

ORNAMENTAL CABBAGE AND KALE PRODUCTION UPDATE

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Ornamental cabbage and kale have become increasingly popular as a fall crop because of their colorful, long lasting foliage. They will often remain colorful until temperatures drop to 15 to 20 °F and are well suited to areas of the Southern US which have mild winters. Ornamental cabbage and kale are also an excellent companion crop to garden chrysanthemums and fall pansies in increasing sales. Below is an update on an earlier article run in the June 1996 NCFG Bulletin (Vol. 41, No. 3:1-5). Please refer to that issue for cultural information.

The updated information presented here includes the interpretation standards for leaf tissue samples of ornamental cabbage and kale by Dr. Ray Campbell of the NCDA - Agronomic Division (Table 1). These are the first values to be published for ornamental cabbage and kale. In addition, the latest insect and disease management strategies are listed in Tables 2 and 3. These tables were contributed by Ray Cloyd of Purdue University and Ron Jones of NC State University, respectively.

This fall Mr. Jamie Gibson will be starting his Master's degree at NC State University. He will be working with ornamental cabbage and kale as his thesis project. In addition, we have received a Fred C. Gloeckner Foundation grant to help finance the fertilization studies which Jamie will be conducting during the fall of 1999. Further updates about ornamental cabbage and kale will published over the next two years.



Table 1. Foliar concentrations of elements in ornamental cabbage and kale plants. All values are from the most recently matured leaves.

Element	Units	Adequate Range
N	%	3.5 to 4.5
P	%	0.2 to 0.6
K	%	3.0 to 4.0
Ca	%	0.5 to 1.0
Mg	%	0.2 to 0.4
Na	%	<1.0
S*	%	0.2 to 1.0
B	ppm	20 to 40
Cu	ppm	3 to 10
Fe	ppm	50 to 300
Mo	ppm	0.1 to 2.0
Zn	ppm	20 to 75

Source: C. Campbell, NCDA - Agronomic Division.

**The N:S ratio should be between 10 and 15. Ratios above 18 are considered high and indicate a need for sulfur.*

Table 2. Common insect pests of ornamental cabbage and kale.	
Insect	Management Strategies
Aphids	
<p>Aphids use their piercing-sucking mouthparts to remove plant juices. They may also inject toxins into plants. Aphids secrete a clear, sticky liquid called honeydew. Honeydew serves as a medium for black sooty mold fungi, which can reduce photosynthesis and crop marketability. Aphids are generally located on leaf undersides. They are usually wingless, but they can be winged under high populations. Aphids can increase in large numbers within a short period of time due to their ability to give birth to live young.</p>	<ul style="list-style-type: none"> • Cultural: Inspect plants regularly for the presence of live aphids, old cast-skins, and/or honeydew. Remove all leaf debris and weeds from the area. • Chemical: Acephate (Orthene), Bifenthrin (Talstar), Chlorpyrifos (Duraguard), Diazinon (Knox-Out), Endosulfan (Endosulfan), Horticultural oil (Sunspray Ultrafine Spray), and Insecticidal soap (M-Pede/Insecticidal Soap). • Biological: Predators such as ladybird beetles and lacewings. Apply early, before aphid populations are high. Consult biological control supplier catalogs for availability of natural enemies.
Caterpillars	
<p><i>Diamondback moth larvae</i> feed on all plant parts, but prefer the undersides of older leaves. They chew small holes on leaf undersides, giving the plant a shot-hole appearance. Larvae feeding on the growing points of small plants can cause stunting. Large populations can cause considerable damage to small plants.</p>	<ul style="list-style-type: none"> • Cultural: Inspect plants regularly for the presence of larvae and/or larvae damage. Use yellow sticky cards to monitor adult (moth) activity. Remove leaf debris and weeds from the area. This removes potential overwintering sites. • Chemical: Azadirachtin (Azatin), <i>Bacillus thuringiensis aizawai</i> (Xentari), <i>Bacillus thuringiensis kurastaki</i> (Dipel), Bifenthrin (Talstar), Lambda-cyhalothrin (Topcide), and Permethrin (Astro). • Biological: Parasitic wasps such as <i>Trichogramma</i> can be used against cabbage looper and imported cabbageworm. Consult biological control supplier catalogs for availability of natural enemies.
<p><i>Cabbage looper larvae</i> eat irregular holes in leaves, and feed on leaves in the head region causing stunted growth. Small larvae feed primarily on the undersides of leaves. Older larvae feed deeper within the plant canopy, burrowing through several layers of leaves. This means that control should be implemented when larvae are small. These caterpillars move with a characteristic "looping" motion.</p>	
<p><i>Imported cabbageworm larvae</i> eat large irregular holes in leaves and burrow into heads causing stunted growth. Damage is similar to cabbage looper. Larvae usually feed on upper leaf surfaces near the midrib. They generally don't feed on large veins. Extensive feeding can kill small plants. Older larvae can burrow into the center of plants.</p>	
Flea Beetles	
<p>Flea beetle adults chew small, circular holes or pits in leaves. Flea beetles may cause plant stunting if they are present in large numbers. They can be particularly serious on small plants. Larvae are located in plant medium. Flea beetle adults come in various sizes and colors, but they all have enlarged hind legs that allow them to jump considerable distances when disturbed.</p>	<ul style="list-style-type: none"> • Cultural: Remove all leaf debris and weeds from around the area. This may help to reduce flea beetle populations. Avoid placing plants near other crucifers (i.e. cauliflower and broccoli). • Chemical: Azadirachtin (Azatin), Bifenthrin (Talstar), Carbaryl (Sevin), Chlorpyrifos (Duraguard), Cyfluthrin (Decathlon), and Lambda-cyhalothrin (Topcide).
Whiteflies	
<p>Whiteflies remove plant fluids with their piercing-sucking mouthparts. Their feeding can cause plant stunting and leaf distortion. Whiteflies are generally located on the undersides of leaves. Whiteflies produce a clear, sticky liquid called honeydew. Honeydew serves as a medium for growth of black sooty mold fungi, which can reduce photosynthesis and crop marketability.</p>	<ul style="list-style-type: none"> • Cultural: Inspect plants regularly, look at leaf undersides for the presence of young whitefly stages. Use yellow sticky cards to monitor for whitefly adults. Remove leaves heavily infested with whitefly young. Dispose of leaves in plastic bags. Remove all leaf debris and weeds from the area. • Chemical: Acephate (Orthene), Bifenthrin (Talstar), Endosulfan (Endosulfan), Fluvalinate (Mavrik), Imidacloprid (Marathon), and Insecticidal soap (M-Pede/Insecticidal Soap). • Biological: Parasitic wasps such as <i>Encarsia formosa</i>. Predators such as lacewings. Apply early, before whitefly populations reach high numbers. Consult biological control supplier catalogs for availability of natural enemies.
* Mention of chemical trade names does not constitute an endorsement. Omission of any registered chemicals does not imply criticism.	

Table 3. Common diseases of ornamental cabbage and kale.	
Disease	Management Strategies
Alternaria Leaf Spot (<i>Alternaria</i> spp.)	
This fungus causes small, round, brown lesions on infected leaves and oval or elongated lesions on stems. These lesions may enlarge to the size of a dime. They are characterized by the presence of concentric rings within dead tissue.	<ul style="list-style-type: none"> • Cultural: Inspect plants regularly for the presence of disease symptoms. Minimize leaf wetness for prolonged periods. Remove plant debris from the area. Keep plants on schedule with transplanting and fertilizer applications. Sell plants promptly. • Chemical: Chlorothalonil (Daconil 2787), Iprodione (Chipco 26017), and Mancozeb (Protect T/O).
Black Rot (<i>Xanthomonas campestris</i> pv. <i>campestris</i>)	
The initial infection of this bacteria is the presence of small, yellow to light brown patches at the margins of leaves. Later, black veins develop within the yellow areas. Affected areas dry out, leaving a triangular-shaped lesion on the leaf margin. Older infected leaves can drop from plants. Cross-sections of infected stems cut near the substrate surface will show distinct rings of black tissue.	<ul style="list-style-type: none"> • Cultural: Use disease free seed. Remove infected plant debris and weeds from the area. Minimize leaf wetness for extended periods.
Club Root (<i>Plasmodiophora brassicae</i>)	
This soil borne fungus causes a club shaped swollen gall on the roots. This disease occurs in fields with a history of crucifer production and should not occur in greenhouse production with soilless substrate.	<ul style="list-style-type: none"> • Cultural: Use clean substrate.
Downy Mildew (<i>Peronospora parasitica</i>)	
Downy mildew is a water mold fungus that causes purplish irregular spots on leaves. These spots later enlarge and turn a light brown to yellow. A grayish-white fluffy growth can develop on leaf undersides early in the morning. Severe leaf and/or stem infections can stunt plants. This disease is favored by cool, wet weather conditions, and high humidity. It is also favored by long periods of leaf wetness.	<ul style="list-style-type: none"> • Cultural: Inspect plants regularly for the presence of disease symptoms. Remove infected plant parts. Maintain good air flow. Avoid crowding plants together. Avoid splashing water. Minimize leaf wetness for extended periods. • Chemical: Mancozeb (Protect T/O) can be used as a protectant.
Fusarium Yellows (<i>Fusarium oxysporum conglutinans</i>)	
This fungus causes plants to have a dull cast. Lower leaves turn yellow-green in color. Symptoms may appear on one-side of the leaf and/or plant. Entire plants can wilt and die. This is a soil borne pathogen that occurs in fields where cabbage and other crucifers have been grown. It should not occur in greenhouse production with soilless substrate.	<ul style="list-style-type: none"> • Cultural: Use clean substrate.
Rhizoctonia Stem Rot (<i>Rhizoctonia solani</i>)	
This fungus, which is also called wire stem, causes a brown, dry, sunken stem rot at the soil line that results in a general root destruction. As a result, roots are unable to take-up water and/or nutrients. Roots, which are normally light-brown in color, turn a dark-brown to black. If the disease starts on older plants, the stem may not be completely killed. Such plants can be stunted and/or wilted. Leaf yellowing may also occur.	<ul style="list-style-type: none"> • Cultural: Start with clean medium. Avoid splashing water. Discard infected plants. • Chemical: Iprodione (Chipco 26019), PCNB (Terraclor), Thiophanate-methyl (Cleary's 3336), and Triflumizole (Terraguard).
Root Rots (<i>Pythium</i> and <i>Phytophthora</i>)	
These soil-borne fungi attack the root system causing plant wilting, stunting, and leaf yellowing. Roots cannot supply adequate amounts of water and nutrients to top growth. Phytophthora is much less likely to occur than Pythium.	<ul style="list-style-type: none"> • Cultural: Avoid overwatering plants and use a well-drained substrate. Don't let plants sit in water. Use clean soilless medium. • Chemical: Etridiazole (Truban), Etridiazole + Thiophanate-methyl (Banrot), and Mefenoxum (Subdue Maxx).
* Mention of chemical trade names does not constitute an endorsement. Omission of any registered chemicals does not imply criticism. ** If you are unsure of a problem, consult your Cooperative Extension office and/or call a diagnostic laboratory.	