Onions

VEGETABLE CROPS PRODUCTION GUIDE

FOR THE ATLANTIC PROVINCES

Prepared by the ADVISORY COMMITTEE ON VEGETABLE CROPS

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Introduction

The common dry yellow onion belongs to the Amaryllidaceae (Amaryllis family). *Allium Cepa* is related to a great number of other species of similar odor and taste -- garlic, leek, chive, welsh onion. The shallot is considered a form of *A. cepa*. Asia is considered the centre of origin -- Northwestern India, Afghanistan, parts of the USSR and China. The onion has been known and cultivated from the earliest period of history (for at least 5000 years). Onion culture spread into Northern Europe in the Middle Ages.

Onions are a cool season crop. The germination of onions is slow at 6 to 7 C, the optimum germination temperature range is 10 to 35 C, and the maximum temperature is 40 C. The onion crop is adapted to a growing season with air temperatures at 13 to 24 C. Low temperatures early in the season are desirable with higher temperatures after bulb formation. The onion is tolerant of frost but seedlings are generally only tolerant down to -1 C. Some bunching onion cultivars overwinter in the milder areas of Atlantic Canada. Adequate soil moisture is required due to the relatively small root system.

Onions are sensitive to photoperiod. Long days are favorable to onion production as this enhances leaf development and formation which, in turn, is directly related to bulb size. Early varieties require 13 hours for bulb initiation while late varieties require 16 hours for bulb initiation.

Onions begin to form bulbs when day length reaches the appropriate duration for the cultivar, providing temperatures are high enough. Early seeding or transplanting is therefore essential. Cool weather during early growth of the plant promotes formation of seed stalks (bolting). The onion bulbs quicker in warm than at cool temperatures. At 40 C bulbing is retarded. In the onion there is an interaction between day length and temperature in the bulbing process of an individual cultivar.

Onion soils should be well drained and well supplied with organic matter. Sandy loams and loams without stones are optimal. Heavy clay soils should be avoided. Coarse sand soils may be used for specialty onion production under irrigation.

Early onions are grown from sets sown in mid to late April. These stands mature in late August and early

September and are marketed. Usually these are "Jet Set". Onions from seed do not usually mature until mid to late September. (Onions started from transplants mature about the same time as sets.)

Bunching onions may be planted in early August and overwintered. Bunching onions also may be planted in the spring for harvest in late July and August. It is possible tunnel houses could be used to extend the season on bunching onions. Large Spanish onions are usually grown from transplants as they take a long time to mature. Spanish type onions can be direct seeded if only a 7 to 8 cm diameter onion is required for processing. Yellow onion yields range from 18,000 to 40,000 kg per hectare. Green bunching onions yield 20,000 to 24,000 kg per hectare.

There are relatively large markets for yellow onions (including Spanish) for both fresh and processing in the Atlantic Area. There are export markets to the Caribbean that are being developed. Onions of all types could be grown for roadside market sales and for speciality items for the Hotel, Restaurant &Institutional Trade.

Nutrient Content: One medium raw onion supplies 40 kilocalories. It contains Vitamin C, potassium and calcium plus trace amounts of other nutrients.

Crop Establishment

Onions are established in many ways: from seed, bare root transplants, multiple transplant plugs, sets, and overwintered.

Seed Treatment - Onion seeds may be pelleted for precision seeding. This type of seeding produces more uniform size, less culls and higher yields.

Seeding/Planting - Seed in two lines 7.5 cm apart in the row with 40 seeds per meter of row. For beds at 1.7 to 1.8 m five rows may be seeded.

Spanish onions may be transplanted 10 cm apart in rows or beds appropriate to available equipment.

Field seed as early as possible in the spring - early to mid May. Seed of some cultivars of bunching onions, sown in the fall, produce small plants which overwinter in milder coastal areas and produce an early crop in the spring. Sweet Spanish cultivars should be greenhouse seeded in late February for transplanting in May.

Approximately 4 kg of raw seed is required for dry onions which are not precision seeded; 6 kg

of seed is required for bunching onions and 35 to 45 kg per hectare is required for pickling onions. For growing sets, sow seed 70 to 80 kg per hectare in bands. Approximately 2000 to 4000 kg of sets are required per hectare (depending on the set size).

Seed onions (seed) no deeper than .5 to 1.5 cm.

Crop Management

Irrigation

Onions have a shallow and limited root system which explore mainly the upper 30 cm of the soil. This crop should be irrigated frequently throughout the growing season. The soil moisture should not be allowed to fall below 50%. Most soils should receive 2.5 cm of water per week from the combination of rainfall and irrigation. Soil moisture is important in the growth of new roots, the soil moisture must reach the base of the bulb periodically if the newly formed roots from the stem are to grow into the soil. New roots will not grow into dry soil.

Nutrition

ALL ADDITIONS OF LIME AND FERTILIZER OR MANURES SHOULD BE BASED ON RECOMMENDATIONS FROM A SOIL TEST.

Onions require a highly fertile soil but well balanced.

Manure is not recommended as weeds are a serious problem in this crop and due to the irregular availability of nitrogen.

Lime - Mineral soils must have a pH of 6.5 to 6.8 for satisfactory crops. On peat soils pH of 5.5 is sufficient. The soil must contain adequate calcium for crop growth. This means that calcium must be evenly distributed and incorporated into the field. Crop failure is common on fields with inadequate liming. Also, some cultivars may be more sensitive than others to pH.

Nitrogen - Apply most of the nitrogen preplant incorporated (at least 2/3 of the required amount). Sidedress the remainder in mid to late June after the seeded onions are about 15 cm tall. Excessive nitrogen especially in July can cause delayed maturity (thick necks) and soft bulbs.

Phosphorus - Should be banded if possible at the time of seeding. Otherwise relatively heavy applications of phosphorus must be broadcast and preplant incorporated.

Potash - Potash should be broadcast and preplant incorporated. Application rates depend on the level in the soil.

Micronutrients *Copper* - deficiency occurs on acid mineral or peat soils. Copper may be mixed with the fertilizer and applied. On peat soils (as an initial application) 50 kg of copper sulphate per hectare is recommended. Copper sulphate can be applied by spraying it onto the soil surface

and incorporating it into the soil (this material is extremely corrosive to metal).

Manganese - At high soil pH's a deficiency may show up. Soil application of this element is not suggested due to the large amounts required. Foliar applications of manganese sulphate are recommended, starting when the plants are about 15 cm tall with 1.5 to 2.75 kg manganese per hectare in 300 L of water and repeated in 4 to 5 sprays 10 days apart. Use the low rate on small plants increasing the rate as the season progresses.

Molybdenum deficiency may occur when onions are grown on acid mineral or peat soils. A seed treatment has proven beneficial. The treatment is accomplished by dissolving 15 grams of sodium molybdate in 45 mL of water. Spray this solution from an atomizer bottle on 2.3 kg seed spread thinly on a plastic sheet. Do not use excessive water as this can cause the chemical to penetrate the seed embryo and cause injury. Mix the seed thoroughly and let dry. Spraying the plants with sodium molybdate at rates supplying 0.1 to 0.25 kg molybdenum per 1000 L also will help to avoid deficiency symptoms. On new peat soils apply an initial application of 10 kg of either ammonium molybdate or sodium molybdate per hectare.

Zinc - If zinc becomes a problem spray the foliage with zinc sulphate at rates supplying 0.6 kg zinc per 1000 L of water.

Boron - On peat soils an initial application of 1.5 kg of actual boron is recommended. On high pH sandy soils with low organic matter and where boron has not been used on rotational crops, foliar or soil sprays of boron may be considered.

Application Method - Generally N, P & K is broadcast and preplant incorporated. N, P & K may be partly banded. Nitrogen may be sidedressed early in the season. Foliar sprays may be used for micronutrient applications.

Pests and Pest Control

Weeds

Onions do not compete well with weeds. Good weed control requires integration of cultural and chemical techniques. Herbicides will provide preemergence and postemergence control of annual weeds but repeat applications may be necessary. Cultivation and hand weeding are usually required to supplement chemical control. Onions should be planted in soil where the annual weed seed population has been reduced by cultural procedures such as crop rotation, fallowing or stale seedbed.

Specialty onions can be successfully grown by transplanting through black plastic mulch. This method provides excellent weed control and crop growth.

Care must be taken to avoid fields where residual herbicides from previous years persist in the soil as crop injury may occur.

Diseases

Damping-off and Root Rots

Damping-off occurs in seedlings which may topple over and die because of decay at the soil line. Surviving seedlings may be stunted because of a brownish rot on the roots and shoot. Pink root is a type of root rot which results in reduced bulb size. Affected plants turn yellow and wither and roots have a pink color which eventually turns brown to black.

Control: Treat seed with thiram for damping-off. To control pink root, practice a rotation of several years.

Botrytis Leaf Blight, Downy Mildew,

Purple Blotch - (fungi)

Characteristics: Botrytis leaf blight develops as white spots 1 to 5 mm in length with light green to silvery halos. The centers of the spots become sunken and straw colored. When spots become numerous, the leaf tips die back down the entire length of the leaf.

Downy mildew first appears on leaves as elongated patches varying in size and slightly paler than the rest of the foliage. Under moist conditions, these areas become covered with a violet gray down, which may spread to surrounding tissue. Leaves fold over at the affected areas and the leaf tips wither. Onions that are severely infected do not cure properly and are susceptible to storage rots.

Purple blotch appears on leaves as brown spots 1 to 3 cm in length with red-purple margins. The brown areas may have alternating dark and light zones giving a target board effect. Leaves weakened by purple blotch may fall over. Purple blotch frequently develops after Botrytis leaf blight or downy mildew has appeared.

Control: A regular spray schedule throughout the summer is necessary to control Botrytis leaf blight and downy mildew. Practice a 2 year rotation and destroy infected crop debris after harvest and destroy refuse heaps of onions culled from storage.

Botrytis Neck Rot and Smudge (fungi)

Characteristics: These rots occur during storage. Infection occurs at harvest time through the neck. Immature onions are more susceptible. Spanish-type onions and white onions require more careful attention.

Control: Be certain onions are mature before harvesting. Cure and dry onions properly (see Curing Section). Store under cool, dry conditions.

White Rot

Characteristics: This is a very destructive disease of the onion family. It occurs in several areas of Canada but is not known to occur in the Atlantic Provinces. It has been found in British Columbia, Manitoba, southern Ontario and eastern Quebec. The characteristic symptoms are a white fluffy fungal growth and soft rot around the base of the bulbs. Masses of tiny black sclerotia form in the fungal growth and in bulb tissues. These sclerotia allow the fungus to survive in soil for 4 to 5 years or longer.

Control: The use of infected onion sets or transplants can introduce the disease to new areas. Do not introduce disease from infested areas via onions, equipment, pallet boxes, etc. Follow a 4 to 5 year rotation.

Bacterial Diseases

Characteristics: There are at least three different diseases caused by bacteria: soft rot, slippery skin, and sour skin. The bacteria causing slippery skin and sour skin enter the onion through wounds on leaves and when heavy irrigation or rainfall results in water standing in leaf axils and the neck. These bacteria can enter the bulb prior to harvest at windrowing or through injuries at harvest. Soft rot often occurs when bulbs are damaged by onion maggot, bulb diseases or mechanical injury.

Control: Control onion maggot, do not over irrigate and avoid mechanical injury. Harvest when onions are fully mature and when weather is dry. Cure and store properly.

Smut

Characteristics: This is a very serious disease of the onion family in Canada. It recently was found in Nova Scotia. The first symptoms appear on the cotyledons and young leaves in the form of longitudinal blisters, which are blackish with a silver sheen and contain the spores of the fungus. Seedlings may die before emergence or if they survive the fungus may become systemic and remain for the entire season. The bulbs become covered with the blackish lesions and blisters. When the blister splits, spores are released into the soil where they remain viable for 15 years. Onions are susceptible only from germination until the first true leaf emerges, a period of 12 to 15 days.

Control: Avoid contaminating smut-free fields with infected soil or crop residues. Use smut-free sets or seedlings. Treat seed with a suitable systemic fungicide.

Insects

Onion Maggot

Characteristics: Onion maggots overwinter in the pupal stage with adult flies emerging from the middle of May to the end of June. Adults resemble the common housefly but are slightly smaller (6 mm) and pale grey. The elongate white eggs are laid in the soil at the base of onion plants. The creamy-white larvae emerge within one week, and reach a length of 7 mm when full grown.

From the middle of June to the end of July, the larvae enter the soil to pupate. Within a week adult flies emerge to lay eggs again. There are two generations in most provinces, or a full first and a partial second. Sometimes even a partial third generation is produced in a long mild fall.

Control: Follow a good crop rotation, if possible avoid planting in fields adjacent to land that had onions on it the previous season. Onion maggot flies are more highly attracted to onion sets than seedlings. If onion maggots have been a problem it would be possible to use onion sets along the margins of the field as a trap crop. When injury is seen, or if onion maggots are known to be a problem in your area, apply a furrow treatment. After harvest remove and dispose of any onions that are left in the field.

Onion Thrips

Characteristics: Onion thrips are minute insects that puncture the leaves or stems and suck up the exuding sap. This causes the appearance of whitish blotches on the leaves. The insects may be found in greatest numbers between the leaf sheaths. Thrips are slender, yellow, active insects, at most 1 mm long. They usually enter field border areas first and become problems especially under hot, dry weather conditions.

Control: The threshold for thrips can be determined by counting thrips. This is done by 1/ generally looking at the newest leaves on the plant - the greatest number of thrips will be found between the new leaves, 2/ counting the number of thrips per plant found on 30 to 50 plants throughout the field 3/ calculating the average number of thrips per plant, 4/ dividing by the leaf number to give the average number of thrips per leaf. Treat when the number of thrips observed exceeds the threshold of 3 thrips per leaf for cooking onions or 1 thrips per leaf for Spanish and green bunching onions. After the crop is harvested, the tops should be raked together and burned.

Harvesting and Handling

Sprout Inhibition - Short storage life cultivars do not benefit from MH sprays. Apply a sprout inhibitor when about 50% of the tops are down and 5 to 7 leaves are still green. Allow 10 to 20 days before harvesting. Do not apply MH after the plant has dried down to 3 partially green leaves. Early application may result in spongy knecked bulbs. Follow manufacturers direction.

Storage and Conditioning

Curing - Undercut or pull and windrow onions when at least 60% of tops are down, and leave in windrow until inside neck tissues are dry before topping and storing. If the season is too damp for field curing, dry in storage at temperatures between 27 to 35 C with relative humidity at 70% to 80% for 2 weeks or cure with forced ventilation at 27 to 35 C. Curing with forced air at 35 C can be complete in as little as 48 hours. Best skin color develops when onions are cured at 24 to 32 C with 80% relative humidity. Properly cured onions will have a tight neck and dry outer scales that rustle.

Onions grown from seed in Atlantic Canada will generally require artificial drying. Spanish type

from transplants have been cured successfully in greenhouses without additional heat. Tobacco kilns have also been used.

Onions for sets are pulled and cured in late summer or early fall while the tops are still green, when the bulbs reach 2 cm in diameter. Larger sets produce a high proportion of "bolters".

Storage - Following the curing period, onions should be cooled and held at 0 C and 65% to 70% relative humidity.

With forced air circulation, it may be possible to allow humidities as high as 85%. Root growth and decay are stimulated at higher humidities, sprouting occurs at higher temperatures. Thick-necked onions will not keep and should be removed before storing if possible. Onions are frequently stored in bulk storage, two or four meters deep, constructed so that the bulbs can be cured by forcing air up through them. This method is considered more efficient and economical than curing and storing in crates. Properly cooled onions can be successfully stored at 0 C for 6 to 8 months.

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(also see General References)

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