Diagnosing Nutrient Deficiencies in Canola

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Normal growth and development of canola depends on the right combination of nutrients available in the soil. Plant nutrients such as nitrogen, phosphorus, potassium, sulfur, magnesium and calcium are needed in relatively large amounts and are often called the macronutrients. Other nutrients such as iron, manganese, copper, zinc, boron and molybdenum are required by plants in relatively small amounts and are termed as micronutrients. When any of these nutrients are below the required minimum level, growing plants may exhibit deficiency symptoms due to malnutrition. Many deficiencies can be recognized by observing the plant leaves.

The location of initial leaf symptoms of nutrient deficiency depends on the degree of mobility of plant nutrients in the plant. For nutrients like nitrogen, phosphorus, potassium and magnesium, which are mobile in the plant, deficiency symptoms will appear in older or lower leaves, as these nutrients are moved out of the older leaves to younger plant parts when supplies are limited. The opposite is true to immobile nutrients like calcium, boron, sulfur, iron, copper and manganese; the new leaves will have symptoms first because they cannot move from older plant part to new ones. Molybdenum and zinc are somewhat immobile in the plant, causing deficiency symptoms to initially appear in the middle leaves then affect both the older and younger leaves as the deficiency progresses. Nitrogen, phosphorus and sulfur are the most commonly observed canola nutrient deficiency symptoms in Oklahoma soils. Most of the others can be observed in certain environmental conditions, but many are quite rare.

Diagnostic flow chart for canola nutrient deficiency symptoms

The diagnostic flow chart for canola nutrient deficiency that follows can be used to identify nutrient deficiency based on common symptoms.

To diagnose a nutrient deficiency:

- Know what a healthy canola plant should look like to identify symptoms correctly.
- Identify where symptoms are appearing (new leaves, old leaves, edge of leaf, veins, etc.).
- Identify patterns of symptoms.
- Compare symptoms to flowchart.

The flowchart on page 2 consists of alternative statements about the appearance of different plant structures. Begin at the top left hand corner of the chart, read the statement and determine whether the statement applies to the plant part being evaluated. If the statement describes the plant's symptoms, proceed along the 'YES' arrow to the next statement. If not, follow the 'NO' arrow to an alternative statement. Continue this process until the probable nutrient responsible for the deficiency is identified.

Interpreting visual nutrient deficiency symptoms can sometimes be difficult, thus soil testing and plant analysis may be used to confirm nutrient stresses.

Older or lower leaves affected?

NO → **New or young leaves affected?**

YES

Effects generalized, plants dark or light green

YES

Plants dark green, distinct pink-purpling of the tips and margins

YES

PHOSPHORUS (P)

NO

Plants light green with leaves light green to yellow

YES

NITROGEN (N)

Effects mostly localized, chlorosis with or without spotting

YES

Interveinal chlorosis, purple petioles, developing necrotic spots

YES

MAGNESIUM (Mg)

NO

Chlorosis begins with margins & develops white dead spots & blotches that gradually join

YES

POTASSIUM (K)

YES

Growing tip dying

YES

Interveinal necrotic spots and leaf dies inwards from leaf edges to veins

YES

BORON (B)

NO

Distortion & reduced size of youngest leaf; yellow patches in the middle

YES

CALCIUM (Ca)

NO → Growing tip remains alive

YES

Interveinal chlorosis

YES

YES

Yellowing and cupping; purpling of leaf edges & undersides (severe deficiency)

YES

SULFUR (S)

NO

Stunted plants;bronzing upper surface

YES

ZINC (Zn)

NO

Stunted pale plants; leaf margins brown and "scorched"

YES

MOLYBDENUM (Mo)

Necrosis of tips and margins as deficiency progresses

YES

IRON (Fe)

NO

Faint yellowing at first, severe deficiency becomes yellow

YES

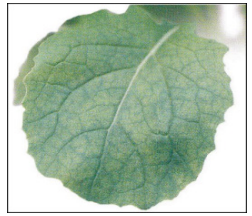
MANGANESE (Mn)

NO

Paling of younger leaves and necrotic patches in the leaf blade

YES

COPPER (Cu)



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Plant Nutrient Deficiency Terminologies

Chlorosis: general yellowing of the plant tissue.
Blotches: irregular dead or discolored areas in the leaf.
Generalized: symptoms not limited to one area of a plant, but rather spread over the entire plant.
Interveinal: in between leaf veins; veins remain green.
Leaf blade: broad flat part of the leaf.
Localized: symptoms limited to one leaf or one section of the leaf or plant.
Margin: outer edge of the leaf.
Mottling: spotted, irregular, inconsistent pattern.
Necrosis: death of plant tissue; tissue browns and dies.
Paling: lacks the usual healthy green color of leaf; light/lime green in color.
Stunting: decreased growth; shorter height of the affected plant.

Precautions in identifying nutrient deficiency symptoms

- Some elements produce similar symptoms. For instance, N and Mo deficiency symptoms can be very similar, depending on the stage of growth and deficiency severity.
- Multiple deficiencies can occur at the same time.
- Some cultivars of canola may differ in their ability to respond to nutrient deficiencies. For example, new varieties of canola are more likely to show chlorotic blotchy 'crisp" leaves than old varieties in response to potassium.
- Symptoms can be easily confused with those caused by pests, diseases, pesticides and genetic abnormalities.
- Field symptoms may appear different than "ideal" symptoms. Many of the plant photographs shown here were grown under controlled nutrient conditions, and deficiency symptoms may or may not appear as they do here.

If symptoms don't meet any of the descriptions, either refer to text for more specific symptom descriptions or consult the local Extension educator.

Deficiency symptoms associated with different nutrients in canola

Nutrients mobile in plants

Nitrogen

- Seedlings have reddened cotyledons.
- Established plants develop yellowing on leaf margins that spreads in toward the midrib between the veins. The midrib becomes discolored then the leaf dies. Old leaves develop whitish-purple veins and mild purple pigmentation that starts at the end of the leaf and progresses to the base on both sides of the leaf.
- From stem elongation, the main stem is thinner and branching is restricted.
- Flowering time and pod numbers are reduced.

Phosphorus

- Deficiency most commonly shows as smaller plants with similar shaped leaves. Severely deficient plants develop a narrow purple margin of the leaf blade that spreads inwards. Leaf turns bronze before dying.
- From stem elongation the main stem is thinner and branching is restricted.
- Flowering time and pod numbers are reduced.

Potassium

- Young plant appear prostrate. Dull pale yellow to yellow-brown color begins at leaf edges and develops white dead spots and blotches that gradually join. Tissue discoloration and death gradually spreads inwards towards the midrib, but leaf vein remains green. Leaf interveinal tissue bulges above the veins and the midrib bends backwards.
- Flowering stems are fewer and thinner that set smaller pods.

Magnesium

- Interveinal chlorosis on older leaves. Develops reddish purple from the leaf edge that spreads inwards.

Nutrients immobile in plants

Boron

- Growing point may die and be replaced by lateral branches resulting in bunchy young plants. Emerging leaf is red-brown to purple, and unfolded leaves have pale interveinal blotching.
- Young plants have shortened, possibly cracked stems and deformed leaves that cup outwards and thicken making them brittle. Young leaves have interveinal necrotic spots and the leaf dies inwards from leaf edges to veins.
- Flowers form but abort, with side branches producing more flowers that eventually aborts.

Calcium

- Distortion and reduced size of youngest leaf with yellow patches in the middle

- Flowering stalk collapses causing withering and death of the flowering head.

Copper
- Tissues begin to rot at the growing tips. Growing point dies on severely deficient plants.
- Deficient plants tend to wilt easily, twisted "weak looking" leaves
- Paling of young leaves and necrotic patches in the leaf blade

Sulfur
- Younger leaves are lime-green, often with interveinal chlorotic mottles and pale leaf margins. Leaves are cupped or roll inwards and become thickened, crisp and brittle. Mildly deficient plants can have subtle purpling on the nearly fully expanded leaf. Leaf then develops strongly purple undersides that are revealed as leaves roll inwards. Very deficient plants are prostrate; leaves extend further down the petiole than normal and protrude horizontally rather than forming a domed canopy.
- Flowering plants have pale yellow-cream flowers that abort or produce short fat pods with few seeds.

Iron
- Interveinal chlorosis of young leaves followed by necrosis of tips and margins as the deficiency progresses.

Manganese
- Whole plant becomes paler.
- Younger leaves develop interveinal paleness to yellowing, but veins remain green.

Molybdenum
- Stunted pale plants.
- Leaf margins are frequently brown and "scorched."
- Tissue between veins of older leaves becomes paler green with scattered white dead spots that expand as deficiency worsens.

Zinc
- Plants are pale and stunted resulting in shortened internodes as the plants elongate.
- Leaf blades bend down. Bronzing of upper surface.

References

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