Annual Report
October 2002 to June 30, 2003

Roadside Flower Research: No-Till Planting

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Submitted To:
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July 30, 2003

I. Introduction

Virginia is on the forefront of no-till planting of roadside (wildflower) flowers. Four years ago we successfully planted roadside flower plots with a no-till planter in Orange County. This was our first trial, and it employed both annual and perennial species. Since then, we have planted over sixteen no-till experiments around the state. Our understanding of this specialized management system has improved through our experiences and benefited from communications with other people. Knowledge of plant species, soil conditions, weed control, and pest management are integral to success with this technique. The mechanics of planting the seed as well as incorporating science requires a great deal of skill and patience.

The no-till technique may be desirable for seeding roadside flowers for the same reasons that it is favored with field crops. Soil erosion, moisture conservation, weed control, and organic matter accumulation are all valid concerns of VDOT roadside managers. In 1999 VDOT requested that we try to establish roadside flowers with no-till techniques. In response, we developed a four-phase research approach to applying no-till technology to the roadside environment: 1) test the feasibility of no-till methodology for establishing desirable annuals and perennials; 2) compare no-till and conventional seeding systems across the three physiographic regions of Virginia; 3) determine how to manage a site prior to and following no-till seeding to minimize weeds; and 4) incorporate plant mixes into a no-till seeding system with complementary herbicides. All phases of examining no-till for roadside plantings were completed and addressed in this report. In the past year we have examined how to prepare a no-till site in efforts to minimize weeds as well as how to combine perennials and annuals into compatible mixtures.

The research that was proposed in December 2001 and then accepted as a contract in late September 2002, was revised to provide meaningful research given the short amount of time (six months) that was left in the contract. In May 2003 the modified studies were planted. Basic data were collected in June and have been evaluated in this report. Additional data from these plots may be collected in the fall 2003 if we are allowed access to the plots that are on VDOT land.

Three studies, planted in the fall of 2001 and spring of 2002, were inadvertently mowed by VDOT in the summer of 2002: Comparison of Site-Preparation Techniques for Fall No-till Seeding of Roadside Flowers; Comparison of Site-Preparation Techniques for Spring No-till Seeding of Roadside Flowers; and Performance of No-Till-Planted Mixtures of Fall-Seeded Species. This occurred because a delay in funding prohibited us from visiting maintaining the plots adequately for the local mowing crew to find the stakes, which marked the area.

II. Performance of No-Till-Planted Mixtures of Spring-Seeded Species: Planted Spring 2002

Objective:

To determine if spring-planted mixtures of annuals and perennials can provide color and interest from summer till frost.

Methods and Materials:

On May 13, 2002, mixtures of annual and perennial species were planted in Henry County. The mixtures of two annuals and perennials (Table 1) were chosen for the summer-to-fall flowering sequence of the annuals and the herbaceous perennials, which extended interest into the following season. Seeding rates of these mixtures varied from 6 to 27 lb/A (Appendix A). The rates were selected by past experience as well as price of the seed. Some of these species, for example downy sunflower and ox-eye sunflower, cost up to $80/lb. We designed the seeding rate with cost in mind. In one mix, the Canada goldenrod pure live seed rate was so low that we tripled its rate in the mixture.

The site was prepared by applying Glyphosate (1 gal/A) twice: 32 (April 11, 2002) and 7 (May 6, 2002) days prior to seeding. The vegetation was mowed 6 inches high 20 days (April 23, 2002) prior to seeding. The seed mixes were planted with a Tye Pasture Pleaser no-till drill on May 13, 2002. Fertilizer (15-30-15, 300 lb/A) was applied after the seedlings had emerged, on June 8, 2002.

Fussion™ (fluazifop + fenoxaprop), a post-emergent grass herbicide, was applied at the rate of 6 oz/A on June 8, 2002 to kill the fall panicum, Johnsongrass, bromegrass, and foxtail weeds that had germinated. Unfortunately but unavoidably, it killed the grasses we planted as well. On March 26, 2003 Pendulum (pendimethalin 3.8 EC 2 qt/A) was applied to the area to reduce weed seed germination.

The strip plots (160 sq. ft.) were arranged in a randomized block design. Seeding treatments were replicated four times (eight mixes x four replications). Data on plant ground cover, overall performance rating, and flowering were collected in June 2003. Data for the previous year was reported in Booze-Daniels et al., 2002.

Results and Discussion:

Data were collected in June 2003, and the dominant species were identified (Table 1). The Maximilian sunflowers dominated their plots and were about 4 feet tall at this time. The advantage of this species is that it towers over the weeds, even the pokeweed. This species was sown at 4 PLS lbs/A, but we believe that rate can be reduced to 2 lb/A as long as water is not limiting. The appearance of the ox-eye sunflower was a surprise. The plant was not observed last year, and this spring it was so prevalent. This plant was paired with sulfur cosmos last spring, and it seemed to do well as a companion with the dominating cosmos. Bidens was also paired with sulfur cosmos the year before, and it too did well the following year. The Gloriosa daisy also managed to survive being paired with garden cosmos. Perhaps cosmos is a better companion than we thought last year.

There were other surprises. The downy sunflower robustly returned after a fair show last year. The goldenrod was the only perennial not seen in 2003. The combination of lanceleaf coreopsis, Gloriosa daisy, and tickseed coreopsis give rise to a nice short stand (less than 3 feet) of wildflowers the second year. The long-headed coneflower and clasping coneflowers also survived. These plants have flowers that are not large and showy; thus, they would look best in a large mass.

We generally recommend fall sowing of perennials; however, we were pleased with this spring-sown plot. The Pendulum applied early in the spring, one year after initial seeding, appeared to help reduce the grassy weeds. This pre-emergent herbicide did not appear to inhibit reseeding and growth of cosmos or bidens the second year. In general, we were satisfied with all of the combinations. If Maximilian sunflower is used, we recommend using crimson clover as a companion. Maximilian sunflower will dominate other species, thus no need to add other species.

From a design implication, we recommend planting a site with alternating rows of the different sunflowers. Place Maximilian sunflower in one-half of the seeding box and downy or ox-eye sunflower in the other half. The driver should meander down the field, no straight lines. A third species, such as clover could be sown in a crosshatch pattern to fill the area to prevent weeds. The ox-eye booms in early June, the downy in mid August, and the Maximillian in late August until frost. This combination would provide flowers from June to frost.

Table 1. Dominant species of spring-planted mixtures (May 2002) on June 2003.

Mix	Annual Summer Color	Annual Fall Color	Perennial Summer Color	Dominant Species in June
1	Tickseed coreopsis	Gloriosa daisy	Maximilian sunflower	100% Max sunflower
2	Cosmos Gloria	Gloriosa daisy	Canada goldenrod	100% Gloriosa daisy
3	Clasping coneflower	Silene	Lanceleaf Coreopsis	75% clasping coneflower + 25% Silene
4	Gloriosa daisy	Downy Sunflower	Lanceleaf coreopsis	50% Downy sunflower + 50% Gloriosa daisy
5	Sulfur cosmos	Tickseed sunflower	Long-head coneflower	50% bidens + 40% LH coneflower + 10% sulfur cosmos
6	Crimson clover	Silene	Maximilian sunflower	100% Max sunflower
7	Tickseed coreopsis	Gloriosa daisy	Lanceleaf coreopsis	30 tickseed + 40% Gloriosa daisy + 30% coreopsis
8	Sulfur cosmos	Gloriosa daisy	Ox-eye sunflower	90% ox-eye + 10% Gloriosa daisy

III. Four Studies Planted in May 2003

A. Performance of Spring-Planted Roadside Flowers in Virginia: A Comparison of Herbicide and Mowing Strategies: Planted Spring 2003

Objective:

To compare herbicide and mowing techniques to prepare sites for no-till seeding of roadside flowers in spring. This study expands the information gained from the site preparation study planted in spring 2002 (Booze-Daniels et al., 2002).

Methods and Materials:

A study was established in the spring of 2003 on a nearly level site in Henry County (Piedmont). The soil was typical of the region. The site had been used the previous year for the study titled, Comparison of Site-Preparation Techniques for Spring No-till Seeding of Roadside Flowers, which was planted in spring of 2002 but mowed by mistake the same year.

In October 9, 2002 the site was mowed and seeded with cereal rye (10 lb/A) to establish a uniform cover. On March 26, 2003, when the rye was 4 to 6 inches tall, the first treatments were applied to plots receiving two-stage treatments. On April 11, 2003 the second treatments were applied (first treatments for plots receiving one-stage preparation). This was not ideal timing, but we adjusted our plans due to of the short intervals between rain events in one of the wettest years on record. The treatment descriptions were as follows and the sequence is explained in Table 2:

1. **Mowing only** – The vegetation was mowed to 4 inches 5 weeks prior to seeding. (1 step process).
2. **Glyphosate (twice) + Mowing** – This is the traditional site preparation method employed with no-till seeding. Glyphosate (4 oz/gal, 41% a.i.) was applied twice, 7 (March 26) and 5 (April 11) weeks prior to seeding. The vegetation was mowed to 4 inches high 5 weeks prior to seeding, before the glyphosate was applied.
3. **Glyphosate (twice) + Mowing + Plateau™**– Glyphosate (4 oz/gal, 41% a.i.) was applied twice, 7 and 5 weeks prior to seeding. Plateau (imazapic) (4 oz/A) was applied 5 weeks prior to seeding (with the glyphosate). Five weeks prior to seeding, the vegetation was mowed to 4 inches before the chemicals were applied.
4. **Mowing + Glyphosate –** Five weeks prior to seeding, the vegetation was mowed to 4 inches and glyphosate (4 oz/gal, 41% a.i.) was applied.
5. **Reduced Glyphosate Rate -** Glyphosate (2 oz/gal, 41% a.i.) was applied 5 weeks prior to seeding and vegetation was not mowed.

6. **Reduced Glyphosate Rate + Plateau™ -** Glyphosate (2 oz/gal, 41% a.i.) and Plateau (imazapic) (4 oz/A) were applied 5 weeks prior to seeding and vegetation was not mowed.
7. **Mowing + Plateau™ -** Plateau (imazapic) (4 oz/A) was applied 5 weeks prior to seeding after the vegetation was mowed to 4 inches.

Table 2. Schedule of treatments in spring 2003.

	Schedule	
Treatment Name	**March 26, 2003** **(7 Weeks Prior to Seeding)**	**April 11, 2003** **(5 weeks Prior to Seeding)**
Mowing Only		Mowing
Glyphosate (twice) + Mowing	Glyphosate (full strength)	Glyphosate (full strength) Mowing
Glyphosate (twice) + Mowing + Plateau	Glyphosate (full strength)	Glyphosate (full strength) Mowing Plateau
Glyphosate + Mowing		Glyphosate (full strength) Mowing
Reduced Glyphosate Rate		Glyphosate (half strength) No Mowing
Reduced Glyphosate Rate + Plateau		Glyphosate (half strength) No Mowing Plateau
Plateau + Mowing		Plateau Mowing

On May 14, 2003, garden cosmos (*Cosmos bipinnatus*), lanceleaf coreopsis (*Coreopsis lanceolata*), Gloriosa daisy (*Rudbeckia hirta* 'Gloriosa'), crimson clover (*Trifolium incarnatum*), and Maximilian sunflower (*Helianthus maximilianii*) were sown across the herbicide and mowing treatments with a Tye Pasture Pleaser no-till drill as pure stands at the rates shown in Table 3. The plots were planted 5 weeks after the last herbicide treatment, in spite of our

intention to plant 2 weeks after the last herbicide treatment. The rain events were so frequent that the soil had little time to dry. We were lucky to have a few dry days, because after May 14, there were few rain-free days.

Table 3. The seeding rates for five species spring-planted by no-till method. Rates are reported as pure live seed (PLS).

Species	Seeding Rate (PLS lb/A)
Garden cosmos	15
Lanceleaf coreopsis	10
Gloriosa daisy	4
Crimson clover	15
Maximilian	15

The strip plots (160 sq. ft.) were arranged in a randomized split-block design. Herbicide/mowing treatments were replicated four times (7 herbicide/mowing treatments x 4 replications). Flower and weed density data were collected in June 2003. Data may be collected at beyond June the discretion of the investigator and if VDOT permission can be obtained to visit the site.

Results and Discussion:

The data collected one month after sowing indicated that Plateau in combination with Glyphosate improved the performance of the desired plants and reduced weed populations (Table 4). It appears that the weeds were suppressed when even a half-rate of glyphosate was used with Plateau. The use of glyphosate alone with or without mowing did not appear to provide adequate weed control and to help newly seeded plants in this study. This may be due to the 5-week lag period between application of the herbicide and sowing. The Companion Study site (will be discussed later in this report) was sprayed with glyphosate at the time of seeding, and the weed control was much better. Combining Plateau with glyphosate reduced the need to apply one more application of herbicide near the time of planting. The added advantages of using the two herbicides together were to create more flexibility in time of seeding, especially when the rain was sporadic, and reduced labor costs of an extra step. The Glyphosate + Plateau treatment was a one-step process, because the site was not mowed, and herbicide was applied

only one time. The results were adequate when planting into cereal rye; however, results may be different if the dominant vegetation had been a mixture of broadleaf weeds and tall fescue.

Data for only cosmos and clover were collected at this time. The other three species were just starting to develop and were too small to evaluate. We suspect the wet, cool weather hindered the development of the coreopsis.

Table 4. Percent ground cover by weeds and two spring-planted flowering species recorded in June 2003, one month after sowing.

Treatment	**Percent Ground Cover**		
	Garden Cosmos	**Crimson Clover**	**Weed (Average for all flower species)**
Mowing Only	12.5 c*	27 b	71.7 a
Glyphosate (twice) + Mowing	13.0 c	25.8 b	85.8 a
Glyphosate (twice) + Mowing + Plateau	45.0 ab	71.2 a	25.0 c
Mowing + Glyphosate	21.2 bc	47.5 b	75.0 a
½ Rate Glyphosate	26.2 bc	43.3 b	70.5 a
½ Rate Glyphosate + Plateau	52.5 a	68.7 a	33.7 c
Mowing + Plateau	32.5 abc	46.2 b	50.0 b

*Means within a column with the same letter are not significantly different at the 5% level according to Student, Newman and Kuels test.

B. Performance of No-Till Spring-Planted Roadside Flowers in Virginia: Timing of Glyphosate with and without Plateau

Objective:

To compare the effect of timing of applications of glyphosate with and without Plateau on no-till seeded roadside flowers. This study expands information gathered from the site preparation study that was planted in spring 2002.

Methods and Materials:

A study was established in May 2003 on a nearly level site (same area as in the previous study) in Henry County (Piedmont) that was planted in cereal rye in fall 2002. On March 26, 2003, when the rye was 4 to 6 inches tall, the first herbicide treatments were applied. On April 11, 2003 the second treatments were applied. The herbicides, glyphosate (4 oz/gal, 41% a.i.) and Plateau (4 oz/A), were applied 7 and 5 weeks prior to seeding (Table 5). This is not a desirable interval between herbicide application and seeding, but the persistent rain was to blame. The whole site was mowed to 4 inches 5 weeks prior to seeding.

Table 5. Herbicide Application Schedule.

	Schedule of Herbicide Application	
Treatment	**Seven Weeks Prior to Seeding**	**Five Weeks Prior to Seeding**
1 (gly/gly)	Glyphosate	Glyphosate
2 (gly/none)	Glyphosate	None
3 (none/gly)	None	Glyphosate
4 (gly/glyplat)	Glyphosate	Glyphosate + Plateau
5 (glyplat/gly)	Glyphosate + Plateau	Glyphosate
6 (glyplat/none)	Glyphosate + Plateau	none
7 (none/glyplat)	None	Glyphosate + Plateau
8 (none/none)	None	None

Four species, garden cosmos (15 lb/A), lanceleaf coreopsis (10 lb/A), Gloriosa daisy (4 lb/A), and crimson clover (15 lb/A), were sown with a no-till Tye Pasture Pleaser seeder. The strip plots of seed mixtures (160 sq. ft.) were arranged in a randomized split-block design. The

herbicide treatments were replicated four times (8 preparation treatments x 4 replications). Data on plant and weed ground cover were collected in June 2003.

Results and Discussion:

The data collected in June 2003 showed no significant differences among all the treatments, in sharp contrast to the previous study (Table 6). The variation was too great to show any differences. In general, the Plateau-treated plots had fewer weeds than the non-Plateau plots. The combined weed cover average of the non-Plateau was 62%, the control was 64%, and the Plateau was 50%. Even though this can't be confirmed statistically, the trend was evident and supported by the previous study. The variation and weed-control failure may be a result of the excessive rainfall. Two replications were particularly soggy.

Table 6. Percent ground cover by weeds and spring-planted flowering species recorded in June 2003, one month after sowing.

Treatment (schedule)	**% Ground Cover**			
	Cosmos	**Gloriosa Daisy**	**Clover**	**Weed (Average for all flower species)**
1 (gly/gly)	25 a	30 a	62 a	70 a
2 (gly/none)	34 a	35 a	66 a	55 a
3 (none/gly)	35 a	40 a	72 a	60 a
4 (gly/glyplat)	36 a	34 a	77 a	54 a
5 (glyplat/gly)	40 a	31 a	79 a	45 a
6 (glyplat/none)	35 a	35 a	78 a	54 a
7 (none/glyplat)	48 a	51 a	70 a	51 a
8 (none/none) (Control)	41 a	31 a	57 a	63 a

C. Evaluation of Companion Crops in Spring No-till Plantings of Roadside Flowers

Objective:

To determine if the use of companion crops can suppress weed density in a spring-seeded roadside flower planting. A companion crop covers the ground quickly to reduce the light from reaching the seedlings, thus discouraging weeds.

Methods and Materials:

A study was established in spring 2003 on the same site as the two previous studies in Henry County (Piedmont). Glyphosate (4 oz/gal, 41% a.i.) was applied three times, 7 weeks prior to, 5 weeks prior to, and day of seeding. The vegetation was mowed to 4 inches 5 weeks prior to seeding. Garden cosmos (15 lb/A), lanceleaf coreopsis (10 lb/A), Gloriosa daisy (4 lb/A), and Maximilian sunflower (15 lb/A) were sown with a Tye Pasture Pleaser no-till drill as pure stands.

The companion crops were sown perpendicularly to the perennial species with the Tye Pasture Pleaser no-till drill. In this study, the following grasses and crimson clover were sown at very low seeding rates:

- Annual ryegrass (5 lb/A)
- Intermediate ryegrass 'Transist', a hybrid (5 lb/A)
- Creeping red fescue, native (5 lb/A)
- Crimson clover (2 lb/A)

The strip plots (160 sq. ft.) of grasses, clover, and control, were arranged in a randomized split-block design and replicated four times (4 treatments x 4 replications). Roadside plant and weed density data were collected in June 2003.

Results and Discussion:

As in the previous study, the plots were so soggy that algae and moss covered a quarter of the ground. The cosmos and Maximilian sunflower were present, but their growth was not vigorous. The Gloriosa daisy and coreopsis growth was so inconsistent and poor that data were not collected. Of the flowering plants, Maximilian sunflower performed the best (Table 7). Of the companions, annual ryegrass, Transist ryegrass hybrid, and crimson clover were present by

June. Because of the wet and atypical conditions, the data were not consistent. Perhaps data from later in the season will be more helpful. However, it was apparent that Crimson clover when used as a companion, should not be seeded greater than 1 to 2 lbs/A. Clover, annual ryegrass, Transist ryegrass hybrid, cosmos, and Maximilian sunflower appear to tolerate the very wet conditions.

Weed control was nearly 95% for the plots. The third application of glyphosate at the time of seeding helped. We would not normally advocate three applications, but the rain kept us from seeding soon after the second application.

Table 7. Percent ground cover by companion species and two spring-planted flowering species recorded in June 2003, one month after sowing.

Companion	Percent Ground Cover		
	Cosmos	Maximilian Sunflower	Companion
Annual Ryegrass	34 a*	45 a	48 a
Transist Ryegrass Hybrid	28 a	31 ab	27 b
Red Fescue	28 a	30 ab	0 c
Clover	34 a	41 a	58 a
Control (no companion)	25 a	20 b	0 c

*Means within the same column and with the same letter are not significantly different at the 5% level according to Student, Newman and Kuels test.

D. Performance of No-till Planted Mixtures of Spring-Seeded Species

Objective:

To determine which annual and perennial mixtures when planted in the spring will provide color and interest from summer to frost, and into the following year.

Methods and Materials:

In May 2003, a spring-seeded study using a mixture of annual and perennial species was installed in Montgomery County, at the Kentland farm. Twenty-four seeding mixtures were based on results from the study that was installed in spring 2002. The species were selected for their summer-to-fall flowering/color sequence. A factorial design with six annuals and four perennials (24 combinations) was created. The following species were used:

Annual:

- Crimson clover (*Trifolium incarnatum*) (5 lb/A)
- Tickseed coreopsis (*Coreopsis tinctoria*) (2 lb/A)
- Gloriosa daisy (*Rudbeckia hirta* 'Gloriosa') (2 lb/A)
- Lemon mint (*Monarda citrodora*)(2 lb/A)
- Tickseed sunflower (*Bidens aristosa*) (8 lb/A)
- Swamp sunflower (*Helianthus angustifolia*) (2 lb/A)

Perennial:

- Brown-eye Susan (*Rudbeckia triloba*) (5 lb/A)
- Lanceleaf coreopsis (*Coreopsis lanceolata*) (8 lb/A)
- Maximilian sunflower (*Helianthus maximilianii*) (8 lb/A)
- Ox-eye sunflower (*Heliopsis helianthoides*)(8 lb/A)

Both 6 and 3 weeks prior to seeding, the site was sprayed with glyphosate (4 oz/gal, 41% a.i.). The site was mowed 3 weeks prior to seeding. The seed mixes were planted on April 28, 2003 with a no-till Tye Pasture Pleaser drill.

The strip plots of seed mixtures (160 sq. ft.) were arranged in a completely randomized design with four replications (24 mixes x 4 replications). Observations on plant ground cover were collected in June 2003.

Results and Discussion:

By June 2003, all of the species had germinated. It is apparent that the mint's and Maximilian sunflower seeding rate were too high, because the plants were packed into the rows. We suggest reducing the rate of the mint to 1 lb/A and Max sunflower to 4 lb/A when moisture is not limiting. The higher planting rates used may be reasonable when rainfall is limited.

In late August, Maximilian sunflower dominated all other species except for the clover. We suggest co-planting only tall species with Maximillian sunflower. As described in Section II of this report, splitting the drill box with other tall species may be a good way to co-plant other species with this sunflower. It was noted that tickseed coreopsis and Gloriosa daisy depressed the growth of Maximilian sunflower by about 2 feet. All of the species were too dense in this planting. The favorable weather allowed development of more seedlings that needed; thus, weeds were not an issue in this planting this year.

All combinations with species besides the Maximilian sunflower appear to be successful at this time. We will to have better data on which mixes work well in the fall 2003.

IV. Conclusion

The weather for the past 2 years has been very atypical. In 2002 a record drought created difficult plant growing conditions; and, in the first 6 months of 2003 there has been record rains (about 31" as of June 2003 in Blacksburg). In spite of these extreme weather swings, the roadside flowers generally germinated and performed as expected. We had more problems with way ward mowers.

We were able to test different combinations of annual and perennial roadside flowers in a spring 2002 planting. The species that were selected did well in Henry Co. We were pleased with how well the perennial species performed when seeded in the spring, especially the Maximilian sunflower. Unfortunately we were not able to plant these species in the fall as a comparison. We were very pleased with the addition of clover to the Maximilian sunflower plots. The clover proved to be a good companion.

The other surprise from the 2002 planted study was the appearance of ox-eye sunflower and bidens the following spring. Both species were planted with cosmos, which strongly dominated the plots. We did not see any evidence of bidens or sunflower in fall 2002. By spring 2003 both species were in abundance. In the report that we submitted last year we strongly recommended not using cosmos in a mixture with other species; this year we have to recant. It

appears that cosmos can be combined with a perennial/semi-perennial species. This will create a show of cosmos the first year, and then the perennial should dominate the following year.

The combination of Plateau and glyphosate seems to be a good weed deterrent. The studies in 2002 and 2003 indicated that the addition of Plateau reduces the weed competition. In the previous year, the combination of the two products was applied to tall fescue/bromegrass vegetation. This year the products were applied to cereal rye vegetation. In the one study, where all combinations of the products were applied, the results were too variable to see any differences. Perhaps someone will repeat this study in the future.

We liked planting into the cereal rye. The seeder moved through the 12 to 16 inch stubble with no evidence of problems with seed placement. The other advantage of using cereal rye is the ability of controlling broadleaf weeds with herbicides. If cereal rye was planted with the no-till seeder in the fall, the area could be treated with broadleaf weed control after the rye had germinated. The rye should be killed when it is still short, March to early April, and then plant into the stubble. In some of our border areas, where the seed was planted into non-killed and non-mowed rye, the flower seedlings developed nicely under the rye canopy. In theory, the rye could be mowed to not damage the developing seedlings, or sprayed with Fussion to "release" the developing seedlings. This strategy could eliminate the use of any pre-plant herbicide.

V. Personal Note/Acknowledgement:

I have enjoyed working with the VDOT managers in the past 11 years. I believe we have learned so much about turfgrass, native grasses, and roadside flower use on the roadsides. I feel that our research, as well as the interaction with VDOT, has helped the VDOT managers shape the direction of the state supported research programs in the future. Thank you for your support.

VI. Reference:

Booze-Daniels, J. N. and D. J. Parrish. 2002. Roadside Flower Research: No-Till Seeding, Source-Identified Native Plant Seed, and Biostimulants. Annual report for VDOT, Environmental Division, 1401 E. Broad St, Richmond, VA 23219, 60 pp.

Appendix A. List of species and seeding rates of plants that were sown with a no-till drill in the Spring Seeded Mixture Study.

Mixture number	Species Scientific Names	Common Name	Bulk rate (lb/A)	PLS rate (lb/A)
1	*Coreopsis tictoria*	Tickseed coreopsis	4.5	3.3
	Rudbeckia hirta 'Gloriosa'	Gloriosa daisy	4.5	3.9
	Helianthus maximilianii	Maximilian sunflower	6.0	4.1
Total			15.0	11.0
2	*Cosmos bipinnatus* 'Gloria'	Cosmos Gloria	3.0	2.3
	Rudbeckia hirta 'Gloriosa'	Gloriosa daisy	4.0	3.2
	Solidago canadensis	Canada goldenrod	20.0	6.3
Total			27.0	11.0
3	*Drycopsis amplexicaulis*	Clasping coneflower	6.2	4.4
	Silene armeria	Silene	1.5	1.4
	Coreopsis lanceolata	Lanceleaf Coreopsis	6.0	4.9
Total			14.0	11.0
4	*Rudbeckia hirta* 'Gloriosa'	Gloriosa daisy	1.7	1.5
	Helianthus mollis	Downy Sunflower	4.0	3.3
	Coreopsis lanceolata	Lanceleaf coreopsis	6.0	5.0
Total			12.0	10.0
5	*Cosmos sulphureus*	Sulfur Cosmos	4.3	3.8
	Bidens aristosa	Tickseed sunflower	4.8	4.1
	Ratibia columnaris	Long-head coneflower	8.5	5.6
Total			18.0	14.0
6	*Trifolium incarnatum*	Crimson clover	2.0	1.9
	Silene armeria	Silene	2.0	1.9
	Helianthus maximilianii	Maximilian sunflower	2.0	1.4
Total			6.0	5.0
7	*Coreopsis tictoria*	Tickseed coreopsis	4.0	3.0
	Rudbeckia hirta 'Gloriosa'	Gloriosa daisy	3.0	2.5
	Coreopsis lanceolata	Lanceleaf coreopsis	4.0	3.3
Total			11.0	9.0
8	*Cosmos sulphureus*	Sulfur Cosmos	4.2	3.8
	Rudbeckia hirta 'Gloriosa'	Gloriosa daisy	4.2	3.5
	Heliopsis helianthoides	Ox-eye sunflower	5.0	4.5
Total			13.0	12.0