NUTRIENT RECOMMENDATIONS FOR COMMERCIAL CUT FLOWER PRODUCTION

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This fact sheet was developed to help guide cut flower growers with fertilizer recommendations for cut flowers. In Maryland, cut flower growers earning $2,500 (gross) or more per year are required to have a nutrient management plan. To develop this nutrient management plan, Cooperative Extension recommendations on rates of fertilization for field grown cut flowers shall be followed. The information provided here serves as a general guideline for nutrient management in commercial cut flower production

NITROGEN

Nitrogen applications are needed on an annual basis for production of most cut flower species. The rate of application varies with plant species and whether the plants are herbaceous or woody. For cut flower production, plant nitrogen needs are divided into three categories: "low," "medium," and high" requirements. Plants started in the fall and harvested in the spring generally have lower nitrogen requirements that crops harvested in the summer and fall. Table 6 lists common cut flowers growing in Maryland and their nitrogen categories. Woody flowering species for cut flower production, such as forsythia, pussy willow and flowering cherry, need 2-4 lbs/1,000 sq. ft. of nitrogen for optimum growth.

Nitrogen use in the higher ranges to species that flower over an extended period could benefit from split applications, i.e., dividing the total recommended amount into two or more applications, over the course of the growing season. This is especially important for water soluble forms of nitrogen, such as urea and ammonium nitrate. Controlled release nitrogen sources may be applied in full at the beginning of the growing season.

Table 1. Nitrogen Fertilization Rate Recommendations for herbaceous cut flowers

Nitrogen Category	Low	Medium	High
Rate (lbs per 1,000 sq ft)	1.0-1.5	1.5-2.0	2.0-3.0

Cover Crops as Nitrogen Sources

Using leguminous cover crops between rotations of cutflowers can reduce the need for nitrogen supplied by fertilizer, manures or other sources. For example, no additional nitrogen application would be needed if a "low" nitrogen-using cut flower crop (see Table 1) were planted after a stand of ladino clover (see Table 2).

Table 2. Nitrogen Credit from Leguminous Cover Crops

	Lbs per 1,000 sq ft	**Lbs per acre**
Perennial Crops		
Alfalfa [1]	2.3-3.4	100-150
Ladino clover	1.4	60
Red clover	0.9	40
Birdsfoot trefoil	0.9	40
Winter annual crops [2]		
Hairy vetch	1.7-3.4	75-150
Crimson clover	1.2-2.3	50-100
Austrian winter peas	1.7-3.4	75-100
Summer annual crops		
Lespedeza	0.5	20
Soybeans [3]	0.3-0.9	15-40

Source: Agricultural Nutrient Management Program, Department of Natural Resource Sciences and Landscape Architecture, University of Maryland

1 Amount of nitrogen credit depends on stand: >4 plants/sq. ft (good) = 150 lbs. N; 1.5-4 plants/sq. ft.(fair) = 125 lbs N; <4 plants/sq. ft.(poor) = 100 lbs N
2 Nitrogen supplied will depend upon planting date, biomass production, kill date and subsequent tillage.
3 Credit 1 lb N per bushel of soybeans yield; a minimum of 15 lbs N, up to a maximum of 40 lbs N

Other Organic Nutrient Sources

All sources of nitrogen, phosphate or potash, including manures, compost, biosolids, food processing waste, used in the production of cut flowers, must be included in a nutrient management plan. These materials must also be tested for nutrient content before they are land applied. Most soil testing labs also offer manure and organic nutrient testing. Results of these tests in combination with soil test results will guide the certified plan developer in calculating the amount of materials to apply for optimum crop growth. Table 3 shows some average values for commonly used organic nutrient sources. These values may be used only for preliminary guidelines and may not be substituted for actual test results.

Table 3. Average nutrient values of manures (as percentage of wet weight)

Manure	Nitrogen (N)	Ammonia (NH_4)	Phosphate (P_2O_5)	Potash (K_2O)	Sulfur (S)
Poultry					
Broiler	2.88	0.73	3.17	2.05	0.40
Caged layer	2.22	0.69	2.91	1.89	0.26
Dairy					
Solid	0.61	0.12	0.37	0.61	0.08
Liquid	0.31	0.11	0.17	0.26	0.03
Swine					
Solid	1.05	0.26	1.12	0.64	0.12
Liquid	0.47	0.18	0.29	0.18	0.04
Horse	0.51	0.03	0.36	0.42	0.09

Source: Agricultural Nutrient Management Program, Department of Natural Resource Sciences and Landscape Architecture

PHOSPHOROUS AND POTASSIUM

Application rates for phosphorous and potassium are based on the amount of plant-available nutrients in the soil, as determined by soil testing. Traditionally, soil test results reported in pounds of nutrient per acre; however, a number that would be considered high for one nutrient could be low for another. More recently, University of Maryland developed a 100-point scale called the Field Index Value (FIV) in which lbs per acre of nutrients are categorized into Low, Medium, Optimum and Excessive ranges. Nutrient recommendations for Maryland crops are based on maintaining the soil nutrient levels within the FIV range of 50-100. The definitions and practical application of these categories are shown in Tables 4 and 5.

Table 4. Field Index Value (FIV) categories and ranges compared to P and K from soil test results

FIV Category	FIV range	Phosphorus lbs/acre	Potassium lbs/acre
Low – nutrient concentration too low for optimal growth	0-25	0-61	0-84
Medium - nutrient concentration may be too low for optimal growth	26-50	62-102	85-160
Optimal - nutrient concentration at a level that can promote optimal growth	51-100	103-205	161-320
Excessive - nutrient concentration at a level above what is needed for optimal growth	>100	>205	>320

Source: Agricultural Nutrient Management Program, Department of natural Resource Sciences and Landscape Architecture

Table 5. FIV categories and amount of Phosphorus and Potassium to apply (lbs/1,000 sq ft)

FIV Category (range)	Phosphorus	Potassium
Low (0-25)	4	4
Medium (26-50)	2	3
Optimal (51-100)	1	2
Excessive (>100)	0	0

Source: Agricultural Nutrient Management Program, Department of Natural Resource Sciences and Landscape Architecture

SOIL pH

Maryland soils are typically acidic (below pH 7) and may require application of a liming material to raise the pH to 6.5, which is suited to most cut flower species. Table 6 gives guidance for the amount of limestone to apply to raise pH in excessively acidic soils.

Table 6. Limestone (50% oxides) needed to raise soil pH to target pH 6.5 for cut flowers (lbs per 1,000 sq ft)

Soil texture	Loamy sand	Sandy loam	Loam		Silt loam & Clay loam	
Region	**All regions**		**Coastal plain**	**Piedmont & mountain**	**Coastal plain**	**Piedmont & mountain**
Soil test pH						
6.3	10	20	25	25	25	40
6.0	20	40	50	55	50	85
5.8	30	55	65	80	70	120
5.5	45	75	85	110	95	165
5.3	55	85	100	130	110	210
5.0	70	105	120	1665	135	210
4.8	90	120	135	185	160	210
4.5	90	140	160	185	160	210

Source: Agricultural Nutrient Management Program, Department of Natural Resource Sciences and Landscape Architecture

GREENHOUSE PRODUCTION OF CUT FLOWER TRANSPLANTS

The greenhouse shall be sited and managed to prevent runoff from the greenhouse. A greenhouse operation that produces plants for off-farm sale is require to have a nutrient management plan as specified in Sections II-D and II-E of this *Manual.* If the greenhouse will be used only to grow transplants for use on the same farm, certain records must be maintained with regards to the transplant production, including:

- Transplant production season
- Months of production
- Number of greenhouse
- Total square footage of production greenhouses
- Transplant species grown
- Substrate components (and % of each in the composition)
- Size of flats or containers
- Irrigation methods (whether hand watering, subirrigation, overhead sprinklers, etc.)
- Fertilizer analysis
- Total amount fertilizer used per season
- Injector setting

Table 7. Nitrogen use categorization for field grown cut flowers

Species	Nitrogen Category[4]	Harvest Frequency or Period
Group 1: Spring Harvest		
Allium, Flowering onion	Low	Once
Consolida, Larkspur	Low	Fall planting, spring harvest
Delphinium	Low	Fall planting, spring harvest
Digitalis, foxglove	Low	
Iris (perennial)	Low	Spring harvest; late summer & early fall harvest for some newer varieties
Lupinus, Lupines (perennial)	Medium	Spring harvest over 3-4 weeks
Mathiola incana, Stocks	Low	Once

4 See Table 1 for N fertilization rate recommendations.

Species	Nitrogen Category[4]	Harvest Frequency or Period
Group 2: Summer and Fall Harvest		
Achillea, Yarrow	Low	Once
Ageratum	Medium	Multiple
Ammi majus	Low	Multiple
Alstroemeria	Medium-high	May- July
Aquilegia, Columbine	Low	Once
Artemisia	Low	Multiple
Asclepias	Low	August-September
Baptisia (perennial), Blue indigo	Low	Once
Celosia, crested, wheat, plume types	Medium-high	July-September
Centaurea, cornflower	Low	Multiple
Callistephus chinensis, China aster	Medium-high	July-September
Chrysanthemum	Medium-high	Multiple
Cosmos	Low-Medium	July-October
Crocosmia (corm)	Low	
Dahlia	Medium	July-frost
Echinacea	Low	July-August
Echinops	Low	
Eucalyptus	Low-medium	
Aster ericoides	Medium-high	Multiple
Chrysanthemum parthenium, Feverfew	Medium	Multiple
Gerbera	Medium-high	Multiple
Gladiolus (bulb)	Low	Once
Gomphrena globosa, Globe amaranth	Medium	Once or can repeat
Grasses & grains	Low	Late summer-early fall
Gypsophila (perennial), baby's breath	Low	Once
Helenium	Low	
Kniphofia, Red hot poker	Low	Mid summer
Lavendula, Lavender	Low	Summer
Lilium (bulb), Lily	Low	Once
Convallaria, Lily-of-the-valley	Low	Early summer
Eustoma grandflorum, Lisianthus	Low-medium	Harvest over 3-4 weeks
Monarda, Bee balm	Low-medium	1-2 months in summer
Nigella	Low-medium	
Penstemon	Low-medium	
Phlox (perennial)	Low-medium	3-4 weeks in summer
Physostegia virginiana (perennial), Obedient plant	Low	Harvest over 3-4 weeks
Poppy	Low-medium	Once
Queen Anne's lace	Low	Once
Ranunculus	Medium-high	
Rudbeckia	Medium-high	Harvest over 3-6 weeks in summer
Salvia	Medium-high	Multiple
Scabiosa	Low-medium	
Sedum (perennial)	Low	August-early October
Antirrhinum majus, Snapdragon		
Limonium sinuatum, Statice	Lo-medium	Once
German Statice (perennial)	Low-medium	
Strawflower	Low-medium	Multiple
Helianthus anuus, Sunflower	Low-medium	July-September
Dianthus, Sweet William	Medium-high	
Veronica	Low-medium	Harvest over 3-4 weeks