Crop Walkers' Guide

AHDB

Allium

HORTICULTURE

Every year, a significant proportion of the UK Allium crop would be lost to pests and diseases if growers did not monitor their crops and employ effective protection strategies.

This Crop Walkers' Guide is aimed at assisting growers, agronomists and their staff in the vital task of monitoring onion and leek crops in the field and in storage. It is designed to help with the accurate identification of pests, diseases, nutritional deficiencies and physiological disorders. Images of key stages in the life cycles of pests and diseases are included, along with comments to help with identification.

It is impossible to show every symptom of every pest, disease, or deficiency, therefore, growers are advised to familiarise themselves with the range of symptoms that can be expressed and be aware of new problems that occasionally arise.

This guide does not offer any advice on the measures available for controlling Allium pests or diseases, as both chemical active ingredients and their approvals frequently change. However, having identified a particular pest or disease in their crop, growers can refer to other AHDB Horticulture publications that contain information on control measures.

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Pests

Allium leaf miner

Phytomyza gymnostoma

- Pest of onion, leek and garlic crops. First detected in the UK in 2002, and since then it has spread, especially in the Midlands.
- Adult flies emerge in spring from pupae, which overwinter within the host plant or in the soil if the host plant dies.
- Female flies feed by making punctures in the leaves and sucking up the exuding sap.
- Larvae make tunnels in foliage stems and bulbs of host plants.
- Plants affected by Allium leaf miner tend to rot, due to secondary infections from fungi and bacteria that develop in the damaged tissues.

Bean seed fly

Delia platura and *Delia florilega*

- Common pest of Allium crops, damage can be localised and sporadic, even though adult flies are common.
- Adults emerge between March and September to lay eggs. Larvae feed on germinating seeds and emerging seedlings.
- The first sign of attack is patchy emergence of seedlings. Plants are often killed at the 'loop' or 'crook' stage.
- Egg laying is stimulated by decomposing organic material. Females prefer to lay their eggs in freshly disturbed soil, especially where crop debris or farmyard manure are present.

Bean seed fly

Delia platura and *Delia florilega*

- Any factors that slow down the speed of germination or reduce shoot vigour increase the risk of damage, especially low temperature and sowing too deep.
- Sheltered fields with a high content of plant debris may increase the severity of attacks.
- Bean seed flies can complete between three and six generations per year, depending on the ambient temperature.

Cutworm – Turnip moth

Agrotis segetum

- Leeks are more commonly affected than onions, most problematic in hot, dry years, and on light sandy soils.
- Cutworms are the larvae of the turnip moth, which has a wide host range.
- Causes sporadic but severe damage, leading to loss of plants and reduction in quality.
- Adults emerge from May onwards and, after mating, lay eggs on host plant leaves and roots.
- Larvae initially feed on aerial parts of the plant before descending underground to damage plant roots and stems.
- Pheromone traps can be used to determine risk. A cutworm forecasting system is available.

Leek moth

Acrolepiopsis assectella

- Affects onion and leek crops. Damage and associated decay can render leeks unmarketable. It is more problematic in warm locations in the south of the UK.
- Caterpillars are small (up to 13 mm in length) and grey at first, turning to yellowish-green as they develop.
- Larvae bore through folded leaves, leaving a 'shot hole' effect, before migrating to the centre, where they destroy developing leaves.
- Mature larvae form silken cocoons on host plant leaves.
- Adult moths emerge in April and lay eggs. Larvae feed May/June. A second generation of larvae cause feeding damage August/September.
- Adult moths are nocturnal. Male moths can be captured by pheromone traps.

Nematodes (Free-living) – Eelworm

Various spp.

- Wide host range, including Alliums.
- Three main species in the UK are stubby root (*Trichodorus* spp.), needle (*Longidorus* spp.), and (*Pratylenchus* spp.)
- Root feeding nematodes are able to move easily through soils, especially sands, both across a field and within the soil profile.
- Root damage causes poor growth and stunting of affected crops.
- Soil sampling in the autumn prior to cropping will aid risk assessment.

Nematodes (Stem and bulb)

Ditylenchus dipsaci

- Serious pest of Alliums in temperate climates, difficult to control once established.
- Unlike other pest nematodes, *D. dipsaci* proliferates in shoots and causes twisting and distortion, with stunted leaves and multiple side shoots – known as 'bloat'.
- Secondary infections then cause rotting at soil level, so that when badly infested plants are pulled they leave their roots in the soil.

Nematodes (Stem and bulb)

Ditylenchus dipsaci

- Spread of nematodes is largely passive. They may be transferred on soil or host plants, including seed, or by flooding.
- Even light infestations can cause secondary bacterial decay in storage that shows as brown necrotic rings.
- GPS soil sampling in the autumn prior to cropping will aid risk assessment.

Nematodes (Root-knot)

Meloidogyne spp.

- Wide host range and worldwide distribution.
- Spends most of its time within the plant and causes characteristic galls on affected roots.
- Galls are 1–2 mm diameter on onions.
- Infected secondary root systems are shorter and have fewer roots and root hairs than healthy plants.
- Erratic plant stand, plant stunting and yellowing may result from loss of vigour of the root system.
- More severe in sandy textured soils than clay soils.

Onion fly

Delia antiqua

- Rare, localised pest of onion and leek crops in the UK. It causes serious damage to bulb and salad onion. Leeks and shallots are also attacked, but damage is less severe.
- Onion seedlings attacked by onion fly larvae quickly collapse and die. Larger plants are rendered unmarketable by the damage caused by larval feeding.
- Usually two generations per year, but, in warm locations, there may be a partial third generation.
- Adults emerge from mid-May and lay eggs close to young seedlings. A second generation emerges in July/August.
- When bulbs are cut open, larval feeding damage is evident.

Onion thrips

Thrips tabaci

- Thrips are a common pest of bulb onion, salad onion and leek crops, being most problematic in hot, dry seasons.
- Orange, brown nymphs (immature adults) live deep in plant leaf sheaths and stems, feeding on developing tissue.
- Damage is highly characteristic, consisting of silvery patches or streaks on the leaves.
- Affected crops may be unmarketable.
- Alliums are the preferred overwintering hosts, but cereals may also be used. High temperatures (around 25°C) promote fast larval development and dispersal to new hosts.
- Blue sticky traps sited around field edges can be used to monitor populations.

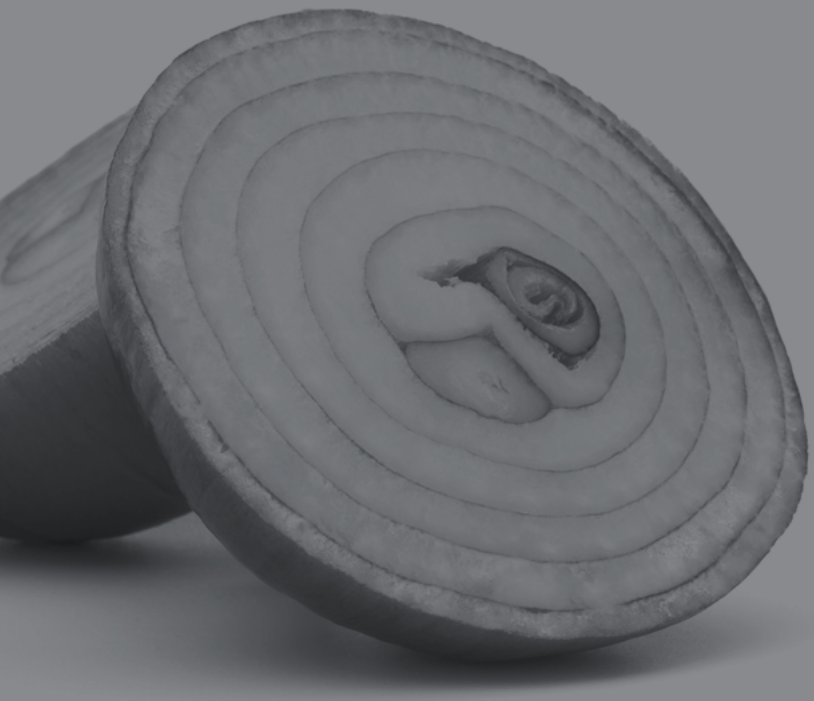
Wireworm

Agriotes spp.

- Locally important pest of onion and leek crops. Most problematic in fields that have been long-term grassland or minimal tillage cereals or set-aside.
- Wireworms are larvae of the click beetle. They have a wide host range.
- Larvae feed on plant roots and stems, feeding for five years, before pupating and living for a year as an adult.
- Bait and pheromone traps to determine presence or absence of wireworms and adult beetles can help to determine risk.

Diseases

BACTERIAL
FUNGAL
OOMYCETE
VIRAL



Bacterial leaf blight

Pseudomonas syringae pv. *porri*

- Primarily a disease of leeks; seedborne.
- Young leaves show water-soaked, and then longitudinal lesions or stripes that eventually split and rot.
- On older leaves, yellowing is seen around wounds. Flowering stalks are very susceptible.
- Leek transplants can develop the disease in propagation.
- Susceptibility is increased by leaf damage due to heavy rain, hail or herbicide scorch.
- Spread by rain splash or overhead irrigation.

Bacterial soft rot

Pectobacterium carotovorum subsp. *carotovorum*

- Distributed worldwide.
- Initially, affected scales develop a watery rot and become pale yellow to light brown. Eventually, the centre of the bulb completely rots, producing a pungent smell.
- Encouraged by in-field damage and high storage temperatures.
- Often a secondary infection after onion fly damage.
- This pathogen was previously called *Erwinia carotovora*.

Slippery skin

Burkholderia gladioli pv. *alliicola*

- Most common cause of UK onion storage rots.
- Typically affects internal scales, which are water-soaked and brown.
- Affected onions appear normal on the surface, but are completely rotten inside, with vinegary odour.
- Encouraged by in-field damage, heavy rain, excessive irrigation, hail, herbicide scorch and high storage temperatures.
- The causal pathogen was previously called *Pseudomonas gladioli* pv. *alliicola.*

Sour skin

Burkholderia cepacia

- Primarily a disease of stored onions, worldwide.
- Infection usually begins with damage in the field.
- Soft bulb scales produce a grainy yellow ooze that smells vinegary.
- Infection spreads within, rather than between, scales.
- Overhead irrigation after bulbing and high temperatures contribute to symptom development.
- The causal pathogen was previously called *Pseudomonas cepacia*.

Xanthomonas leaf blight

Xanthomonas axonopodis pv. *allii*

- Usually occurs in tropical and subtropical climates.
- Lesions initially appear as irregularly shaped pale spots with water-soaked margins, and quickly enlarge and darken. Lesions may extend the entire length of the leaves.
- A bacteria encouraged by moderate to high temperatures and rainfall.
- Spread by rain splash, irrigation and wind-blown sand.
- Carry-over caused by infested crop debris and contaminated seeds
- Seedborne.

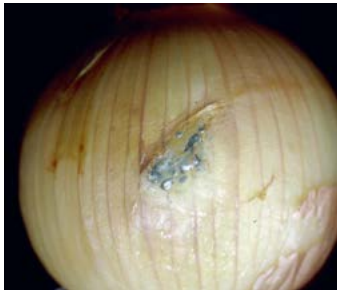
Black mould

Aspergillus niger

- Rarely causes economic damage in the UK, mainly occurs in the tropics.
- Characteristic 'dusty' black fungal spores develop around the bulb neck.
- Optimum temperatures for growth are 28–34°C, with high humidity levels.
- May be seedborne.
- Note – this disease is a potential human pathogen so care is needed when handling affected crops.

Blue/green mould

Penicillium spp.



- Common storage disease of bulb onions and garlic. Mainly occurs in storage but field symptoms can occur on maturing bulbs.
- Develops when storage temperature is above 15°C, and where relative humidity in excess of 85% is present in storage for a prolonged period.
- Initial symptoms include water-soaked areas on scale surface. Then blue-green or grey 'dust'-like spores cover affected bulbs.
- On very thick-skinned bulbs, *Penicillium* spp. may develop under the outer skin around the neck.

Fusarium basal rot

Fusarium oxysporum f. sp. *cepae* and *F. culmorum*

- *Fusarium oxysporum* f. sp. *cepae* commonly affects onions, whereas *F. culmorum* more commonly affects leeks in the UK.
- Causes damping off in seedlings and a tan/pink basal rot on more mature plants.
- Initial field symptoms are yellowing and wilting of affected plants, occurring in distinct patches as temperatures rise in spring to 15°C or more.
- Dense white mycelial growth is often seen around the root base. A progressive bulb rot then develops.
- Root damage by waterlogging, bean seed fly or nematodes significantly increases susceptibility.
- Symptoms in bulb onions may not be apparent at harvest but can develop in store. It also produces spores that can survive in the soil for many years.

Leaf blight

Botrytis squamosa

- Commonly affects onions, causing significant yield loss when severe blighting occurs early in the season.
- Symptoms begin as small white spots surrounded by a light green halo, which occur parallel to leaf veins, eventually coalescing to cause leaf dieback.
- Encouraged by prolonged rainy periods when leaves remain wet for 24 hours or longer.
- Overwinters on infested leaf debris.
- Should not be confused with hail or wind-blown soil damage.

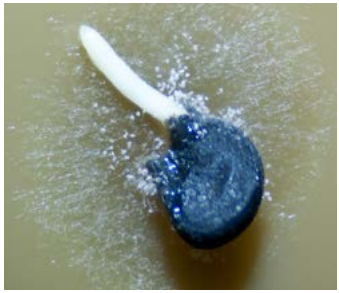
Leaf blotch

Cladosporium spp.

- Common disease of leeks and onions.
- Most damaging in cool, wet conditions October to April.
- While symptoms are visually similar, onions are affected by *C. allii-cepae* and leeks by *C. allii*.
- Overwinters on infested leaf debris.
- Characteristic oval lesions with dark centres. Lesions eventually merge, causing necrotic striping on leaves.
- Young lesions are pure white and can look like chemical scorch.

Neck rot

Botrytis spp.



- Post-harvest onion disease in temperate areas, causing major storage losses.
- Necks develop a water-soaked decay that gradually moves down through the entire bulb.
- Occurs where necks are insufficiently dried after harvest.
- White/grey mycelium threads may appear between scales. Masses of greyish mould and black sclerotia form on the outer scales of the bulb.
- Seedborne. Infected plant debris also cause disease carry-over.

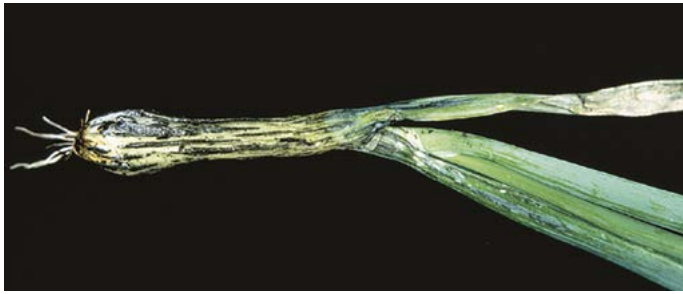
Onion smudge

Colletotrichum circinans

- Occurs worldwide on Alliums.
- Characterised by production of green/black bristled fruiting bodies that form concentric rings on the surface of bulbs that can be seen with a hand lens.
- May also cause lesions on leaves in warm, wet conditions.
- Humidity and temperatures of 13–25°C favour growth.
- Spread by rain splash from infected debris in soil.
- Found mainly on white onion cultivars.

Onion smut

Urocystis cepulae



- Occasional disease of bulb, salad onions and leeks.
- Initial lesions are black streaks on young leaves. Blister-like lesions develop on older plants near the base of scales.
- Mature lesions contain black, powdery spores.
- Optimum temperature for infection is 13–22°C.

Pink root

Phoma terrestris

- Worldwide, especially in tropical and subtropical conditions.
- Infected roots are pink, becoming more intense in colour as the disease develops.
- Roots are destroyed, causing yellowing, stunting and wilting of plants, which may collapse and die.
- Soilborne disease with a wide non-Allium host range.
- May be confused with *Fusarium* basal rot.

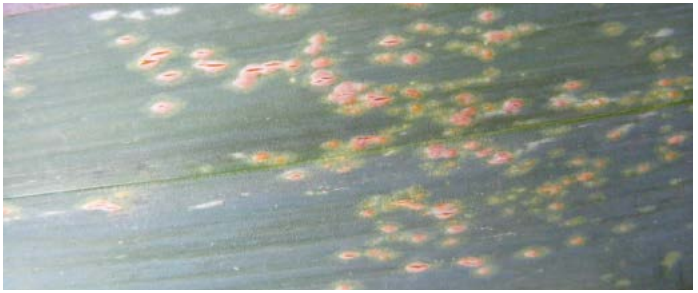
Purple blotch/Stemphylium leaf blight

Alternaria porri and *Stemphylium vesicarium*

- Most common in leek and onion, prevalent worldwide but most damaging in areas with warm, humid climates.
- Initial symptoms are small water-soaked lesions on leaves or stalks.
- These lesions enlarge, turn yellow and develop a purple sporulating centre, leaves may collapse and die.
- Purple blotch is caused by both pathogens, which may occur separately or together.
- Optimum temperature is 25°C with high humidity.

Rust

Puccinia allii



- Most important foliar disease of leeks in the UK. Rarely affects onions under UK conditions. Some strains affect garlic.
- Causes leaf blemishes that affect both crop marketability and yield.
- Initial small, white flecks develop into characteristic orange pustules on the leaf. Bands of pustules occur laterally across individual leaves.

Rust

Puccinia allii

- Yellowing and death occurs when leaves are severely affected.
- Spores are dispersed by wind. Leaf wetness and high humidity are required for infection.
- Dense planting and stressful conditions for the crop encourage disease development.
- Overwintered crops are a source of infection for spring planted crops.

White rot

Sclerotium cepivorum

- One of the most important widespread fungal diseases of Allium species, occurring worldwide in cool conditions. Leeks are less susceptible
- Encouraged by the high plant densities typical of salad onion production.
- Foliar symptoms include premature yellowing and dying of older leaves, and stunting of plants, rapidly followed by foliage collapse.
- Plants die in patches, each resulting from a single sclerotial infection, from June onwards.

White rot

Sclerotium cepivorum

- White, cotton wool-like mycelium growth is often found on the base plate. Small poppy seed-sized sclerotia form on and in decaying tissues.
- Optimum temperature range is 14–18°C.
- When white rot is advanced, roots and bulbs rot, due to secondary infections.
- Sclerotia can lie dormant in soil for at least 20 years in field soil, so crop rotation is of limited value.

Downy mildew

Peronospora destructor

- Occurs worldwide. Serious economically damaging disease of bulb and salad onions, and occasionally leeks.
- Initial symptoms are a fine downy purple/grey sporulation, usually on older leaves.
- Affected leaves become pale green, then yellow, necrotic and collapse.
- Optimum temperature 10–12°C, with free water on leaf for 2–4 hours.
- Encouraged by dense crop canopy and irrigation.
- Infection sources – wind-blown spores, debris, crop overlap and systemically infected bulbs or sets.

White tip

Phytophthora porri

- Common on leek crops and can affect other Alliums, including onions.
- Initial symptoms are yellowing of the leaf tips; lesions are water-soaked, then become bleached, and leaf tips die back and become crisp and white.
- Spread by rain-splash, so particularly affects overwintering crops.
- Can cause loss in harvestable yield as the crop needs extra trimming.
- Infected plant debris cause carry-over of infection.

Iris yellow spot virus

(IYSV)

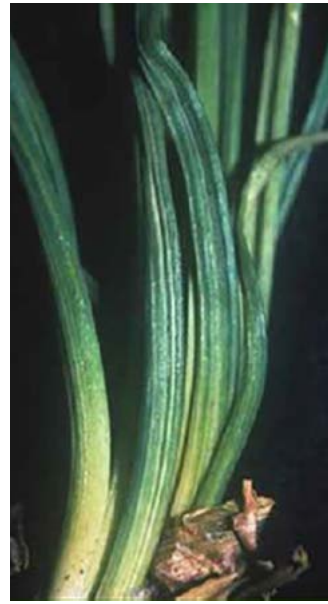





- Occurs on onions in Europe. Reports in UK have not been on Alliums so far.
- Characteristic diamond-shaped yellow/straw-coloured lesions on leaves and stalks. Some lesions have green centres, with yellow or tan borders. Others have concentric rings of yellow and green.
- Lesions can merge, weakening leaves and stems, causing lodging.
- Reduces plant vigour and bulb size.
- IYSV is spread by onion thrips, which are widespread in the UK. May also be spread by movement of thrips infested planting material.

Onion yellow dwarf virus

(OYDV)



- Occurs worldwide on onion, shallot and garlic.
- Initial symptoms are yellow streaks on the bases of the first leaves.
- All subsequent leaves show symptoms from yellow streaks to complete yellowing.
- Leaves may be crinkled, flattened and fall over; bulbs are small but remain firm.
- Spread by *Myzus persicae* and other aphid vectors.

Nutrient disorders

Boron

B

- Alliums grown on leached sands are most at risk.
- Boron is most available for uptake by plants in neutral soils, and becomes less available in acidic or alkaline soil.
- Older leaves become brittle and may turn grey-green to deep blue-green in colour.
- Characteristic transverse cracks – 'cat scratches' – appear at the base of older leaves.

Calcium

Ca

- Appears as dieback of young leaves without prior yellowing in onions, or results in the death of a short length of leaf causing distal parts to collapse and die.
- In leeks, leaves become very narrow and die back abruptly from tips without first yellowing.
- Deficiency is rare in the UK.
- Symptoms similar to those resulting from potassium deficiency.

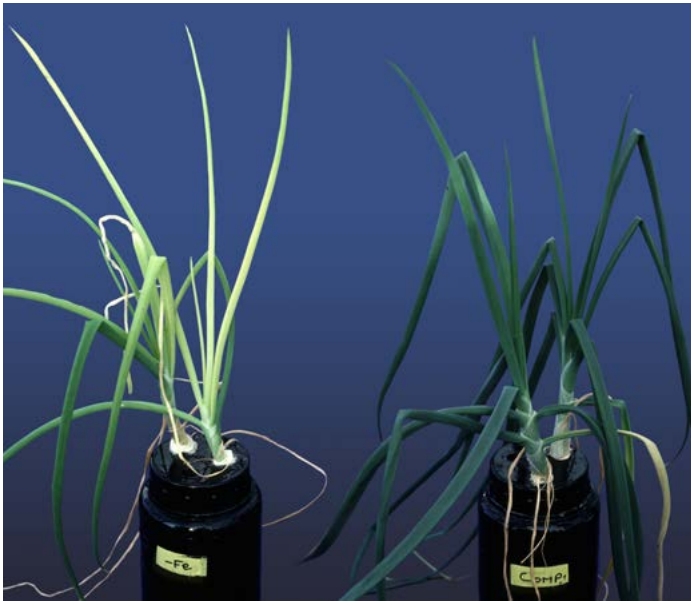
Copper

Cu

- Onions grown on acid light sands and peat soils most at risk.
- Chlorosis symptoms first appear on the leaf tips, which turn white, and then twist, and spiral ‘pig tailing’.
- Deficiency causes soft, thin and light-coloured skins on bulb onions.

Iron

Fe



- High levels required by growing crop.
- However most soils, particularly the iron rich soils of the UK, are capable of supplying this requirement so deficiency is rarely seen.
- Iron is necessary for chlorophyll synthesis, so deficiency causes chlorosis.

Magnesium

Mg

- Moderately common deficiency occurring on a range of soil types.
- Leads to slow plant growth.
- Older leaves become uniformly yellow along their length without any dieback.
- Can be confused with nitrogen deficiency.

Manganese

Mn

- Common deficiency affecting onions and leeks on sandy peat or soils with a high pH.
- Older leaves develop interveinal chlorosis, which appears as longitudinal striping on the older leaves.
- There is also death of affected leaves, leaf curling, reduced bulbing and thick necks.
- Results in slow growth in onions.
- Symptoms can be transient and may disappear following rain.

Molybdenum

Mo

- Alliums grown on light sandy and peat soils with low pH are most at risk.
- Deficiency results in poor emergence and seedling death.
- Leaves die back from tips, with a noticeable soft, water-soaked transition zone between healthy and necrotic tissue.
- Highly mobile nutrient in the soil.

Nitrogen

N

- In onions, plants are stunted, with pale green to yellow leaves that die back from the tips. In leeks, leaves become pale green and erect, growth may also be stunted.
- Crops may become nitrogen deficient under conditions of poor drainage, low temperatures or, in wet seasons, on light soils where plant populations are very high.
- Sulphur or magnesium deficiency can result in similar symptoms.

Phosphorus

P

- Most soils contain good levels of available phosphate but deficiency can occur at high pH, especially on sandy soils.
- Symptoms include slowed growth, delayed maturity and a high percentage of thick-necked bulbs at harvest.
- Leaves become dull-green in colour and older leaves wilt and die back from the tips.

Potassium

K

- Most problematic in wet seasons on sandy soils and peat soils.
- Foliage initially turns darker green. Leaf tips of older leaves begin to wilt, wither and die.
- Leaves may droop and have a papery appearance where deficiency is severe.
- Bulbs may be soft with thin skins and do not store well.

Sulphur

S

- Alliums grown on light sandy and chalky soils are most at risk.
- Onion leaves become thick and deformed, with new leaves turning yellow. Leek leaves become stiff and erect, with early swelling of the stem base.
- Chlorosis first appears on young developing leaves. Whole plants may turn yellow in cases of extreme deficiency.
- Nitrogen deficiency can give similar symptoms.

Zinc

Zn

- Onions grown on light sandy soils with a high pH are most at risk but deficiency is extremely rare in the UK.
- Leaves become noticeably twisted with faint interveinal chlorosis.
- Leaves become striped yellow, twisted and stunted.

Cultural disorders

The importance of early diagnosis of crop nutrient disorders

Suspected nutrient disorders based on the appearance of symptoms should be confirmed by growing media and leaf analysis.

General guidance on collecting both growing media and leaves for analysis can be found in the AHDB factsheet 10/16 ‘Sampling methodologies and analysis interpretation for growers of hardy nursery stock’.

Bolting

- Onions and leeks are biennials (i.e. grow from seeds in the first year of development, and flower and produce seeds in the second). Bolting is premature flowerhead development, usually occurring in the first year of growth.
- Plant size, ambient temperatures and day length are the main factors that initiate flowering.
- Plants in advance of normal development, affected by seasonally colder than average temperatures, are most at risk.

Bulb splitting

- Commonly occurs in bulb onions.
- Basal plate of the onion splits and secondary growth of the affected bulb may occur as protrusions from the damaged base. This damage may allow microorganisms to invade, causing bulb decay.
- Watering heavily after plants have been under significant drought stress increases susceptibility.
- Damage to the root base by bean seed fly, *Fusarium* or nematodes may increase incidence.

Chimera

- Affects both onion and leek.
- Variegated leaf tissue that typically occurs in yellow and/or white strips longitudinally along the leaf.
- The pale-coloured streaks are deficient in chlorophyll, which can result in stunted plant growth.
- Caused by a genetic mutation that typically occurs in a very small percentage of plants.

Hail/heavy rain damage

- Irregular white markings, usually only on one side of the leaf.
- Where severe, holes may be punched in the leaves, or leaves may be broken off completely.
- Crops subject to heavy rainfall or hail damage have increased susceptibility to bacterial infections.

- Immature bulbs, harvested before bulbing is complete.
- Phosphorous deficiency during growth can increase occurrence.
- Common in low population bulb onion crops or where bulbing stimulus is poor, particularly in cool, wet summers.
- Affected plants often regrow leaves in store.

Watery scale and leathery skin

- Common disorder of bulb onions, particularly if conditions are wet at harvest.
- During long-term storage, thick skins restrict the diffusion of oxygen and carbon dioxide into and out of the bulb scales, effectively suffocating the tissues.
- Affected bulbs develop very thick, leathery skins, which are difficult to dry.
- Affected bulbs develop water-soaked outer scales (watery scale).

References

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