu/pesticides/registration/). For the very latest label information on a given herbicide, contact the manufacturer, Extension service in your area, or the company or distributor that sells the product. Also, most chemical labels can be accessed at either www.greenbook.net or www.cdms.net.

² Herbicide groupings follow the Weed Science Society of America's (WSSA) nationally accepted grouping. The grouping is based on the mechanisms of action of herbicides. For effective herbicide resistance management, it is imperative to rotate or mix the herbicides from different groups.

³ Other trade names of these active ingredients alone or in combination may be available on the market. Growers are advised to read the label of herbicides for selecting the correct rates based on the environmental conditions of their area. Refer to the label of each product for information regarding required adjuvants.

Brand names appearing in publications are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned. Persons using such products assume responsibility for their use in accordance with current label directions of the manufacturer.

*The pesticide recommendations in this publication are provided only as a guide. The authors and New Mexico State University assume no liability resulting from their use. Please be aware that pesticide labels and registration can change at any time; by law, it is the applicator's responsibility to use pesticides **ONLY** according to the directions on the current label. Use pesticides selectively and carefully and follow recommended procedures for the safe storage and disposal of surplus pesticides and containers.*

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