Jamie L. Whitten Plant Materials Center

Coffeeville, MS

Vol. 13 No. 1 Technical Note November 1997

Preemergence Herbicides for Native Wildflowers, Legumes, and Grasses

Janet Grabowski and B. B. Billingsley

ABSTRACT

Native legume (groundnut, partridge pea, herbaceous mimosa, trailing wildbean) and wildflower species (lance-leaf coreopsis, calliopsis, clasping coneflower, black-eyed susan, lyre-leaf sage) included in this study exhibited tolerance to DCPA. Most legumes also tolerated metolachlor. Metribuzin, metolachlor, and atrazine generally caused unacceptable damage to most wildflower species. Eastern gamagrass showed very little damage from any of these herbicides. Switchgrass did not tolerate metolachlor. Virginia wildrye was damaged by all herbicides except DCPA. Purpletop was damaged by all herbicides tested.

INTRODUCTION

Determining herbicide tolerances of native grasses, legumes, and wildflowers in evaluation or production at the Jamie L. Whitten Plant Materials Center (PMC) is crucial to release these plants from weed competition and allow maximum growth. Species of interest are listed in Table 1. Atrazine provides effective weed control (Bahler et al., 1990) and was once labeled for switchgrass establishment (Kassel et al., 1982), however, Bahler (1985) found that it decreased seed germination and McKenna et al. (1991) found that it caused some inhibition of first-year seedling growth. No herbicides are labeled for purpletop or eastern gamagrass establishment, however, previous work at the PMC showed purpletop was completely killed by the preemergence herbicides metolachlor, trifluralin, and atrazine, and severely injured by fluometuron. This same study found that partridge pea was not injured by metolachlor or trifluralin, but was completely killed by atrazine and fluometuron. Herbaceous mimosa was killed or severely injured by fluometuron, atrazine, and metolachlor, but was tolerant to trifluralin (Bloodworth, 1991). Metolachlor has been used on trailing wildbean production fields at the PMC with no visible effect on plant growth, however, there has been no research to determine its response to this or other preemergence herbicides. Herbicide tolerances of groundnut have not been tested or recorded.

Weed competition is one factor that often leads to poor establishment of wildflowers (Salac et al., 1982). Few herbicides are labeled for wildflower use (Gallitanoi, 1993), however, DCPA, which controls annual grasses and some broadleaf weeds, is labeled for several ornamental species, including *Coreopsis* and *Salvia*. DiDario et al. (1962) found that a large number of herbaceous and woody ornamentals tolerated rates up to 15 lb a.i./acre. Bing (1983) found that black-eyed susan was tolerant to DCPA at 10 and 20 lb a.i/acre, but was injured by alachlor, oxadiazon, oxyfluorfen, and oxyfluorfen + pendimethalin. These studies were conducted on liners or established plants, so the effect of DCPA on seed germination was not determined. Skroch et al. (1992) listed pendimethalin, trifluralin, and oryzalin as being registered for use on black-eyed susan, and pendimethalin, metolachlor, and trifluralin registered for certain *Coreopsis* species.

More information is needed on the response of these native species to commonly used preemergence herbicides, especially when applied preemergence to the species itself. Therefore, a study was conducted in 1996 and 1997 to determine tolerance to the preemergence herbicides metolachlor, metribuzin, DCPA, and in 1997 only, atrazine.

MATERIALS AND METHODS

This study was designed as a randomized complete block with four replications. Seeding rates and planting depths for each species are given in Table 1. Seed lots for several species varied between study years due to unavailability and/or quality concerns. Purpletop and eastern gamagrass seed was stratified for three months before use. Seeding rates for partridge pea, herbaceous mimosa, trailing wildbean, and eastern gamagrass were increased in 1997 because of the low germination rates experienced in 1996. A further measure, taken in 1997 to improve seed quality of eastern gamagrass, was to visually inspect the seed and select for improved fill. Seed of each species was sown in one gallon nursery containers. Soil used was a sandy loam topsoil (Smithdale soil) dug from a PMC field. In 1996, the pots were seeded soon after filling, which led to considerable settling problems that affected germination. In 1997, this problem was remedied by filling three weeks prior to sowing and allowing natural rainfall to settle the soil. Sowing dates were April 3, 1996 and April 7, 1997. Containers were watered after planting to ensure good seed to soil contact and were then moved into a shed where herbicide drift could be minimized. In both years, herbicide treatments were applied the day following planting. Application rates are given in Table 2. All herbicides were applied with a CO_2 backpack sprayer at 20 gal/acre.

Table 1. Species tested and planting information.

Common Name	Scientific Name	Seeds Per Pot		Planting Depth
		1996	1997	
Groundnut	*Apios americana* Medik.	25	25	½ inch
Partridge pea	*Chamaecrista fasciculata* (Michx.) Greene	25	50	¼ inch
Lance-leaf coreopsis	*Coreopsis lanceolata* L.	100	100	near surface
Calliopsis	*Coreopsis tinctoria* Nutt.	100	100	near surface
Clasping coneflower	*Dracopis amplexicaulis* (Vahl) Cass.	100	100	near surface
Switchgrass	*Panicum virgatum* L.	100	100	near surface
Herbaceous mimosa	*Mimosa strigillosa* Torr. & Gray	25	50	½ inch
Black-eyed susan	*Rudbeckia hirta* L.	100	100	near surface
Lyre-leaf sage	*Salvia lyrata* L.	100	100	¼ inch
Trailing wildbean	*Strophostyles helvula* (L.) Ell.	25	50	½ inch
Purpletop	*Tridens flavus* (L.) A.S. Hitchc.	100	100	near surface
Eastern gamagrass	*Tripsacum dactyloides* (L.) L.	25	50	½ inch

Virginia wildrye	*Elymus virginicus* L.	100	100	¼ inch

Pots were moved into a greenhouse and plant counts were taken at 2, 3, and 7 weeks after planting. Irrigation was provided as needed. No fertilizer was applied during the experiment. Percent plant stand was calculated for each count and subjected to an analysis of variance with years treated separately. Mean separation was determined by least significant difference (LSD) at the 5 percent probability level ($P<0.05$). To determine initial germination of each seed lot, seed samples were placed in a germinator on appropriate germination media under recommended environmental conditions. Only seed that could be expected to germinate during the study period was determined, so hard seed was not included in the germination percentages for legume species.

Table 2. Herbicides used and application rates.

Trade Name	Common Name	Rate (lb a.i./ac)
Lexone 75DF	metribuzin	0.375
Dual 8EC	metolachlor	2
Dacthal 75WP	DCPA	8
Atrazine 4L	atrazine	1.5

RESULTS AND DISCUSSION

Initial germination percentages presented in Table 3 indicate that most seed lots used were of fair to good quality, with some notable exceptions. Legume seed was not scarified before planting which might have lead to some of the depression in germination rates shown. Germination percentages of trailing wildbean in 1996 and herbaceous mimosa in 1997 were particularly low. Eastern gamagrass germination was improved by quality selection in 1997, but was still low. There was a substantial reduction in germination rates from the switchgrass lot used in 1996 to that used in 1997. Lance-leaf coreopsis also showed reduced germination rates in 1997. These germination tests were performed under optimum conditions and it can be expected that germination rates of the greenhouse pot test will be somewhat lower.

Table 3. Initial germination percentage by species and year as determined in a germinator.

Species	1996	1997
	--------%---- ---	
Groundnut	72	84
Partridge pea	24	31
Lance-leaf coreopsis	78	46
Calliopsis	64	91
Clasping coneflower	77	67
Switchgrass	73	25
Herbaceous mimosa	36	6

Black-eyed susan	89	80
Lyre-leaf sage	70	74
Trailing wildbean	4	21
Purpletop	70	84
Eastern gamagrass	4	16
Virginia wildrye	74	91

Plant stand percentages for the greenhouse test are presented in Table 4. Large stands of weeds were present in control pots with few weeds occurring in any herbicide treated pots. Atrazine was only evaluated for one year so it is difficult to definitively determine the tolerance of these species to atrazine. However, both atrazine and metribuzin are triazine herbicides and it appears that most species responded in a similar fashion to both herbicides. Generalizations can be made on atrazine tolerance for most species based on the single year of data when the response to metribuzin is also considered. Several of these species are not well adapted to growing in containers filled with field soil. Over time, the soil becomes compacted and soil particles splash onto the foliage during irrigation, which often resulted in decreased plant stands in all pots, including the controls. Effects of herbicide treatment generally could not be separated from the response to growing conditions at the 7 week evaluation date. For this reason, only the data from the 2 and 3 week counts are presented, except for Virginia wildrye. Virginia wildrye showed no deleterious effects from the growing conditions and in 1996 the seedlings did not respond to the metribuzin treatment until after the 3 week count. Results for each species will be discussed below.

Table 4. Percent plant stand of species by year as affected by herbicide treatment.

Herbicide	Groundnut				Partridge pea				Lance-leaf coreopsis			
	1996		1997		1996		1997		1996		1997	
	2 wk	3 wk	2 wk	3 wk	2 wk	3 wk	2 wk	3 wk	2 wk	3 wk	2 wk	3 wk
	---%---											
Metribuzin	48	71	18	54	9	5	9	2	10	5	8	5
Metolachlor	26	53	12	46	12	15	22	25	8	8	3	9
DCPA	12	51	19	63	9	13	27	26	7	13	13	28
Atrazine	---	---	11	41	---	---	4	3	---	---	11	13
Control	39	71	34	64	11	20	27	29	15	18	13	14
LSD (0.05)	NS	NS	NS	17	NS	NS	9	8	NS	NS	NS	NS
Mean	31	62	19	54	10	13	17	17	10	11	9	14

Table 4 (Cont.). Percent plant stand of species by year as affected by herbicide treatment.

Herbicide	Calliopsis				Clasping coneflower				Switchgrass			
	1996		1997		1996		1997		1996		1997	
	2 wk	3 wk	2 wk	3 wk	2 wk	3 wk	2 wk	3 wk	2 wk	3 wk	2 wk	3 wk

	%											
Metribuzin	0	0	1	0	11	0	8	1	30	16	1	2
Metolachlor	0	0	0	1	3	3	0	2	4	7	1	4
DCPA	13	7	11	10	3	4	16	16	21	24	3	5
Atrazine	---	---	0	0	---	---	9	1	---	---	2	5
Control	8	4	35	31	19	18	22	23	26	37	5	8
LSD (0.05)	10	NS	21	21	NS	12	NS	14	14	20	NS	NS
Mean	5	3	9	8	9	6	11	9	20	21	2	5

Table 4 (Cont.). Percent plant stand of species by year as affected by herbicide treatment.

Herbicide	Herbaceous mimosa				Black-eyed susan				Lyre-leaf sage			
	1996		1997		1996		1997		1996		1997	
	2 wk	3 wk	2 wk	3 wk	2 wk	3 wk	2 wk	3 wk	2 wk	3 wk	2 wk	3 wk
	%											
Metribuzin	14	0	1	0	7	0	0	0	1	2	15	7
Metolachlor	15	12	2	2	0	0	1	1	0	0	0	3
DCPA	18	19	4	3	7	3	16	11	3	4	12	19
Atrazine	---	---	3	1	---	---	0	0	---	---	12	6
Control	22	17	4	4	21	13	10	7	2	8	10	13
LSD (0.05)	NS	NS	NS	3	8	3	10	8	NS	5	NS	NS
Mean	17	12	3	2	9	4	5	4	1	3	10	10

Table 4 (Cont.). Percent plant stand of species by year as affected by herbicide treatment.

Herbicide	Trailing wildbean				Purpletop				Eastern gamagrass			
	1996		1997		1996		1997		1996		1997	
	2 wk	3 wk	2 wk	3 wk	2 wk	3 wk	2 wk	3 wk	2 wk	3 wk	2 wk	3 wk
	%											
Metribuzin	5	9	12	18	15	2	14	7	1	7	15	23
Metolachlor	3	5	15	21	0	0	0	0	2	5	23	30
DCPA	7	9	21	27	0	0	0	0	2	4	18	24
Atrazine	---	---	16	12	---	---	9	8	---	---	13	17
Control	7	11	14	17	36	46	37	38	2	4	21	30
LSD (0.05)	NS	NS	NS	8	14	6	20	20	NS	NS	NS	NS
Mean	6	9	15	19	13	12	12	11	2	5	18	25

Table 4 (Cont.). Percent plant stand of species by year as affected by herbicide treatment.

Herbicide	Virginia wildrye					
	1996			1997		
	2 wk	3 wk	7 wk	2 wk	3 wk	7 wk
	--------------------------%------------------------					
Metribuzin	33	41	2	75	6	0
Metolachlor	0	7	6	27	27	2
DCPA	23	52	51	81	83	82
Atrazine	---	---	---	72	28	0
Control	25	47	59	80	82	81
LSD (0.05)	20	29	24	23	17	6
Mean	20	37	29	67	45	33

Groundnut: Groundnut is a fairly large-seeded legume, therefore, as a general rule, it should not be as susceptible to herbicide damage as would smaller seeded species. That is the basically trend that was observed. There were no significant differences between herbicide treatments in 1996. It appears that the low plant count for the DCPA treatment at 2 weeks is an anomaly, because it was not sustained in later counts, nor in 1997. The 3 week count in 1997 did show significant differences between treatments, with atrazine and, to a lesser extent, metribuzin affecting plant stands. However, in 1996 the metribuzin treatment had the largest stands, exceeding the control at 2 weeks and equaling it at 3 weeks. Plant stands for both herbicides decreased further at the 7 week count (data not presented). It appears that triazine herbicides may not be safe for this species. DCPA and metolachlor did not cause significant damage to the seedlings, so they may be possible candidates for use on groundnut.

Partridge pea: No significant differences were detected between the treatments in 1996 which may have been due to the overall low germination rates in that year. Metribuzin and atrazine did cause significant damage for both plant counts in 1997. Metolachlor has previously been shown to cause no damage to partridge pea (Bloodworth, 1991) and that was confirmed in this study. This study indicates that DCPA can also be used safely on partridge pea.

Lance-leaf coreopsis: No differences were detected between treatments in either year, however, there was a trend towards decreased plant stands due to metribuzin and metolachlor treatment. Skroch et al. (1992) listed the herbicide Pennant (active ingredient metolachlor) as being labeled for use on *Coreopsis* species. Dual 8EC may be more damaging than Pennant or recommended application rates and methods may be different than those used in this study. Plant stands for the DCPA treatment were generally equal to or greater than those of the control, which is to be expected because it is labeled for *Coreopsis* species. Atrazine stands in 1997 were about equal to those of the control, which is surprising because of the response to metribuzin. Correll and Bing (1980) found that herbicide combinations that included simazine (another triazine) and oxadiazon caused some plant damage to *Coreopsis verticillata* that was not shown on those treatments without simazine. This study indicates that DCPA is safe for lance-leaf coreopsis and should be recommended for use in field production. Further research may need to be conducted to definitively determine the response to atrazine.

Calliopsis: Growth in the control pots was very poor in 1996. This may have been due to the soil settling problems discussed previously or to weed pressure in the control pots. DCPA was found to significantly increase percent stand at 2 weeks. However, the 1997 data shows that plant stands for all treatments, including DCPA, were significantly lower than the control. This difference in response to DCPA between the two years may have been less due to the herbicide than to the negative effects of the growing conditions. Because calliopsis is a species of *Coreopsis*, DCPA is labeled and should be approved for use.

Clasping coneflower: Germination rates were very poor in 1996 and probably can also be attributed to soil settling. There were significant differences shown for the 3 week count, with all herbicides showing stand reductions compared to the control. Metribuzin showed a substantial decrease in plant stand between the 2 and 3 week counts. In 1997, there were significant differences for the 3 week count with the control having the largest stands, followed by DCPA. It appears that DCPA is the only herbicide in this test with potential for use on this species.

Switchgrass: There were treatment differences for both counts in 1996. Metolachlor stands were very low at both 2 and 3 weeks. Seed in the metribuzin treatment germinated normally, but there was substantial mortality by the 3 week count. Unfortunately, there was a seed quality problem in 1997 and no differences could be detected between herbicide treatments. Although atrazine effects could not be rated in this study, Bahler et al. (1990) have shown in greenhouse studies that atrazine did not affect switchgrass stands. Metribuzin may affect plant stands, but more testing would be required to confirm this. Metolachlor was very damaging and should not be used. DCPA did not appear to cause any damage and may be an alternate herbicide for switchgrass.

Herbaceous mimosa: No differences could be detected in 1996, but there was a trend towards greater plant damage due to metribuzin treatment at the 3 week count. Although germination rates were very low in 1997, differences could be detected at the 3 week count and metribuzin again had the lowest stand. Atrazine was also damaging. Bloodworth (1991) found that atrazine and metolachlor completely killed herbaceous mimosa. It appears herbaceous mimosa has little tolerance for triazine herbicides. Metolachlor may cause more damage in the field than was shown in the greenhouse. DCPA appears to be quite safe for use on herbaceous mimosa.

Black-eyed susan: In 1996, all herbicides significantly affected plant stands. However, in 1997, DCPA had the largest plant stands of any treatment. This difference in response to DCPA between the two study years is difficult to explain. Black-eyed susan is especially intolerant of soil deposition on the plant crown and foliage. All herbicide treated containers had less weed growth than the controls and therefore more soil may have splashed onto the seedlings. The soil settling problem discussed previously also may have affected the 1996 results. Bing (1983) found that DCPA was safe for black-eyed susan and these results appear to support his findings. None of the other herbicides in this test appear to be suitable for use on this species.

Lyre-leaf sage: Lyre-leaf sage, with its decumbent growth habit, had considerable soil deposition on its foliage during the testing period, but it was not as negatively impacted as black-eyed susan. Germination rates were fairly low in the 1996 test, however, significant differences could be detected for the 3 week count, with DCPA having the least effect on plant stand. There were no differences between treatments in 1997, however, there was a trend towards greater plant damage from metribuzin, metolachlor, and atrazine. DCPA treatments had the highest stand counts of all treatments. DCPA is labeled for several *Salvia* species (Skroch et al. 1992), however, this particular species is not widely grown commercially. This research suggests that DCPA may be safe for use on lyre-leaf sage.

Trailing wildbean: Trailing wildbean is also a fairly large-seeded legume and that may decrease its susceptibility to preemergence herbicides. Germination rates were low in 1996, and no differences could be detected between herbicide treatments. In 1997, atrazine caused significant damage as shown by the 3 week count. Metribuzin also decreased plant stands. DCPA and metolachlor treatments had larger stands than the control, which may have been due to decreased weed pressure in the pots. Both herbicides can be safely used on trailing wildbean.

Purpletop: Similar results were seen in both years. All herbicides tested caused significant damage. Metolachlor and DCPA completely killed purpletop. Stands in the metribuzin treatment decreased markedly between the 2 week and 3 week count in both study years. In 1997, atrazine stands were low at both evaluation dates. Bloodworth (1991) found that both atrazine and metolachlor completely killed purpletop in field studies. Based on the data from this test, none of the herbicides tested can be recommended for use on purpletop.

Eastern gamagrass: Germination rates in 1996 were very low. The reason for this was discussed previously. Although overall germination rates improved in 1997, there were no significant differences between treatments. This is not unexpected, because the fairly large size of the caryopsis and the mitigating effects of the surrounding fruit structure or cupule would probably limit herbicidal activity on this species. Plant stands were slightly lower in the atrazine treatment compared to the other herbicides. Further study would need to be conducted to determine whether or not this is a true trend. It appears that metribuzin, metolachlor, and DCPA can be used on eastern gamagrass.

Virginia wildrye: Results followed basically a similar pattern in both study years. In 1996, significant differences were detected between the metolachlor treatment and all other treatments for the 2 and 3 week counts. By 7 weeks, stands in the metribuzin treatment were substantially decreased. In 1997, plants responded more quickly to the metribuzin treatment, with mortality occurring by the 3 week count. The response to metribuzin was a classic triazine response. Seedlings germinated normally, however, they were slightly off-color; normal Virginia wildrye seedlings are purple, but the treated ones were a greenish color. When the seedlings were a few inches tall, they became chlorotic and died. Seedlings responded identically to atrazine. In addition to reducing plant stands, metolachlor severely stunted the seedlings before causing mortality. DCPA caused no damage to Virginia wildrye seedlings in either year and provided comparable stands to the control with reduced weed growth.

FURTHER CONSIDERATIONS

Grasses: Native warm season grasses are generally slow to establish and suffer from weed competition. Switchgrass, eastern gamagrass, and Virginia wildrye all appear to have potential herbicidal weed control options. However, no herbicide was found safe for use on purpletop in this or in a previous study (Bloodworth, 1991). For purpletop establishment, it may be worthwhile to examine the use of a safener applied to the seed to protect the seedlings from herbicide damage. In this study, metribuzin and atrazine, and in the previous study, fluometuron were the least damaging herbicides. These herbicides should probably be studied in combination with various seed safener treatments.

Legumes: Metolachlor can be used safely on most legumes that were tested. This herbicide has been used on trailing wildbean and partridge pea production fields at the PMC for several years. However, the fact that it will not control several commonly present morningglory species causes harvesting and seed cleaning problems, especially for trailing wildbean. Additional research needs to be conducted to find herbicides that will control these problem weeds.

Wildflowers: DCPA can be used safely on most wildflower species, however, there are some factors that may limit its use. Wettable powder formulations are more difficult to apply than emulsifiable concentrate or liquid formulations. It is also marketed in granular and flowable formulations, but these also present application problems. It is not effective on ragweed (*Ambrosia* sp.), smartweed (*Polygonum* sp.), and horsenettle (*Solanum* sp.), even at rates up to 15 lb a.i./acre (DiDario et al., 1962). Most of these are weed problems at the PMC, especially ragweed, which can occur in large stands that become highly competitive with the wildflower species. It is highly effective on crabgrass (*Digitaria* sp.) (DiDario et al., 1962) which is also a major weed problem at the PMC. On many fields, control of this weed alone would justify its use.
This study tested the effect of these herbicides applied immediately subsequent to seeding. However, in the Southeast these wildflower species are planted in the fall and most will germinate before winter. Many of our most troublesome weeds germinate in the spring. A potential future study would be to determine if some of the herbicides that caused unacceptable damage in this study can be safely applied in the spring, prior to weed seed germination, over the top of established wildflower seedlings.

LITERATURE CITED

Bahler, C.C. 1985. Atrazine tolerance of warm-season grass seedlings. Diss. Abstr. Int. 45(9): 2740B-2741B.

Bahler, C.C., L.E. Moser, T.S. Griffin, and K.P. Vogel. 1990. Warm-season grass establishment as affected by post-planting atrazine application. J. Range Manage. 43(5): 421-424.

Bing A. 1983. Weed control on perennials. Proc. Northe. Weed Sci. Soc. 37: 352-356.

Bloodworth, L.H. 1991. Response of selected accessions to common herbicides. Technical Notes. No. 4. Coffeeville PMC, MS.

Corell, T., and A. Bing. 1980. Preemergence weed control in ornamental perennial crops. Proc. Northe. Weed Sci. Soc. 34:334-339.

DiDario, A., H.H. Harris, T.L. Curry, and L.G. Utter. 1962. Evaluation of dacthal herbicide on trees, shrubs and herbaceous ornamentals. Proc. Northe. Weed Contr. Conf. 16: 205-211.

Gallitanoi, L., W.A. Skroch,, and D.A. Bailey. 1993. Weed management for wildflowers. Leaflet 645, North Carolina Cooperative Extension Service, Raleigh.

Kassel, P.C., J.A. Fawcett,, G.E. Myers, and J.E. Nelson. 1982. Herbicide for switchgrass establishment (abstract). Proc. No. Cent. Weed Contr. Conf. 37: 99.

McKenna, J.R., D.D. Wolf, and M. Lentner. 1991. No- till warm-season grass establishment as affected by atrazine and carbofuran. Agron. J. 83(2):311-316.

Salac, S.S., J.M. Traeger, and P.N. Jensen. 1982. Seeding dates and field establishment of wildflowers. HortScience 17(5): 805-806.

Skroch, W.A., J.C. Neal, J.F. Derr, and A. Senesac. 1992. Weed control suggestions for christmas trees, woody ornamentals, and flowers. Publication No. AG-427. North Carolina Cooperative Extension Service, Raleigh.

Mention of a trademark or proprietary product does not constitute a guarantee or warranty of the product by USDA-NRCS and does not imply its approval to the exclusion of other products that also may be suitable.
Herbicide labels should be consulted on all products before use.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice or TDD). USDA is an equal opportunity provider and employer.

USDA NRCS
Natural Resources Conservation Service

Homer L. Wilkes, State Conservationist
Jackson, Mississippi