

Selection and Use of Stress-Tolerant Bedding Plants for the Landscape

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What is Stress?

Each of us are subjected to stresses and pressures every day in our home, work, and living environment; plants are no different. Unfortunately, there is no “stressless” environment, and there is no totally stress-resistant bedding plant. Each site has its stress level and each plant has its tolerance level. There are steps that can be taken to reduce or avoid stress in the landscape. However, no program can prevent all problems, and the key to successful landscape color using bedding plants is to match the particular site with specific plant species. But before you can select plants to use, the site should be accurately analyzed and characterized, and preparations should be made to minimize stress conditions that may occur.

Characterization of the Landscape Site

A site analysis for bedding plants should include ① temperature averages for the color season, ② amount of sunlight received daily, ③ rainfall averages and average intervals between rains, and ④ soil characteristics such as drainage and moisture retention. Each of these components should be further defined prior to plant selection.

Temperature. Very few species look attractive and flower profusely from early spring through late fall, and rotational planting for continuous color should be considered (Table 1.). Cool-season flowers

such as dianthus, snapdragons, and pansies can be used early in the season. It is possible to extend the flowering season of cool-season annuals by placing them in a protected location, shaded from direct sunlight from 12:00 to 4:00 PM. Heat-loving flowers such as gaillardias, portulaca, sand verbena, and vinca do not begin to flower until early summer and should be used for summer color and high temperature situations. Heat tolerance is an advantageous characteristic, and bedding plant trials can offer cultivar suggestions to landscapers interested in plant performance in high temperatures (Table 2). Another temperature consideration is frost tolerance (Table 1). Avoid early planting of tender plants to prevent frost damage. Tender species also will be the first to be killed from frosts in the fall.

Light. Light and temperature are closely related, and plants listed as preferring lower light may tolerate more sun, if temperatures are moderate. When evaluating light exposure, note the duration and intensity of light the site receives. Four hours of full sun during the morning is much different than four hours of afternoon sun. Also, in a shaded location, the degree of light filtration can vary. In general, if the site receives more than 3 hours of unfiltered mid-day sun, it should be treated as a “full sun” site, with respect to plant selection (Table 1). “Partial shade” can be defined as receiving

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Table 1. Bloom period, frost tolerance, light preference, and relative drought tolerance of bedding plants.

Name	Bloom Period	Frost tolerance	Light	Drought tolerance
<i>Ageratum</i> <i>Ageratum</i>	Summer	Tender	Full sun	Moderate
<i>Alyssum</i> <i>Lobularia</i>	Spring– early fall	Tolerant	Full sun to partial shade	Low
<i>Aster</i> <i>Callistephus</i>	Summer– early fall	Moderate tolerance	Full sun to partial shade	Low
<i>Begonia</i> <i>Begonia</i>	Late spring– early fall	Tender	Full sun to heavy shade	Low
Blanket Flower <i>Gaillardia</i>	Summer– early fall	Tolerant	Full sun	Moderate
<i>Browallia</i> <i>Browallia</i>	Summer	Moderate tolerance	Full sun to partial shade	Low
<i>Calliopsis</i> <i>Coreopsis</i>	Summer	Moderate tolerance	Full sun to partial shade	Moderate
Candytuft <i>Iberis</i>	Late spring– early summer	Tolerant	Full sun to partial shade	Low
<i>Calendula</i> <i>Calendula</i>	Summer– fall	Tolerant	Full sun to partial shade	Low
<i>Celosia</i> <i>Celosia</i>	Summer– early fall	Tender	Full sun	Moderate
<i>Coleus</i> <i>Solenestemon</i>	Late spring– fall (foliage)	Moderate tolerance	Partial to heavy shade	Low
Cornflower <i>Centaurea</i>	Summer	Moderate tolerance	Full sun to partial shade	Low
<i>Cosmos</i> <i>Cosmos</i>	Spring– early fall	Moderate tolerance	Full sun	Moderate
Dahlberg Daisy <i>Dyssodia</i>	Summer– fall	Moderate tolerance	Full sun	High
<i>Dahlia</i> <i>Dahlia</i>	Summer– fall	Tender	Full sun	Low
<i>Dianthus</i> <i>Dianthus</i>	Spring and fall	Very tolerant	Full sun to partial shade	Low
Dusty Miller <i>Senecio</i>	Spring– fall (foliage)	Tolerant	Full sun to partial shade	Moderate
<i>Geranium</i> <i>Pelargonium</i>	Late spring– early fall	Tender	Full sun	Low
Globe Amaranth <i>Gomphrena</i>	Late spring– early fall	Moderate tolerance	Full sun	High
Gloriosa Daisy <i>Rudbeckia</i>	Summer	Tolerant	Full sun to partial shade	Moderate

Table 1. Continued.

Name	Bloom Period	Frost tolerance	Light	Drought tolerance
Hypoestes <i>Hypoestes</i>	Summer (foliage)	Tender	Partial to heavy shade	Low
Impatiens <i>Impatiens</i>	Late spring–early fall	Tender	Full sun to heavy shade	Low
Lisianthus <i>Eustoma</i>	Mid-summer to fall	Tender	Full sun	High
Lobelia <i>Lobelia</i>	Summer	Tolerant	Full sun to partial shade	Low
Marigold <i>Tagetes</i>	Late spring–fall	Moderate tolerance	Full sun	Moderate
Melampodium <i>Melampodium</i>	Late spring–early fall	Tender	Full sun	Moderate
Nicotiana <i>Nicotiana</i>	Summer	Tender	Full sun to partial shade	Low
Ornamental Pepper <i>Capsicum</i>	Late summer–fall	Tender	Full sun	Low
Pansies and Violas <i>Viola</i>	Early spring, fall, and winter	Very tolerant	Full sun to partial shade	Low
Petunia <i>Petunia</i>	Spring–early fall	Tolerant	Full sun to partial shade	Moderate
Phlox <i>Phlox</i>	Spring–early summer	Tolerant	Full sun to partial shade	Low
Portulaca <i>Portulaca</i>	Summer–early fall	Tender	Full sun	High
Salvia <i>Salvia</i>	Early summer–early fall	Tender	Full sun	Low
Sanvitalia <i>Sanvitalia</i>	Early summer–fall	Tender	Full sun	Moderate
Snapdragon <i>Antirrhinum</i>	Spring–early summer, fall	Very tolerant	Full sun to partial shade	Low
Spiderflower <i>Cleome</i>	Summer–early fall	Tender	Full sun	Moderate
Treasure Flower <i>Gazania</i>	Late spring–fall	Tolerant	Full sun	High
Verbena <i>Verbena</i>	Late spring–early fall	Moderate tolerance	Full sun to partial shade	Moderate
Vinca <i>Catharanthus</i>	Late spring–fall	Tender	Full sun to partial shade	Moderate
Zinnia <i>Zinnia</i>	Late spring–early fall	Tender	Full sun	Moderate

Table 2. Heat and humidity tolerant bedding plants.*

Name	Color	Name	Color
Bronze-leaved Begonia		Impatiens	
'Brandy'	Pink	'Dazzler Blush'	Blush
'Whisky'	White	'Accent Bright Eyes'	Blush
'Espresso White'	White	'Super Elfin Blue Pearl'	Lilac
'Vision'	Red	'Accent Lilac'	Lilac
'Bingo Red'	Red	'Dazzler Burgundy'	Burgundy/Purple
'Espresso Rose'	Rose	'Super Elfin Violet'	Burgundy/Purple
'Bingo Rose'	Rose	African Marigold	
Green-leaved Begonia		'Perfection Gold'	Gold
'Prelude Pink'	Pink	'Perfection Orange'	Orange
'Viva'	White	'Voyager'	Yellow
'Prelude White'	White	French Marigold	
'Varsity Scarlet'	Red	'Red Marietta'	Single Red
'Scarlanda'	Red	'Orange Boy'	Double Orange
'Eliza'	Rose/Salmon	'Bonanza Orange'	Double Orange
'Ambra'	Rose/Salmon	'Bounty Gold'	Double Gold
'Rum'	Bicolor	'Early Queen Sophia'	Double Bicolor
Geranium		'Hero Harmony'	Double Bicolor
'Pink Orbit'	Pink	Petunia	
'White Orbit'	White	'Pink Carpet'	Pink
'Ringo White'	White	'Eterna Pure Pink'	Pink
'Pinto Red'	Red	'Pink Madness'	Pink
'Pinto Rose'	Rose	'White Carpet'	White
'Hollywood Rose Pink'	Rose	'Celebrity White'	White
'Pinto Salmon'	Salmon	'Eterna Vivid Red'	Red
'Hollywood Star'	Bicolor	'Rose Madness'	Rose
Impatiens		'Rose Carpet'	Rose
'Dazzler White'	White	'Deep Rose Pearls'	Rose
'Impulse White'	White	'Coral Madness'	Coral
'Impact Rose'	Rose	'Velvet Picotee Improved'	Bicolor
'Novette Deep Rose'	Rose	'Electra Blue'	Blue
'Dazzler Coral'	Coral/Salmon	'Eterna Lilac'	Burgundy
'Impact Coral'	Coral/Salmon	'Supercascade Lilac'	Burgundy
'Impulse Salmon Orange'	Coral/Salmon	'Purple Pirouette'	Double Purple
'Accent Rose Star'	Star	Vinca	
'Spotlight Mix'	Mix	'Peppermint Cooler'	Upright White/Red Eye
'Impulse Carmine'	Carmine	'Grape Cooler'	Upright Pink/Rose Eye
'Impact Carmine Rose'	Carmine	'Rose Carpet'	Prostrate Rose
'Accent Deep Pink'	Pink		

**Adapted from Armitage, A. 1988. 1988 heat tolerant annuals for the landscaper. Greenhouse Grower 6(13):54,56.*

unfiltered morning sun, but shade during the afternoon hours, or moderate shading throughout the entire day. A “heavily shaded” site would receive very little direct mid-day light and less than 60% of the sun’s intensity during the remainder of the day. A mismatch of plant and light can lead to reduced flowering, leggy growth habit, burning of plants, and stunting of growth.

Water. Water stress in North Carolina covers both extremities of the spectrum, even for the same landscape site. Bed preparation is essential for avoiding both moisture excess and drought conditions (See Horticulture Information Leaflet No. 551). For most situations, supplemental irrigation will be required at some point during the growing season. For minimal irrigation sites, select “drought tolerant” species (Table 1). The best insurance against excessive moisture is proper bed preparation and sufficient drainage. Keep in mind that the majority of overwatering problems, assuming a well-prepared site, occur from too frequent irrigations rather than too much water applied at any one time. If supplemental irrigation is in place, apply enough water at every watering to assure complete bed coverage. Also, an irrigation schedule should take into account rainfall and be adjusted appropriately to be most effective.

Soil Characteristics. Plants depend on the soil for water, anchorage, and nutrients. Frequent heavy rains in combination with poorly drained beds will reduce plant performance and increase the chances of root rot problems. On the other hand, beds with excellent drainage combined with little water holding capacity could require irrigation as frequently as every other day. Nutrient deficiencies and toxicities are common in the landscape, although they are easily avoided if proper steps are taken. Do not guess at fertility levels—take a soil test and send it in for analysis.

Follow proper bed preparation guidelines given in Horticulture Information Leaflet No. 551 to avoid water, pH, and nutrient stress situations. Again, stress prevention and avoidance is much easier than relying on stress tolerance.

Air Pollutants. Some landscape sites, especially in highly urbanized areas, are subjected to significant levels of air pollution. The most damaging of these pollutants are sulfur dioxide (SO₂), ozone (O₃), and peroxyacetyl nitrate (PAN). Symptoms of SO₂ injury include necrotic (dead) spots between the major veins, where the tissue turns light tan and papery in texture. The most common symptom of exposure to O₃ is the formation of tiny, light-colored flecks or spots on the upper surfaces of affected leaves, similar to spider mite damage. PAN injury is expressed as silverying, glazing, bronzing, and sometimes death of the lower leaf surfaces. Bedding plants do exhibit relative sensitivity and tolerance to these materials (Table 3), and if pollutants are a problem, plants should be selected accordingly.

Program for Stress Reduction

Successful colorscaping accepts there is no perfect planting site and builds upon given parameters. Steps to follow include:

- 1) Site analysis for temperature, light, water, and soil characteristics.
- 2) Proper adjustment of beds to reduce/prevent nutrition and water stress.
- 3) Selection of proper plant species for specific sites, including rotation of plants for specific time periods.

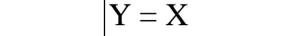
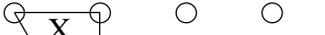
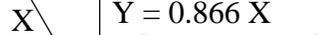
Paybacks include more attractive color, less maintenance requirements, and more satisfied clients.

Table 3. Bedding plant sensitivity to air pollutants.*

Sensitive		Intermediate	Resistant
Sulfur Dioxide			
Aster	Coleus	Dianthus	Castor Bean
Begonia	Cosmos	Nasturtium	Chrysanthemum
Centaurea	Geranium	Zinnia	(most varieties)
China Aster	Marigold		
Chrysanthemum (some varieties)	Poppy		
Ozone			
Ageratum	Fuchsia	Impatiens	China Aster
Aster	Marigold	Verbena	Chrysanthemum
Begonia	Pansy		(most varieties)
Chrysanthemum (some varieties)	Petunia		Geranium
Dahlia	Salvia		Lobelia
			Ornamental Pepper
Peroxyacetyl Nitrate			
Aster	Ornamental Pepper		Begonia
Dahlia	Petunia		Calendula
Fuchsia	Salvia		Chrysanthemum
Impatiens	Snapdragon		Coleus
			Gaillardia
			Pansy
			Periwinkle

**Adapted from Rogers, M.N. 1976. Air pollution, p. 441-481. In: J. Mastalerz (ed.). Bedding Plants, Prentice-Hall, Englewood Cliffs, N.J.*

Table 4. Estimated number of plants to fill 100 ft² of bed area at various spacings.

Planting pattern	Inches between rows of plants (Y)	Inches between plants (X) within rows	Estimated number of plants per 100 square feet	
<u>Square</u>				
FOR SQUARE SPACING, THE DISTANCE BETWEEN PLANTS WITHIN ROWS (X) EQUALS THE DISTANCE BETWEEN ROWS (Y).		4	4	900
		6	6	400
		8	8	225
		10	10	144
		12	12	100
<u>Triangular</u>				
FOR TRIANGULAR SPACING, THE DISTANCE BETWEEN PLANTS WITHIN ROWS AND BETWEEN ROWS BOTH EQUAL X, AND THE DISTANCE BETWEEN ROWS (Y) EQUALS 0.866 X.		3.46	4	1039
		5.20	6	462
		6.93	8	260
		8.66	10	166
		10.39	12	115