

North Carolina Flower Growers' Bulletin

Volume 44, Number 2
April, 1999



\$4.00

Official Publication of the North Carolina Commercial Flower Growers' Association

Growing Asian Vegetables as Floricultural Crops

James L. Gibson, Graduate Research Assistant
Brian E. Whipker, Floriculture Extension Specialist
Raymond Cloyd, University of Illinois
and Ron Jones, Ornamental Plant Pathology Extension

Introduction

A number of species in the *Cruciferae* family provide both nutritional value to our diet as well as showy landscape specimens in our gardens. Ornamental cabbage and kale has been the standard ornamental vegetable for providing colorful and attractive foliage during the winter months, but recently the presence of leafy vegetables, in particular oriental mustards, has been observed in the fall landscape. Leafy mustards which have been used for years as edible components in salads and stir-fry dishes are now being adopted by curators of botanical gardens, landscape contractors, and greenhouse growers as attractive and profitable items. These vegetables are being used as specimen plants, border plants, and are used in mass plantings in winter gardens at conservatories and arboretums, shopping center entranceways, and community gardens. Planted with fall pansies and garden mums, these vegetables offer texture and foliar color. The shades of green and purple provided

by these leafy mustards are attractive characteristics contributing to the life of cool season gardens which do not display much color during the months of October through March. The mild winter climate of the Southeast allows mustards to show attractive vegetation throughout the winter.

Leafy vegetables like mustards and kales are some of the oldest cultivated crops in the world. Mustards have been utilized in the Far East and India for more than 2,000 years as a source of oil, medicines, fodder for cattle, and condiments (Knott and Deanon, 1967). Mustard leaves are tender and tasty and contain an abundance of vitamins and minerals. The seeds are rich in oil and proteins. Today's society has incorporated these plants into gardens which provide color during the winter months. The mustard's robust attractive foliage, whether it be curly, crinkled or smooth, is an asset to the dormant shrub or perennial garden. The presence of brilliant yellow flowers in early spring after

1:00

2:00

4:00

5:00

their elongated stalk has developed, provides addition color with flowering bulbs and pansies.

Kales of different leaf morphology and genetic variability are also used in the winter landscape. Ornamental cabbage and kale are popular as fall crops because they have colorful, long lasting foliage (see Horticulture Information Leaflet Number 507 for additional production information). Other types of kales, which are used in the landscape are Russian red kale, dinosaur kale, and red bor kale. Swiss chard, with its brilliant green and red foliage and stems, has also been adopted as a specimen plant in the winter garden.

Cultivars

Three cultivars were studied at NC State University in Raleigh. Each variety possesses different characteristics such as form, leaf shape, leaf color, and bolting potential. All varieties require high amounts of irrigation and fertilization. Their performance has been evaluated in soilless substrate in both the greenhouse and outdoors, and they have also been evaluated over time in the garden. The varieties observed are described below.

India mustard or red mustard (*Brassica juncea* var. *rugosa*) is a large leaved, thick petioled mustard which outperformed the other vegetables in garden appeal. The cultivar 'Red Giant' is attractive in both foliage size and shape. The large bronzed blades become more intense in color as the plant matures and the application of plant growth regulators enhances the color intensity. The plant's rapid growth and intense leaf color enable growers to market the plants shortly after transplanting, 5 weeks earlier than ornamental cabbage and kale. The leaf blades taper down to the main growing point which is thick and fleshy, the roots are fibrous and water requirements are great as the root mass develops. The midribs are bright white and as the plant reaches full maturity the "meat" of the blade changes from a rusty red to a reddish black color. The plant's leaves convert from a dull to a shiny

appearance as well. Temperatures below 15°F (-9.4°C) can cause the unprotected outer leaves to become shriveled and damaged. The interior leaves of this biennial can survive low temperatures, but the entire plant can be reduced to only 5 to 6 leaves. These plants will regrow when warm weather returns. To limit cold injury, the plants should be planted under trees or in wind protected areas. Red mustard can achieve a height of three feet as long as winters remain warm and wet. The tall mounding growth habit makes 'Red Giant' an attractive specimen plant or background texture plant.

'Tatsoi' (*Brassica rapa* var. *rosularis*) is similar to the popular Asian vegetable, pack choi. The leaves are flat, shiny, and broad and the leaf margins are smooth. The fleshy dark-green leaves are firm and the white petioles attach to a central growing point forming a rosette. The low growing habit of 'Tatsoi', makes the plant an attractive border plant in winter gardens. Planting of this type of mustard-spinach in mass is suggested (Farmer, 1998). 'Tatsoi' does not survive temperatures lower than 25°F (-4°C) and is reduced to blacked tissue as a result of exposure to low temperatures. It has a short vernalization requirement and bolts rapidly as temperatures begin to increase in the spring. 'Tatsoi', with its small compact form, can be grown with a tight spacing. Like the red mustard, 'Tatsoi' requires constant irrigation and fertilization.

The final leafy vegetable studied, 'Early Mizuna' (*Brassica rapa* var. *nipposinica*) is also called potherb mustard and is a popular vegetable which is used in salads and stir-fry dishes (Stephens, 1988). This plant is used as a specimen item in the landscape as well as a groundcover. 'Early Mizuna' grows in the form of a mound and may reach a height of two feet. The leaves are yellow-green and deeply notched. The feathery leaved plant may possess up to 180 leaves and all petioles are attached to a thick, tan stem. The plant may survive light frosts, but is killed by sub-freezing weather. The plant, after the vernalization period has been achieved, can

produce several elongated stalks, which harbor the reproductive structures. 'Early Mizuna' is very attractive in bloom, as several bright yellow flowers cover the plant.

Scheduling

Mustard plants generally require 6 to 8 weeks of growth to achieve marketable size in 1 gallon or 8" mum pans. Due to their rapid growth rate, mustards can be of wholesale shipping size by 6 weeks, and retailers can market the crop in 8 weeks. A typical production schedule is listed in Table 1.

Seeding, Containers, and Transplanting

Germination takes around 3 to 5 days at 70°F with the seeds being lightly covered with a germination mix. Seeds can be sown in plug flats, germination trays, or into a 606 or an 806 flat. The plants should not be allowed to become root bound in the germination container before transplanting, as restriction of the roots will result in stunted plant growth. The seedlings should be transplanted into larger pots capable of holding a large amount of substrate with excellent water holding capacity. The plugs are transplanted when the rootballs are fully developed and the first true leaves are twice as large as the cotyledons.

If the plants have become too tall in the seedling flats, they can be planted deeper (up to the first set of leaves) in the final pot. Growers are commonly producing Asian vegetables in 6, 7, or 8 inch pots.

For maximum growth, growers should transplant one seedling per pot.

These vegetables are heavy feeders and competition for nutrients should be avoided. Seeds can also be sown in the final containers and then thinned when the seedlings begin to produce true leaves, or seeds can be sown in plug trays. It is common for southern growers to purchase plugs (typically 128s or 162s) from northern plug producers. Some northern plug producers are now adding mustards into their plug production scheme. If growers decide to sow these leafy vegetables themselves, germination substrate needs to remain cool and moist. An application of B-Nine two weeks after sowing should be applied at 2,500 ppm to control plant height in the plug tray.

Spacing

Due to their robust foliage, mustard plants should be spaced in order to maximize airflow, which prevents foliar diseases, and it allows for uniform growth around the pot. If plants are to be established in greenhouses, one should take extra care in watering, spraying, and shifting plants, because the foliage may be fragile when temperatures are warm. Use 6" centers for 4" pots, 11" to 12" centers for 6" pots, and 16" to 18" centers for 1 gallon or 8" mum pans.

Table 1. Typical North Carolina ornamental mustard production schedule for an 8" mum pan.

Time	Cultural Practice
Week 0	Sow seeds into plug flats and grow out
	Fertilize at the rate of 50 to 100 ppm N and K after seedlings emerge
Weeks 3-5	Transplant the plugs into 8" mum pan
	Fertilize at the rate of 150 to 250 ppm N and K
	Apply preventive fungicide drench
	Apply insecticides as needed
Weeks 6-8	Respace plants if needed
	Acclimate plants to cooler temperatures if greenhouse grown
	Decrease fertilizer to 100 ppm N and K

Root Substrate, Irrigation and Nutrition

Root Substrate (Medium). Plants can be grown in a good quality soilless substrate, which has good water holding capacity. If the plants are to be grown outdoors in pots, a soil based substrate or the addition of sand may help avoid toppled plants during windy weather.

Irrigation. During the summer months, when the plants are establishing themselves in pots, an adequate supply of water should be provided to the substrate. Use of an automated drip watering system similar to one used on garden chrysanthemums is recommended. Mustards are not tolerant of water stress, which results in the stalling of plant growth, yellowing, and dropping of lower leaves. Premature bolting can occur if moisture levels become low in the substrate and extensive wilting takes place.

Nutrition. Maintain the root substrate pH between 5.8 and 6.5. Irrigation water alkalinity levels should be around 2 meq/L of alkalinity (100 ppm CaCO_3 or 120 ppm HCO_3^-) to avoid a general increase in pH over the growing season. If alkalinity levels are higher, consider using acid injection or an acidic fertilizer (as long as the $\text{NO}_3\text{-N}$ to $\text{NH}_4\text{-N}$ ratio is greater than 2:1). Fertilize the plants with a balanced fertilizer of calcium nitrate ($\text{Ca}(\text{NO}_3)_2$) and potassium nitrate (KNO_3), with periodic applications of 20-10-20 or 21-5-20 (for phosphorus and micronutrients) and $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ (for magnesium and sulfur). High levels of $\text{NH}_4\text{-N}$ + urea in a fertilizer mix will stimulate stem elongation, resulting in the need for higher plant growth regulator rates to control plant growth. For the seedling stage, fertilize at the rate of 50 to 100 ppm of N with a constant liquid feed. After transplanting into the final container, fertilize with a balanced fertilizer at the rate of 150 to 250 ppm N and K. Electrical conductivity (EC) should be maintained between 1.0 and 2.5 mS/cm during periods of active growth. Excessive fertilization will prevent good coloration, but deficient levels of fertility will

result in yellowing (nitrogen deficiency), purpling (phosphorus deficiency), or defoliation of the basal leaves. Deficiency symptoms are more likely to occur in a soilless substrate, which has a low cation exchange capacity (the ability to hold nutrients). Therefore, for the final two weeks of growth, a fertilization rate of 100 ppm N and K should be sufficient while allowing the plants to develop color and avoid deficiency symptoms.

Growth Regulators

In order for growers to achieve profitability from the sale of ornamental mustards, the aesthetic appeal of the crop should be of primary concern. The ratio of pot to vegetation must be maintained and stretching must be avoided. Plant growth regulators (PGRs) can be used to achieve desired wholesale and retail heights and diameters. PGRs can only be applied to mustards grown as a non-food crop. A PGR study was conducted at NC State University on the leafy mustards 'Tatsoi', 'Early Mizuna', and 'Red Giant'. 'Tatsoi' is a low growing plant and PGRs are not needed for height control. Single applications of B-Nine at 2,500 or 5,000 ppm were not effective in controlling height of 'Early Mizuna' or 'Red Giant', but both B-Nine rates were effective in controlling plant diameter. To control plant height of 'Early Mizuna' or 'Red Giant', multiple B-Nine applications at 2,500 and 5,000 ppm would be required. A second PGR study was conducted on 'Red Giant' using a single higher rate of B-Nine (up to 10,000 ppm) and B-Nine with Cycocel as a "tank mix". Higher rates of B-Nine at 7,500 or 10,000 ppm provided no additional control of plant height or diameter. The addition of Cycocel to the B-Nine also gave little additional control. Phytotoxicity along the margins of the leaf was observed with Cycocel concentrations of 3,000 ppm. Once again, multiple applications of B-Nine at 2,500 or 5,000 ppm to 'Red Giant' are suggested and periodic monitoring of plant height and leaf expansion should be followed to determine the proper application

schedule. The use of PGRs not only controls the amount of internodal stretch and leaf expansion, but it also enhances the bronze appearance of 'Red Giant'.

Temperatures

During the late summer, the large leaved mustard varieties should be lightly misted during the day when the light and temperature are intense. Optimal growth occurs with plants of the *Cruciferae* family grown in outdoor production (Whipker et al., 1998). When plants are grown in greenhouses, nighttime temperatures should be held at 55 to 60°F during the final 4 weeks of production. The cooler temperatures will avoid the plant from becoming to "soft" and fragile and will allow the plant to harden and become acclimated to much cooler outdoor temperatures.

Insects and Diseases

A number of insects and diseases can attack ornamental mustards. A descriptive listing of insect and disease pests and management strategies are listed in Table 2 and Table 3. (*Mention of chemical trade names does not constitute an endorsement. Omission of any registered chemical does not imply criticism.*)

For Further Reading

- Farmer, J. 1998. Cool Veggies. American Nurseryman. 188(1):30-36.
- Knott, J. and J.R. Deanon. 1967. Vegetable Production in Southeast Asia. Univ. of the Phillipines. pp. 366.
- Stephens, J.M. 1988. Mustard, p. 72. In: J.M. Stephens. Manual of Minor Vegetables. Univ. of Florida Coop. Ext. Serv., SP-40.
- Whipker, B.E., J.L. Gibson, R.A. Cloyd, C.R. Campbell, and R. Jones. 1998. Success with ornamental cabbage and kale. NCSU Horticulture Information Leaflet 507.