

Pennsylvania State University–PennDOT Roadside Research Project: Wildflower Evaluation

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As part of a cooperative project between Pennsylvania State University and the Pennsylvania Department of Transportation, a study was initiated to investigate the performance of 50 different wildflower species for use on Pennsylvania's roadsides. Each species was evaluated for percent cover, percent weed invasion, and percent of the plot covered by blooms. The wildflowers were planted in the spring of 1988; their performance is evaluated through 1989.

A cooperative research project between Pennsylvania State University and the Pennsylvania Department of Transportation (PennDOT) was initiated in October 1985. The purpose of this research was to investigate several aspects of roadside vegetation management including brush control, Canada thistle control in crownvetch, and plant growth regulator use for turf areas. In 1988, the scope of the project increased and included the investigation of wildflowers for use on Pennsylvania's roadsides. PennDOT roadside managers were interested in using wildflowers but needed information on species selection. In April 1988, 50 wildflower species were screened as part of a national test coordinated by Pure Seed Testing Inc. of Oregon. The objective of this test was to evaluate the performance of these species over several growing seasons. The most successful wildflower species were to be incorporated into mixes for use on Pennsylvania's roadsides.

MATERIALS AND METHODS

The planting site is located near State College, Pennsylvania, on a Hagerstown silt loam soil that was previously used for alfalfa production. The alfalfa was eliminated with an application of Roundup (glyphosate) and 2,4-D on April 10, 1988. A total of 24 annuals and 26 perennial wildflower species were planted on April 20, 1988, in individual 5 × 5-ft plots and replicated three times. The seeding rates were predetermined by Pure Seed Testing Inc. A power take-off driven verticut unit from an Olathe overseeder was used to slit the soil approximately 0.5 in. deep on 3-in. centers. To simulate a drop spreader, the seed for each plot was suspended in 100 g of Milorganite and shaken on the plot using a quart mason jar with a perforated lid. A wind screen was placed around each plot during the seeding operation. In late October 1988, each plot was mowed and the residue was left in the plot. A

list of the common names and scientific names of the wildflower species evaluated in 1988 is presented in Table 1.

The study site was not irrigated or fertilized during the growing season. The average rainfall for the study area is approximately 38 in./year. Adequate rainfall for germination fell during late April and early May of 1988. However, June, July, and most of August were extremely hot and dry. Because of this drought, total rainfall was lower than average for 1988. In the spring of 1989, higher than normal rainfall occurred. Rainfall accumulation data in inches for the growing seasons of 1988 and 1989 are as follows:

	1988 (in.)	1989 (in.)
April	1.5	0.70
May	4.20	6.15
June	0.92	8.80
July	3.35	5.47
August	5.88	0.55
September	2.97	3.17
October	1.27	3.50
Growing season total	20.09	28.34

The average rainfall for a growing season was 24.20 in.

Each plot was rated visually for percent of the plot area covered by the wildflower species, percent weed cover, and percent of the plot covered by blossoms. By the end of the 1988 season, the area of the plot not covered by the wildflowers was covered with weed growth. Only percent wildflower cover and percent blossom cover will be discussed. Ratings in 1988 were performed on June 13, June 27, July 12, August 9, and September 28. The 1989 ratings were performed on May 29, June 22, July 4, July 18, August 8, and September 28. The success of each species was determined by considering its competitiveness with weeds and its flowering characteristics. A wildflower was considered successful if it vegetatively covered at least 60 percent of the plot area and its flower production covered at least 30 percent of the plot area. Successful species will be considered as candidates for use in mixes. If a wildflower were being evaluated for a single species planting, 60 percent vegetative cover may not be considered adequate.

RESULTS AND DISCUSSION

In general, the annual species established and produced cover sooner than the perennial species at the early rating periods in 1988. A total of 20 of the 24 annual species produced more than 60 percent vegetative cover in 1988 (Figure 1). These 20

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TABLE 1 COMMON AND SCIENTIFIC NAMES FOR THE WILDFLOWER SPECIES EVALUATED IN 1988

<i>Annual Species</i>		<i>Perennial Species</i>	
<i>Scientific Name</i>	<i>Common Name</i>	<i>Scientific Name</i>	<i>Common Name</i>
<i>Anagallis arvensis</i>	pimpernel	<i>Achillea millefolium</i>	white yarrow
<i>Centaurea cyanus</i> dwf.	dwarf cornflower	<i>Achillea millefolium rubra</i>	red yarrow
<i>Chrysanthemum coronarium</i>	garland chrysanthemum	<i>Anthemis tinctoria</i>	chamomile
<i>Clarkia amoena</i>	farewell to spring	<i>Aquilegia vulgaris</i>	dwarf columbine
<i>Clarkia unguiculata</i>	clarkia	<i>Cerastium biebersteinii</i>	snow in summer
<i>Coreopsis tinctoria</i>	T. plains coreopsis	<i>Cheiranthus allionii</i>	Siberian wallflower
<i>Cosmos bipinnatus</i>	cosmos	<i>Cheiranthus cheiri</i>	English wallflower
<i>Delphinium ajacis</i>	rocket larkspur	<i>Coreopsis lanceolata</i>	lance-leaf coreopsis
<i>Dimorphotheca aurantiaca</i>	African daisy	<i>Dianthus barbatus</i>	sweet William
<i>Eschscholzia californica</i>	California poppy	<i>Dianthus deltoides</i>	maiden pinks
<i>Gaillardia pulchella</i>	Indian blanket	<i>Echinacea purpurea</i>	purple coneflower
<i>Gilia capitata</i>	globe gilia	<i>Gaillardia aristata</i>	blanketflower
<i>Gypsophila elegans</i>	baby's breath	<i>Hesperis matronalis</i>	dames rocket
<i>Layia platyglossa</i>	tidy tips	<i>Ipomopsis rubra</i>	standing cypress
<i>Linanthus grandiflorus</i>	mountain phlox	<i>Linum perenne lewisii</i>	blue flax
<i>Linaria maroccana</i>	spurred snapdragon	<i>Myosotis sylvatica</i>	forget-me-not
<i>Linum grandiflorum rubrum</i>	scarlet flax	<i>Oenothera lanarkiana</i>	evening primrose
<i>Lobularia maritima</i>	sweet alyssum	<i>Oenothera missouriensis</i>	Missouri primrose
<i>Mertensia virginica</i>	blue bells	<i>Penstemon strictus</i>	Rocky Mountain penstemon
<i>Monarda citriodora</i>	lemon mint	<i>Ratibida columnifera</i>	prairie coneflower
<i>Nemophila menziesii</i>	baby blue eyes	<i>Rudbeckia hirta</i>	black-eyed Susan
<i>Papaver rhoeas</i>	corn poppy	<i>Sanguisorba minor</i>	small burnet
<i>Scabiosa stellata</i>	scabiosa	<i>Sanvitalia procumbens</i>	creeping zinnia
<i>Silene armeria</i>	catchfly	<i>Saponaria ocyroides</i>	soapwort
		<i>Thymus serpyllum</i>	wild thyme
		<i>Viola cornuta</i>	Johnny jump up

species are grouped on the basis of general growth patterns. The first group produced a flush of growth by June 5, and coverage remained stable throughout the season. Some examples of species in this group were garland chrysanthemum, tall plains coreopsis, and California poppy. A second group displayed a decline in cover after the initial flush of growth, and by the end of the season were typically invaded by weed growth. Examples of these species were farewell to spring, clarkia, spurred snapdragon, and corn poppy. A third group displayed a relatively slow establishment rate, yet coverage increased steadily throughout the season. Examples of species in this group are Indian blanket, cosmos, scarlet flux, and lemon mint.

All of the annual species bloomed during the 1988 season (Figure 2). The bloom production was diverse across the species and occurred throughout the season. Some species such as baby's breath, farewell to spring, and clarkia displayed profuse flower production for a short period of time. Others such as Indian blanket and catchfly flowered steadily throughout the season. Still others such as tall plains coreopsis, cosmos, and sweet alyssum started flowering later and peaked throughout August and September.

The growth and flowering of the perennials were slower than those of the annuals in 1988. A total of 14 out of the 26 species produced more than 60 percent coverage during 1988 (Figure 3). Coverage generally increased at a steady rate throughout the season with most species producing the best cover by the last rating date.

Ten perennials produced flowers during 1988 (Figure 4). Of these, only Siberian wallflower, black-eyed Susan, and blanketflower provided blossoms that covered more than 30 percent of the plot area. All other perennial species produced most vegetative growth.

Wildflower performance varied considerably in 1989 from that observed in 1988. In 1989, few annuals reseeded sufficiently for acceptable performance, whereas the growth of several perennials was impressive. Although 20 annual species were successful in 1988, only 3 provided more than 60 percent coverage in 1989 (Figure 5). The greatest percent coverage was achieved by rocket larkspur and tall plains coreopsis. These species provided excellent cover by June 22 and remained competitive throughout the season. Dwarf cornflower also provided excellent cover by June 22, but peaked in mid-July and was invaded by weeds at the end of the season. Five other species provided a peak in cover that approached 60 percent in early July, but were invaded by weeds at the end of the season. They were globe gilia, California poppy, sweet alyssum, catchfly, and mountain phlox. All other annual species provided less than 20 percent vegetative cover. The annuals with the best flower production were rocket larkspur, tall plains coreopsis, and dwarf cornflower (Figure 6). Peak flower production for the annuals occurred between June 22 and August 3.

Vegetative cover for the successful perennials tended to increase throughout the season. A total of 14 perennial species were successful in 1988, yet only 9 of these provided more than 60 percent vegetative cover in 1989 (Figure 7). They were blue flax, dames rocket, chamomile, red yarrow, white yarrow, prairie coneflower, lance-leaved coreopsis, black-eyed Susan, and evening primrose. The five species that performed well in 1988, but did not perform well in 1989, included blanketflower, English wallflower, standing cypress, Siberian wallflower, and small burnet. Sweet William and purple coneflower were considered unsuccessful in 1988, but were impressive in 1989.

The 11 species that provided over 60 percent coverage in

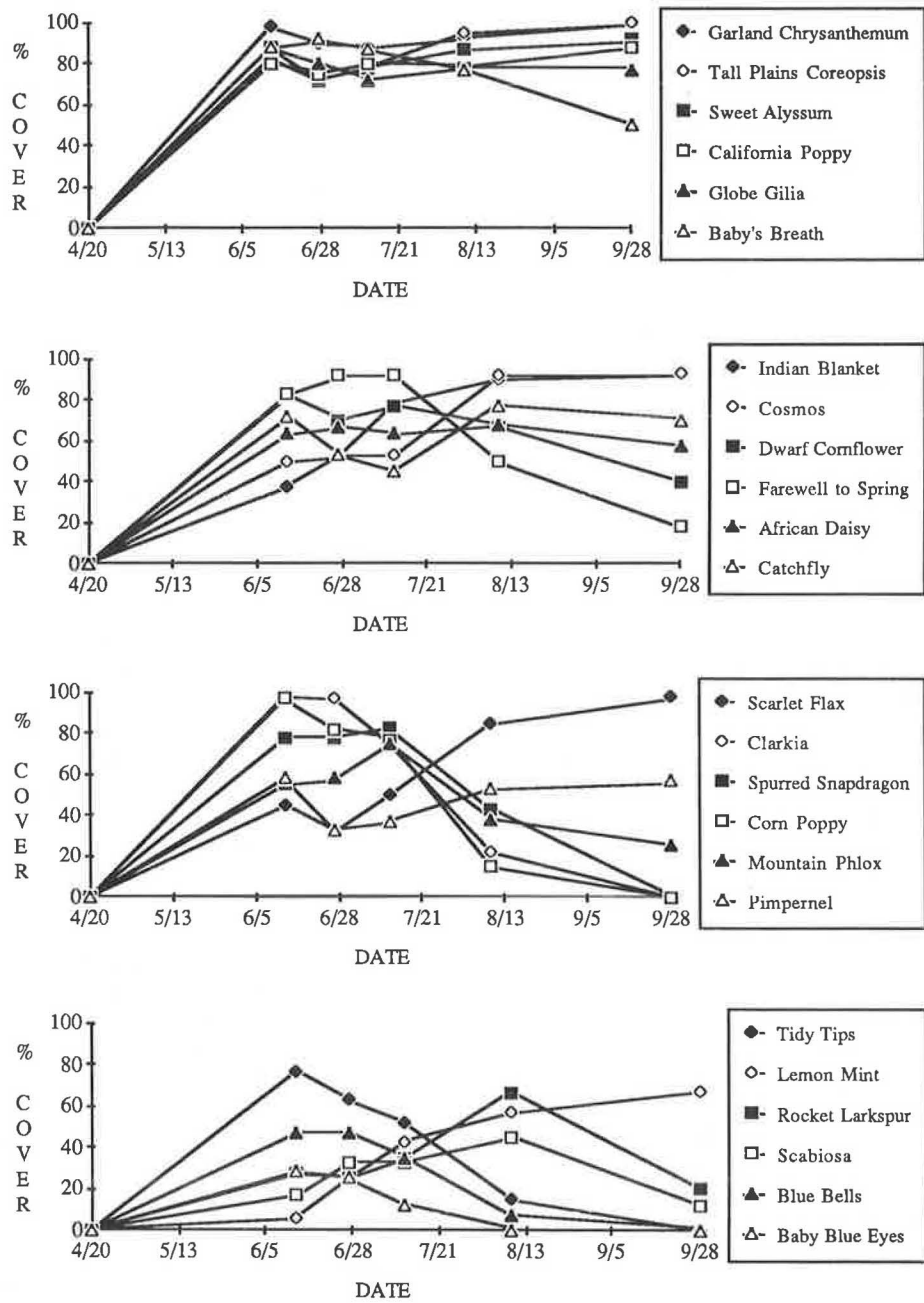


FIGURE 1 Percent vegetative cover provided by annual wildflower species in 1988.

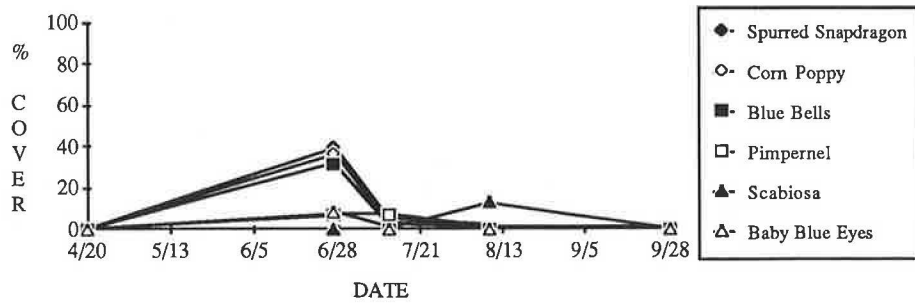
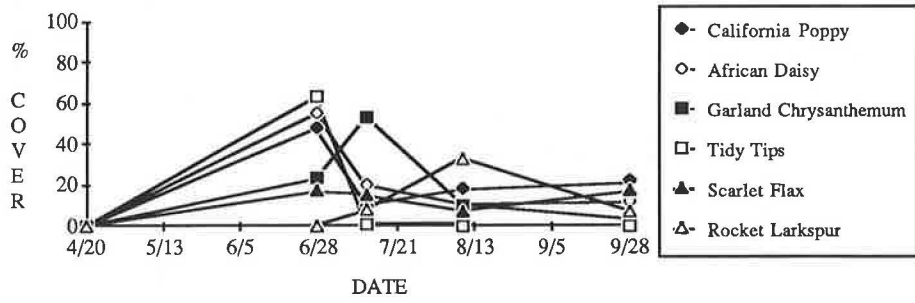
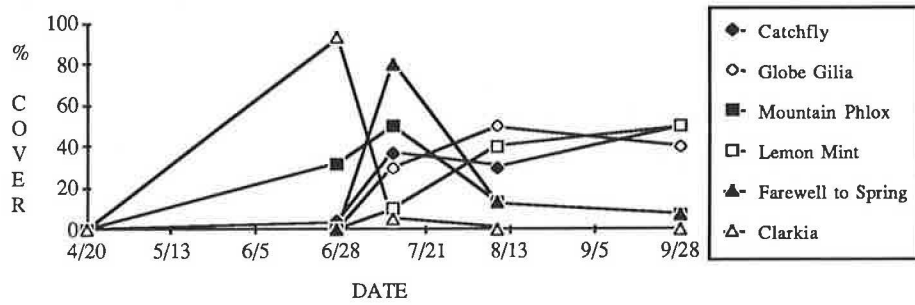
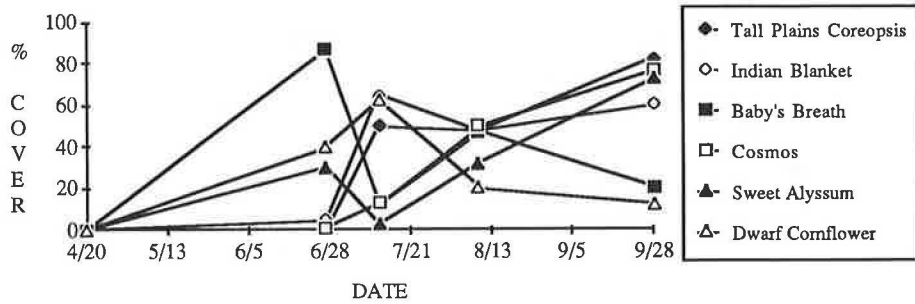


FIGURE 2 Percent blossom cover provided by annual wildflower species in 1988.

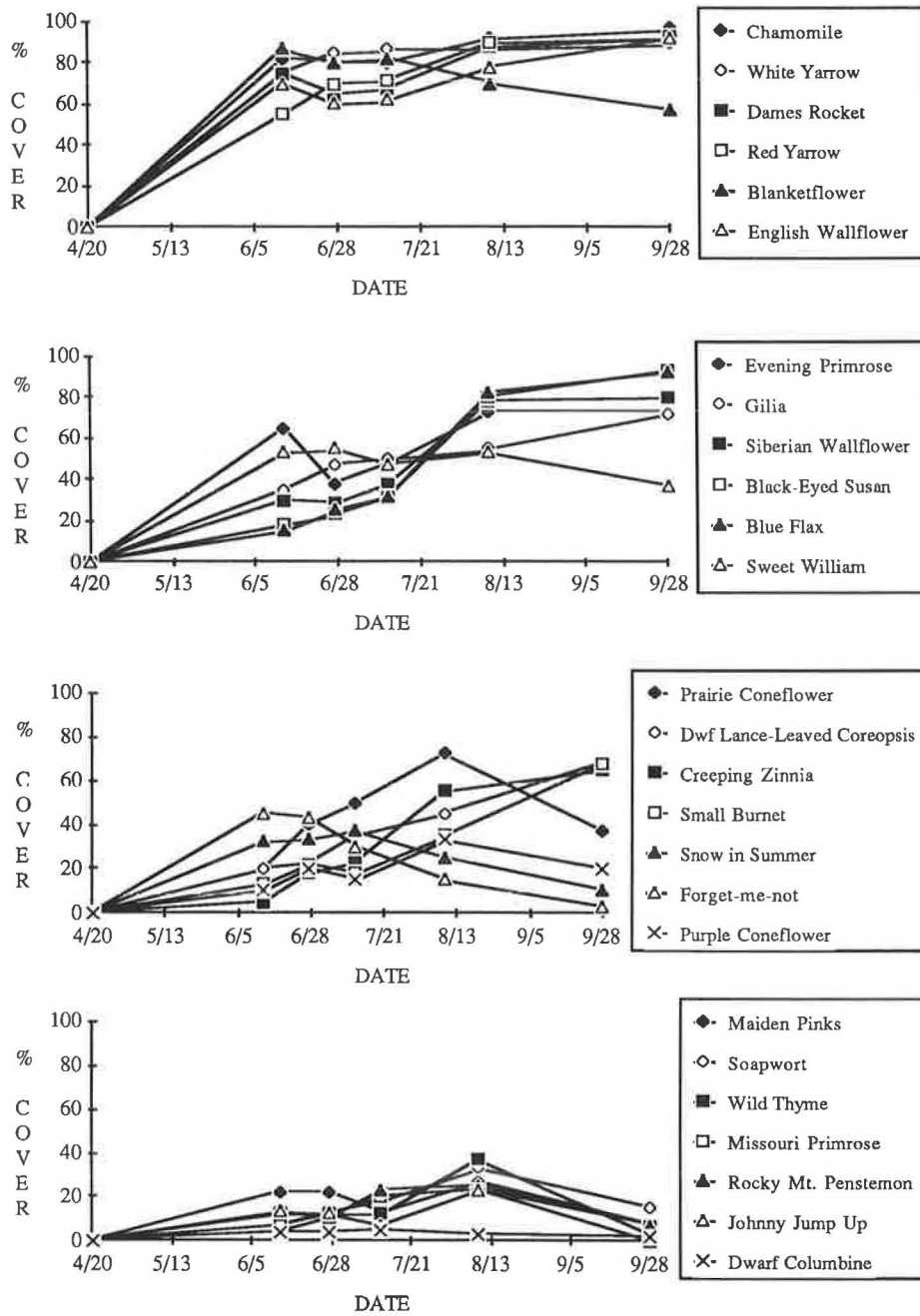


FIGURE 3 Percent vegetative cover provided by perennial wildflower species in 1988.

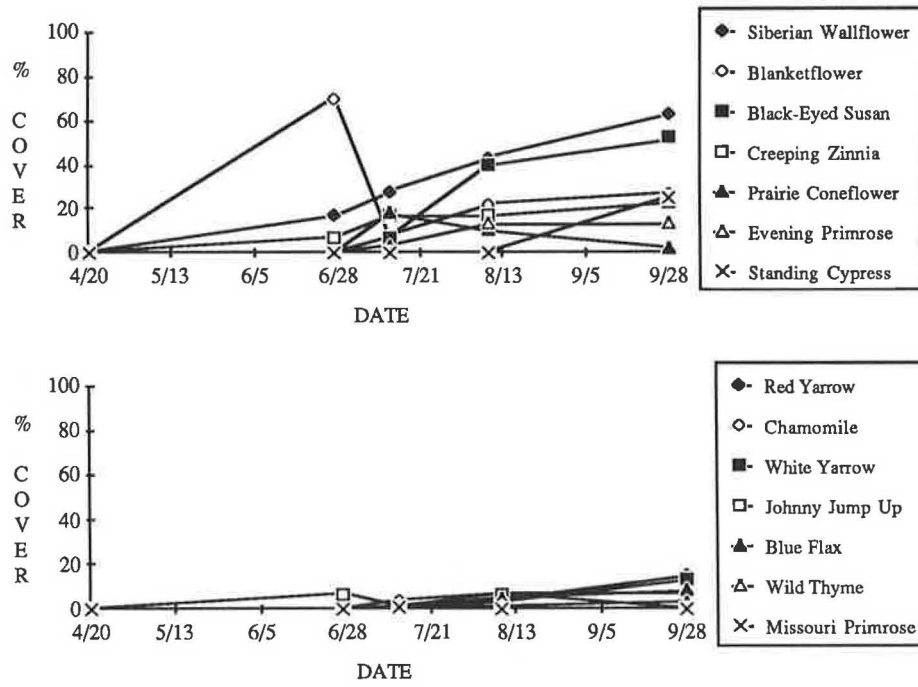


FIGURE 4 Percent blossom cover provided by perennial wildflower species in 1988.

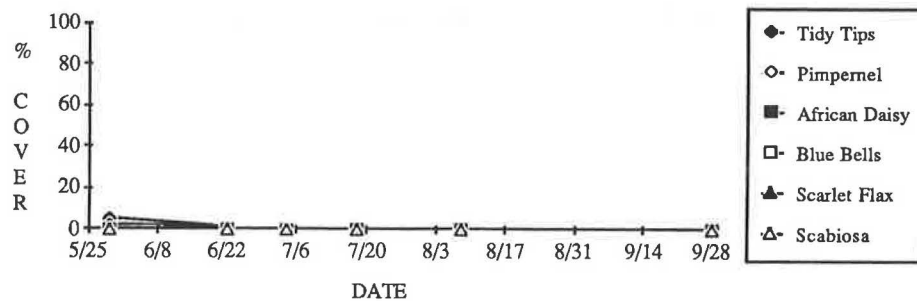
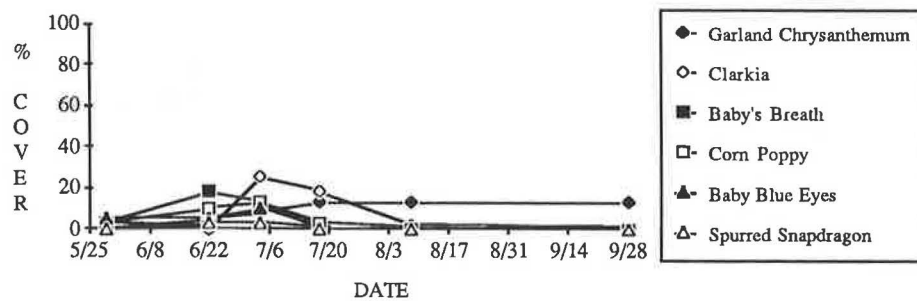
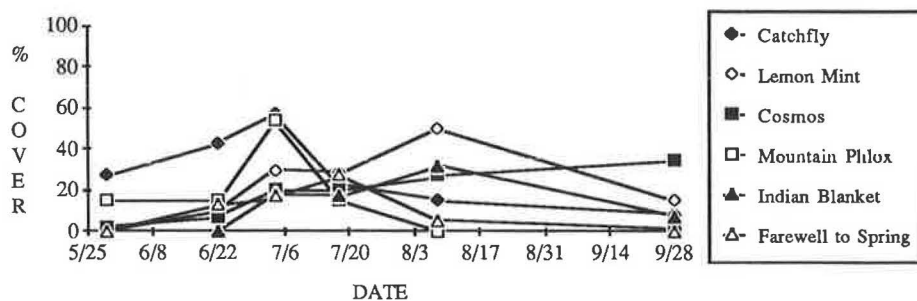
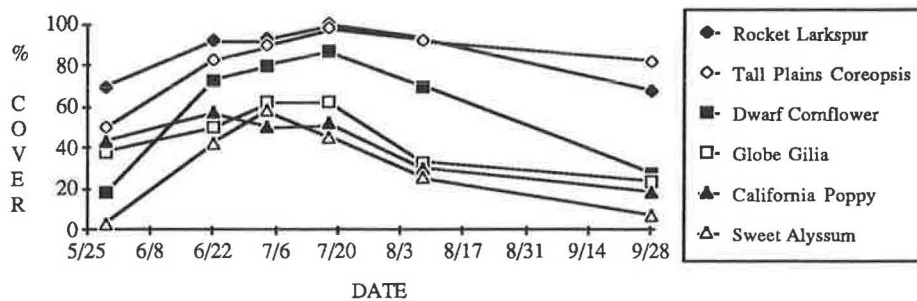


FIGURE 5 Percent vegetative cover provided by annual wildflower species in 1989.

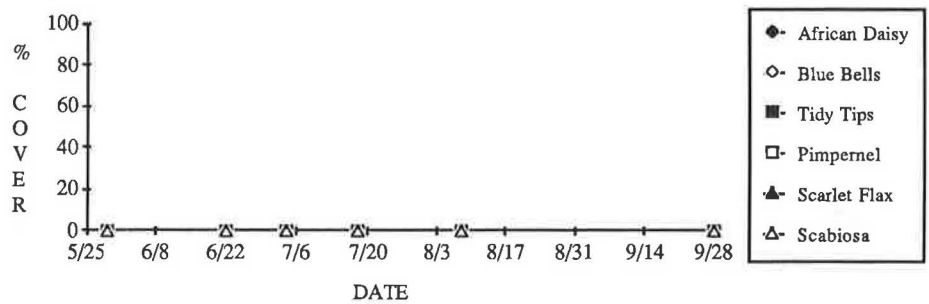
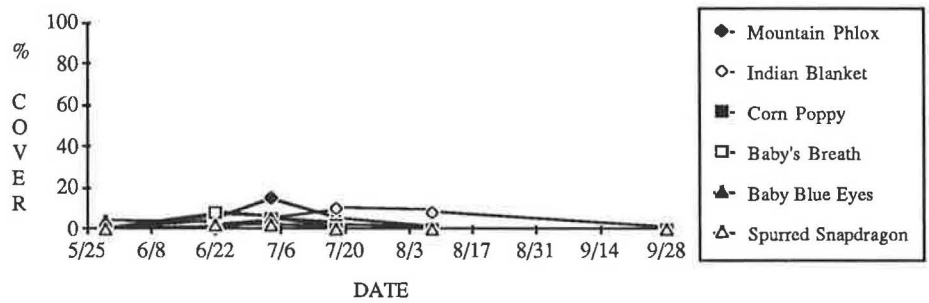
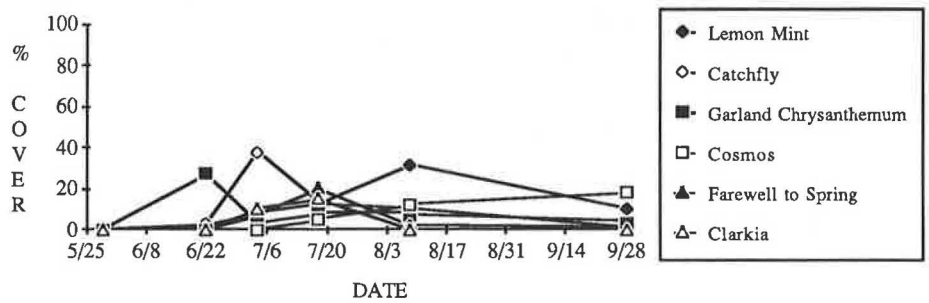
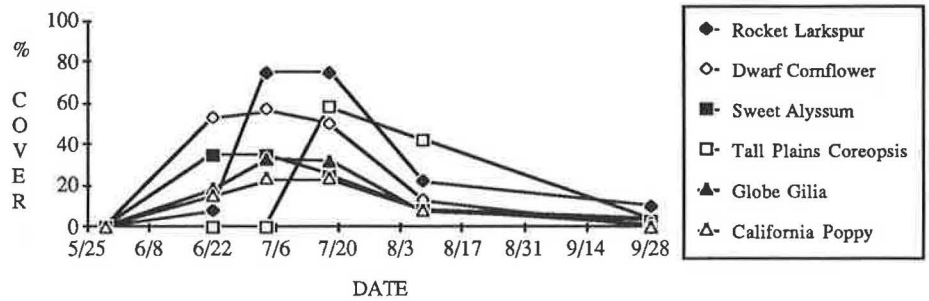


FIGURE 6 Percent blossom cover provided by annual wildflower species in 1989.

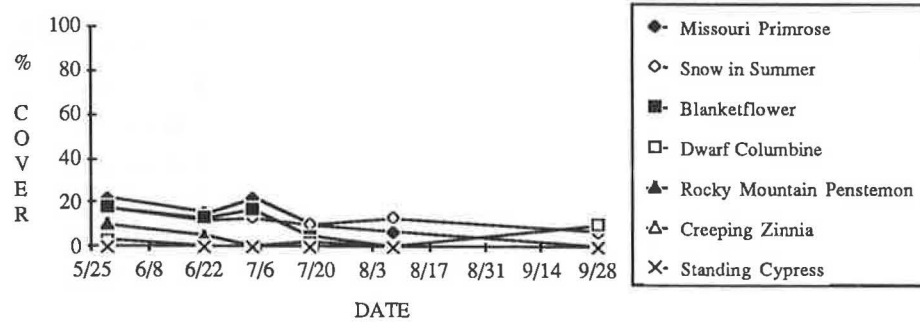
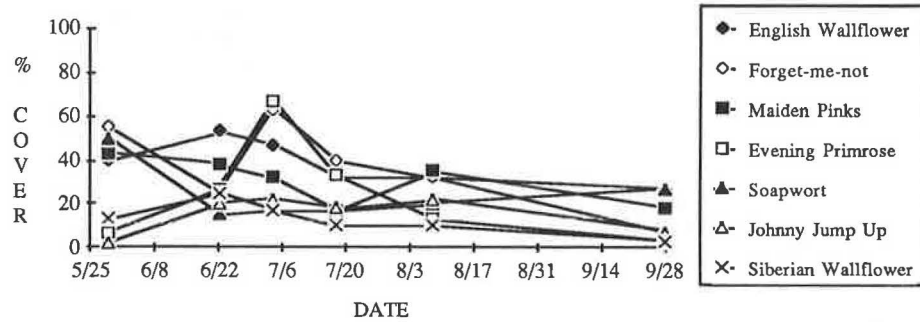
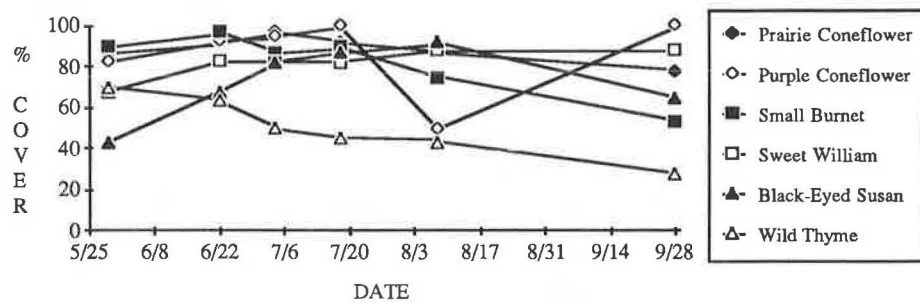
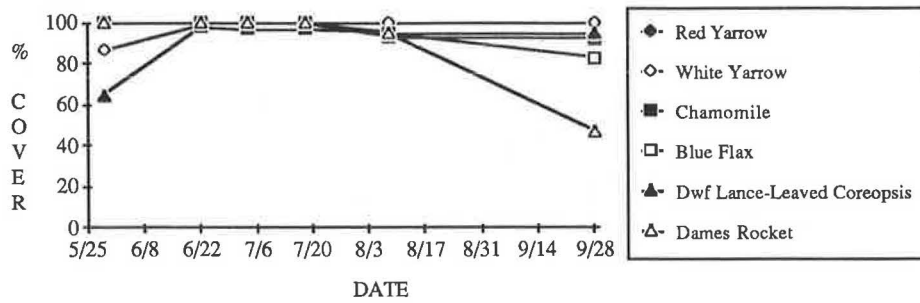


FIGURE 7 Percent vegetative cover provided by perennial wildflower species in 1989.

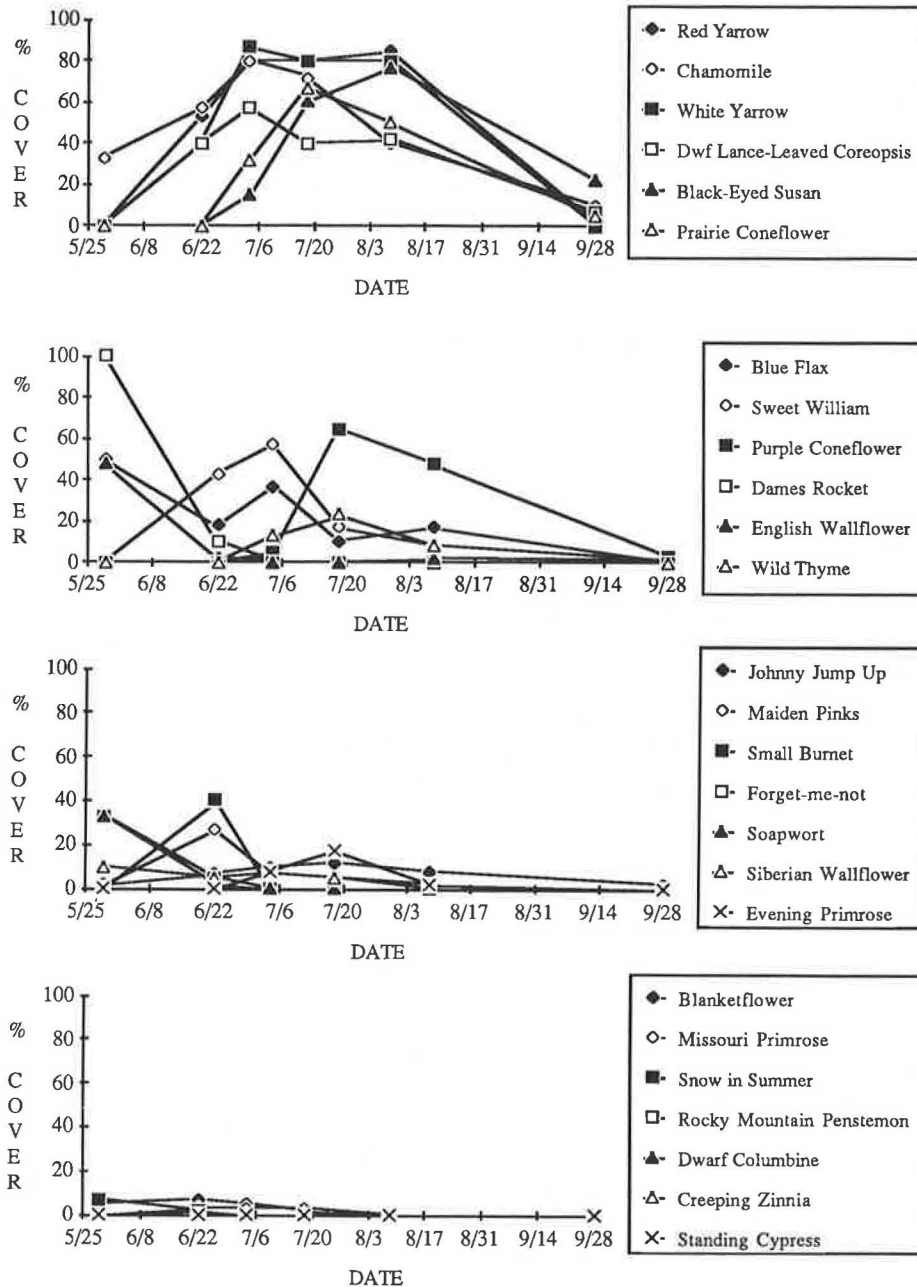


FIGURE 8 Percent blossom cover for perennial wildflower species in 1989.

1989 also provided impressive flowers during the 1989 ratings (Figure 8). Blue flax flowered the earliest and was already past its peak before the first rating date on May 29. Dames rocket had started flowering approximately a week before May 29 and was at its peak at that date. Chamomile, sweet William, lance-leaf coreopsis, and red and white yarrow were producing blooms on June 22 that continued into August. Black-eyed Susan, prairie coneflower, and purple coneflower were at peak flower production from July to early August.

From this information, wildflower mixes can be developed

that combine annuals and perennials on the basis of their competitiveness, flowering time and duration, and growth characteristics. The performance of the individual species may be different when combined into a mix. Mixes will be tested under roadside conditions in several locations across Pennsylvania in 1990 to determine their performance over a variety of site and environmental conditions.

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