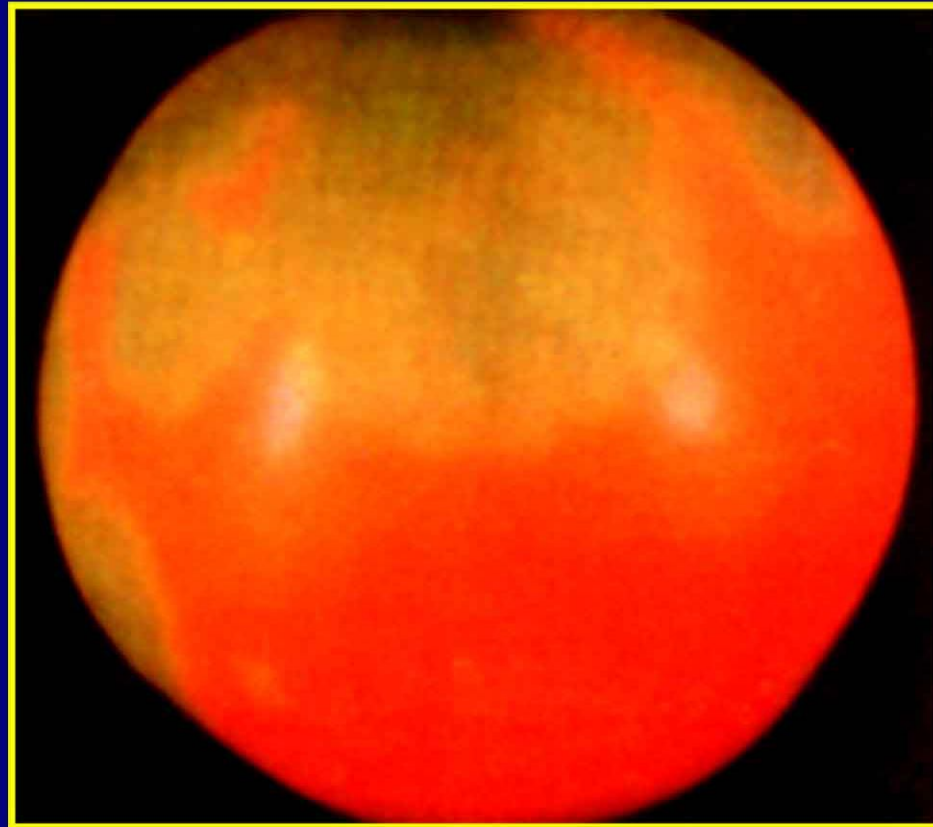


Physiological Disorders

BLOTCHY RIPENING OF TOMATO



CAUSE : Severe water stress; poor potassium uptake and distribution in plant

SYMPTOMS : Irregular ripening; occurrence of green blotches scattered over red skin

REMEDY : Regulated water supply during fruit development; foliar spray of 0.5% KCl

BLOSSOM-END ROT OF TOMATO

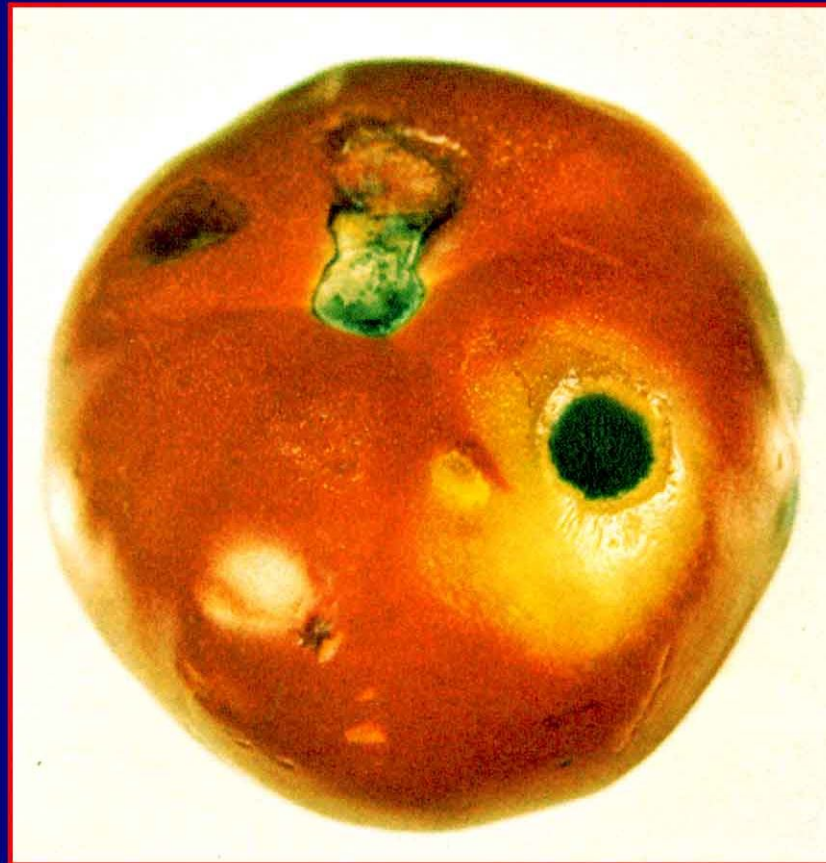


CAUSE : Essentially a pre-harvest problem; initiated during early fruit development stage; local deficiency of calcium in fruit tissue; severe water stress; inappropriate use of fertilizers

SYMPTOMS : Affected fruits showing discoloured, leathery area at distal end, dark and sunken

REMEDY : Adequate water availability during early fruit development; frequent irrigation very effective in dry seasons; addition of calcium salts to the soil or foliar sprayed on young plants

SUNSCALD / SUNSCORCH OF TOMATO



CAUSE : Day-time field temperatures reaching 35-45°C; a form of heat injury coupled with scorching sunlight

SYMPTOMS : Occur in both attached and detached fruits; bleaching of affected area; weakened tissues later being colonised by moulds, alternaria and cladosporium rots causing decay; ripening inhibited and colour development impaired

REMEDY : Providing shade to plants; choosing cultivar with bushy foliage for covering developing fruits; controlling powdery mildew otherwise resulting in defoliation thus exposing fruits; post-harvest handling reducing fruit temperature below 25°C

SUNSCORCH / HEAT INJURY OF TOMATO



CAUSE : High temperature (> 35 - 40°C) after harvest.

SYMPTOMS : Occur in both attached and detached fruits; results in bleaching of affected area; Breakdown of peel due to high respiration leading to wilting; ripening inhibited & colour development impaired; sunscorch followed by moulds, alterneria & cladosporium rots

REMEDY : Providing shade for plants; choosing a cultivar with bushy foliage for providing cover to developing fruits; controlling powdery mildew for arresting defoliation & exposure of fruits; reducing fruit temperature to below 25°C by appropriate post harvest handling technologies

ROOT FORMATION OF ONION



CAUSE : Storage Disorder; Relative Humidity greater than 85% initiates roots within few days at any temperature.

SYMPTOMS : First sign of root formation is swelling of basal plate, followed by cracking of papery scales in the region; new roots are white and plump, about 1 mm in dia. while emerging; but remains of older roots are dark and withered.

REMEDY : Maintaining RH below 85% for preventing root growth; harvested bulbs to be subjected to irradiation treatments for rooting inhibition.

SPROUTING OF ONIONS



CAUSE : Delayed sowing, cool growing period (10 - 20°C); overuse of fertilizer; bulbs with internal disease; mild varieties sprout more readily than pungent types; summer crops & early harvested bulbs sprout sooner; “Market Disorder” accompanied by rise in respiration

SYMPTOMS : Initial sprouting indicated by presence of yellowish-green leaf initials in bulb neck; later shoot emerges from neck reaching over 30 cm length;

REMEDY : Spraying crop with Maleic Hydrazide at 2 weeks before harvest; harvesting at correct maturity high temperature during storage (25 - 30°C); proper curing processess

SKIN - SPLITTING OF ONIONS

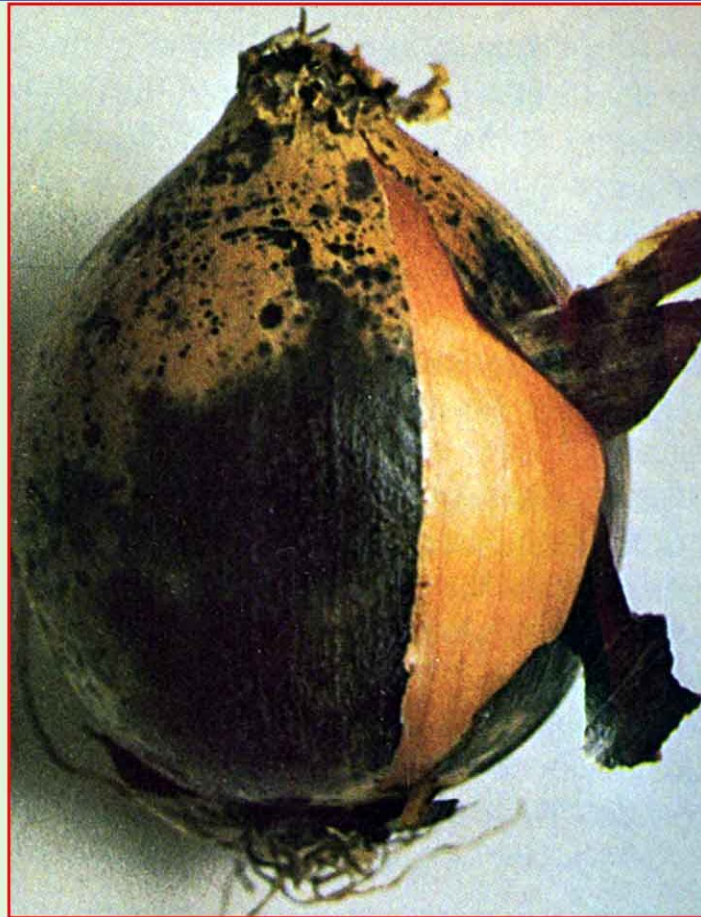


CAUSE : High temperature during later part of growing season

SYMPTOMS : Disorder tends to affect second or third fleshy scale; symptoms develop only after a period of storage

REMEDY : In hot climate, covering of maturing bulbs with soil is recommended

SEA-WATER STAINING OF ONION

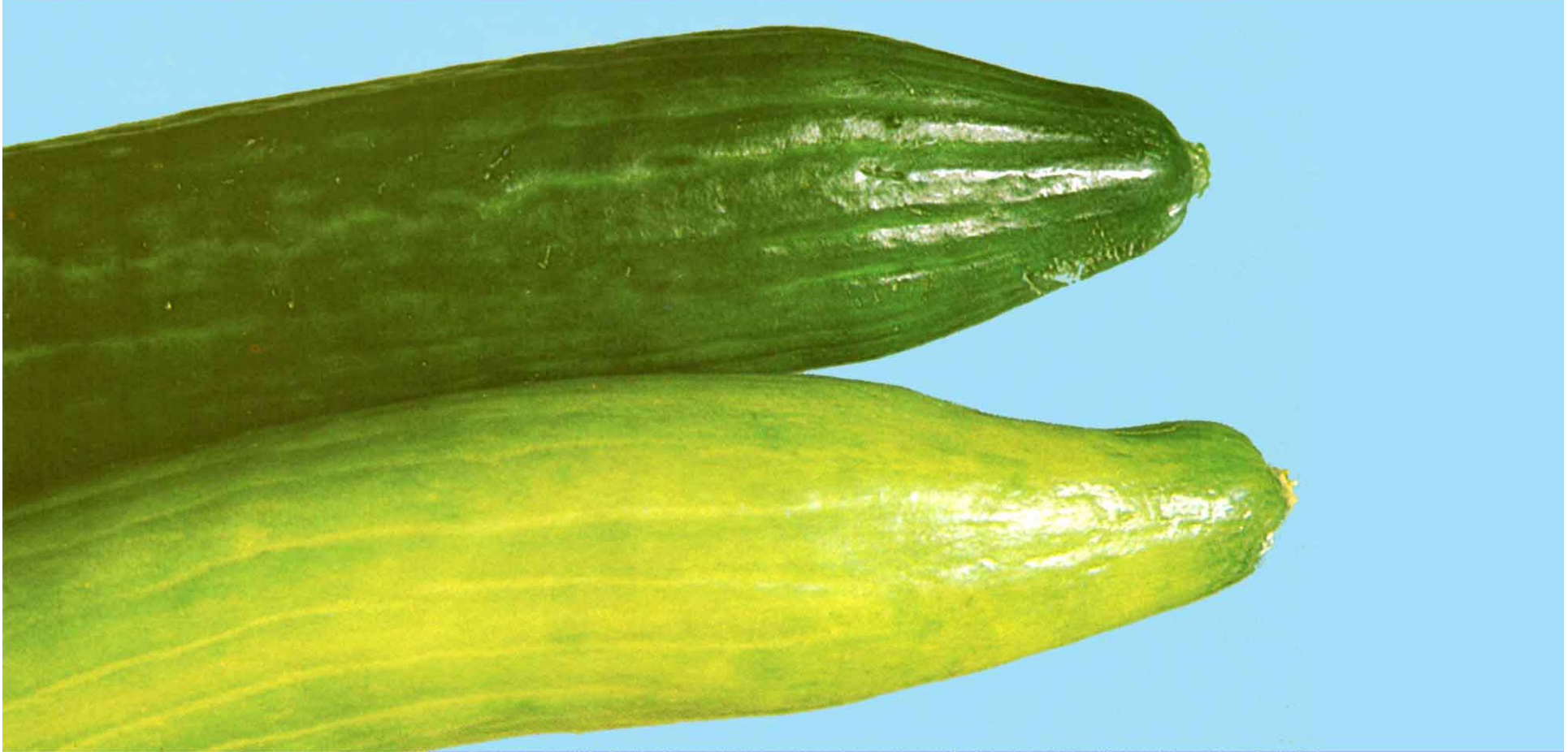


CAUSE : Induced by sea water; also results from action of alkaline substances under damp conditions; due to wet conditions in the field and after harvest

SYMPTOMS : Outer scales characterised by discolouration from dull grey blotches to deep blackness resembling scorching by fire; associated with superficial mould growth following wetting of bulbs by rain or condensation

REMEDY : Harvesting the crop directly and curing in storage instead of in the field; good ventilation necessary to dissipate respiratory moisture during storage

YELLOWING OF CUCUMBERS

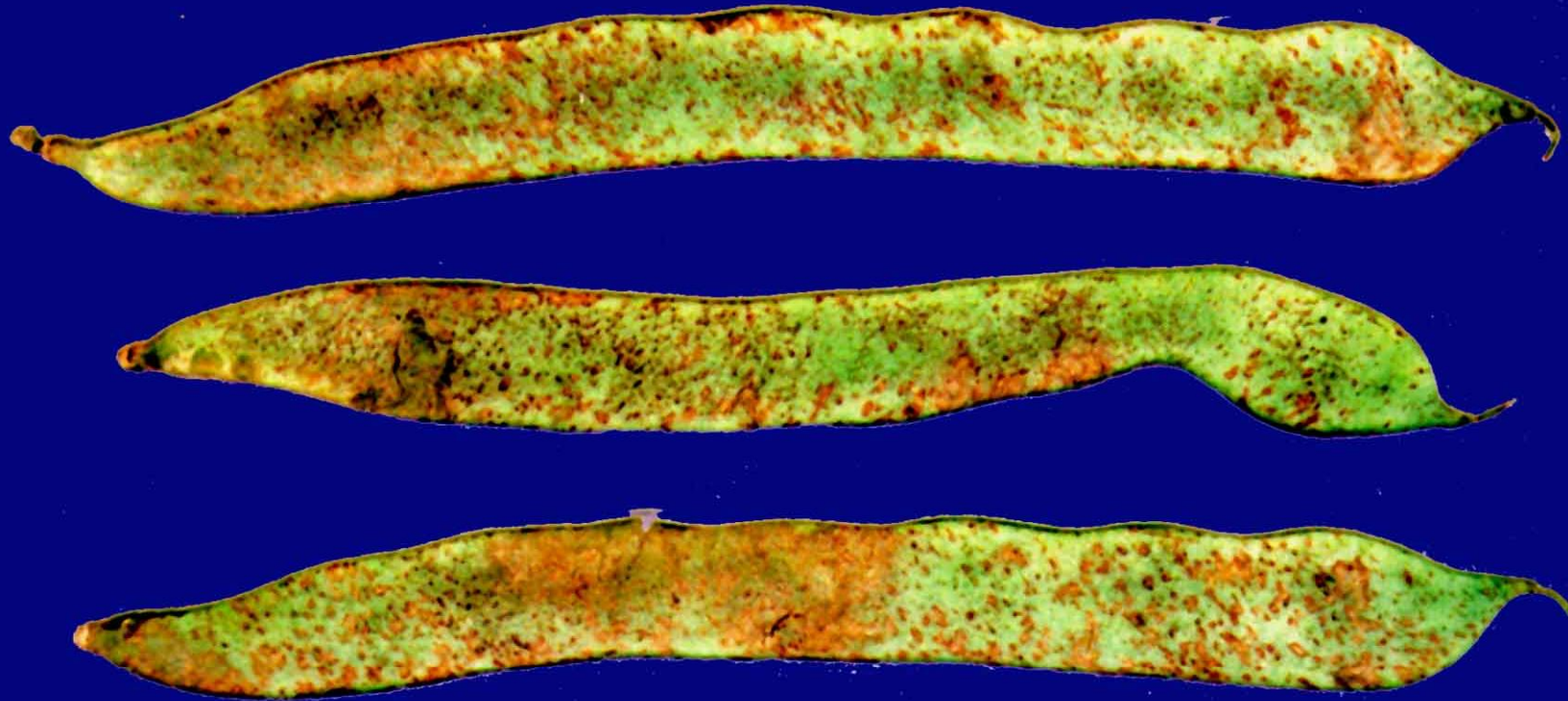


CAUSE : Sign of ageing or senescence; greatly accelerated by the presence of ethylene

SYMPTOMS : Fruits becoming yellowing, flesh softening accompanied by development off-flavours

REMEDY : Use of ethylene absorbent during storage

CHILLING INJURY OF BEANS



CAUSE : Injury induced within few days at temperatures below 5°C; presence of free moisture aggravates the injury

SYMPTOMS : Surface pitting, diagonal brown streaks (rossetting), general dullness; increased susceptibility to decay

REMEDY : Optimum storage temperature ranging from 5 - 8°C

WARTY / SENESCENT BHENDI PODS



CAUSE : Physiological disorder caused by nitrogen deficiency

SYMPTOMS : Pods becoming very hard or warty in appearance thus affecting cooking as well as nutritive value

REMEDY : Proper nitrogen fertilizers

CHILLING INJURY OF CHILLY



CAUSE : Exposure of fruits to less than 7°C during cool season

SYMPTOMS : Surface pitting, premature loss of firmness and increased tendency to decay; alternaria and cladosporium rot often associated with chilling injury; fruits failing to ripen and showing poor colour development

REMEDY : Matured fruits to be stored at 13-15°C for 1 - 2 weeks; prevention of moisture loss by plastic film packaging

CHILLING INJURY OF CAPSICUM



CAUSE : Temperature less than 7°C

SYMPTOMS : Pericarp of fruit becoming wrinkled at distal end

REMEDY : Optimal storage conditions such as high humidity and moderate temperature

BLACK SPEC / PEPPER SPOT OF CABBAGE

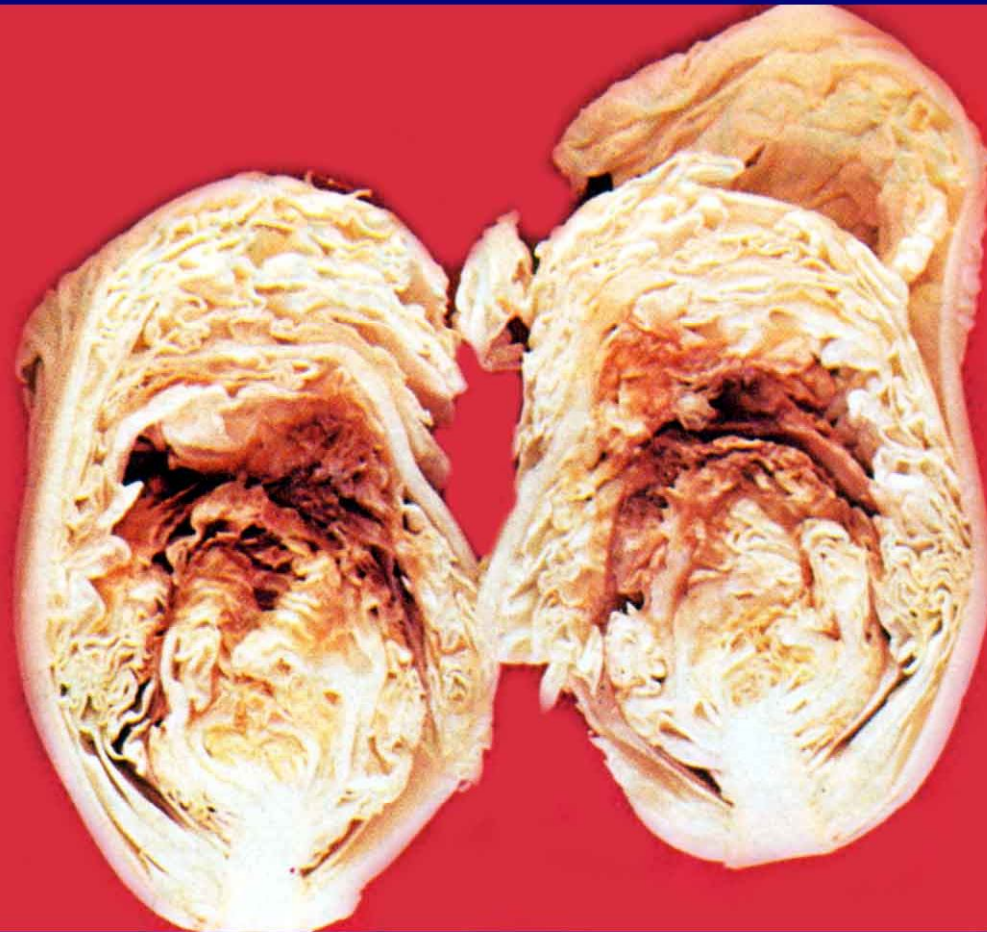


CAUSE : Caused by manganese deficiency; post-harvest fungicide dipping to increase susceptibility to disorder

SYMPTOMS : Black spec resulting from discolouration and collapse of tissue surrounding stomata in both inner and outer leaves of the head; initially specks or minute but develop further, coalescing into more substantial lesions

REMEDY : Spray of manganese salts; controlled atmosphere storage

TIP-BURN OF CABBAGE



CAUSE : Results from improper distribution of calcium within the plants causing calcium deficiency;
water stress

SYMPTOMS : Serious disorder when affecting the inner leaves; margins becoming brown and papery,
later turning dark brown to black; affected areas be restricted to the edges or extended to
half the leaf; injured tissue predisposed to attack of soft-rot bacteria

REMEDY : Closer spacing, reduced N application; adequate soil moisture at all times

BLACKHEART OF CELERY



CAUSE : Calcium deficiency disorder; water stress; temperature and humidity at harvest

SYMPTOMS : Margins and tips of heart leaves turning brown and later black; symptoms appear at later part of growing season; worsened during storage

REMEDY : Calcium spray or soil drenching; adequate irrigation especially during later part of growing season

VASCULAR DISCOLOURATION / STREAKING OF TAPIOCA



CAUSE : As a result of complex bio-chemical changes following wounding discoloration occurs within 24 hours at 35°C results from severe stress, increased respiration rate & ethylene production

SYMPTOMS : When tubers cut transversely, blue-black discoloration is apparent in the ring of vascular tissue; in longitudinal sections, disorder takes the form of streaks, called as “blue vein”; cooking quality and taste impaired

REMEDY : Pruning arial parts 2 or 3 weeks before harvest; heating the tubers for short period before storage or keeping them immersed in water

GREENING OF POTATO

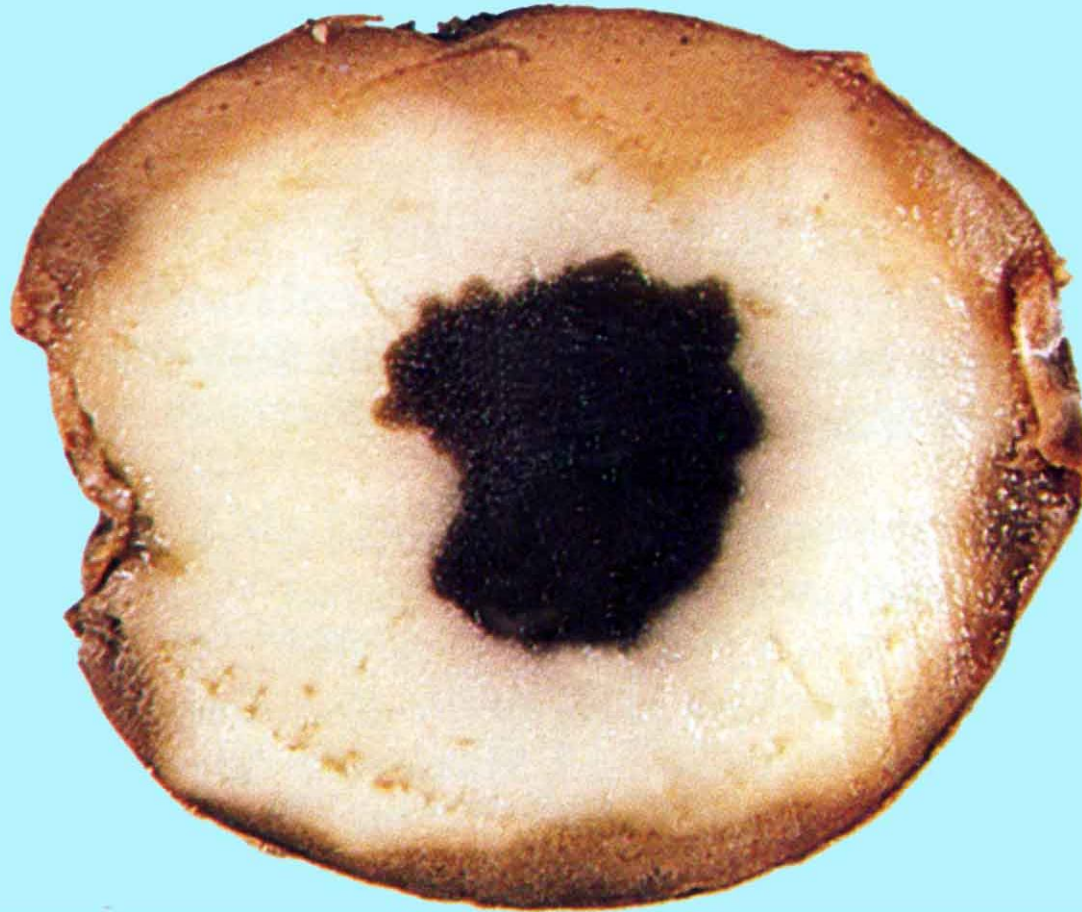


CAUSE : Tuber when exposed to light in the field if tubers project above soil surface

SYMPTOMS : Characterised by intense colouration of path of tuber when exposed to sunlight for several weeks

REMEDY : Planting seed tubers at correct depth; earthing of plants when necessary; storing potatoes in complete darkness

BLACK HEART OF POTATO



CAUSE : Insufficient oxygen in storage leading to anaerobic respiration; excessive carbondioxide concentration; high temperature because of high respiration.

SYMPTOMS : Central core becoming dark; browning of internal tissues.

REMEDY : Optimum storage condition.

THUMB-NAIL CRACKING OF POTATO



CAUSE : Irregular water supply; very low soil and air temperatures; tubers handled roughly after cool dry storage

SYMPTOMS : Curved cracks, known as thumb-nail cracks because of the shape develop due to sudden swelling of tuber tissue, followed by cracking; split tissue develops corky layer during wound-healing

REMEDY : Judicious water and fertilizer supply; harvesting during warm period

INTERNAL RUST SPOT OF POTATO



CAUSE : Localised calcium deficiency; large or long tubers affected much; inadequate water supply during tuber development

SYMPTOMS : Dry, corky, reddish-brown blotches in the flesh of tubers towards the “rose end”; affecting tuber quality

REMEDY : Adequate water supply during tuber development; spray of calcium salts during tuber development

SPROUTING OF POTATO



CAUSE : Storage disorder; hot dry climate before harvest; moisture loss accelerates, leaving tubers soft, flabby with increased susceptibility to sprouting; higher respiration during storage

SYMPTOMS : New shoots grow out of eyes, located mainly at “rose end”; sprouts are pale yellow in dark but purple or greenish when formed in light

REMEDY : Storing the tubers at 4 - 5°C

FREEZING INJURY OF CARROT



CAUSE : Occurs at temperature below 0°C due to presence of dissolved sugars.

SYMPTOMS : Cells killed; ice crystals protrude from tissues; loss of weight.

REMEDY : Optimum storage condition.

COMB EFFECT OF BANANA



CAUSE : Manganese deficiency in the plantation

SYMPTOMS : Marginal chlorosis; developing along main transverse veins, leaving interveinal areas greener, thus giving leaf a striated appearance from edges (Chlorosis in a **comb** form)

REMEDY : Soil application of 40 kg / hectre manganese sulphate or foliar spray of 0.3% MnSO_4

YELLOW PULP OF BANANA



CAUSE : Abnormal growing conditions, nutrition imbalance, stress and defoliation; factors delaying fruit maturation (Sigatoka leaf spot & excessive shade), magnesium deficiency in delayed maturity

SYMPTOMS : Yellowing or a honey-coloured tint to normally dull white pulp at harvest accompanied by softening of pulp in centre of the finger.

REMEDY : Magnesium and sulphur application reduces incidence.

CHILLING INJURY OF BANANA



AFFECTED

NORMAL

CAUSE : Induced by temperatures below 12 - 14°C; even few hours at chilling temperature sufficient to induce irreversible changes.

SYMPTOMS : Dark and water-soaked areas on the peel; brown, under-peel discoloration, appearing as streaks in longitudinal cut or as a ring of brown dots in a transverse section; finally fruits turn black and pulp off-taste.

REMEDY : Injury prevented by use of oil-based dip.

SOFT NOSE / SPONGY TISSUE OF MANGO

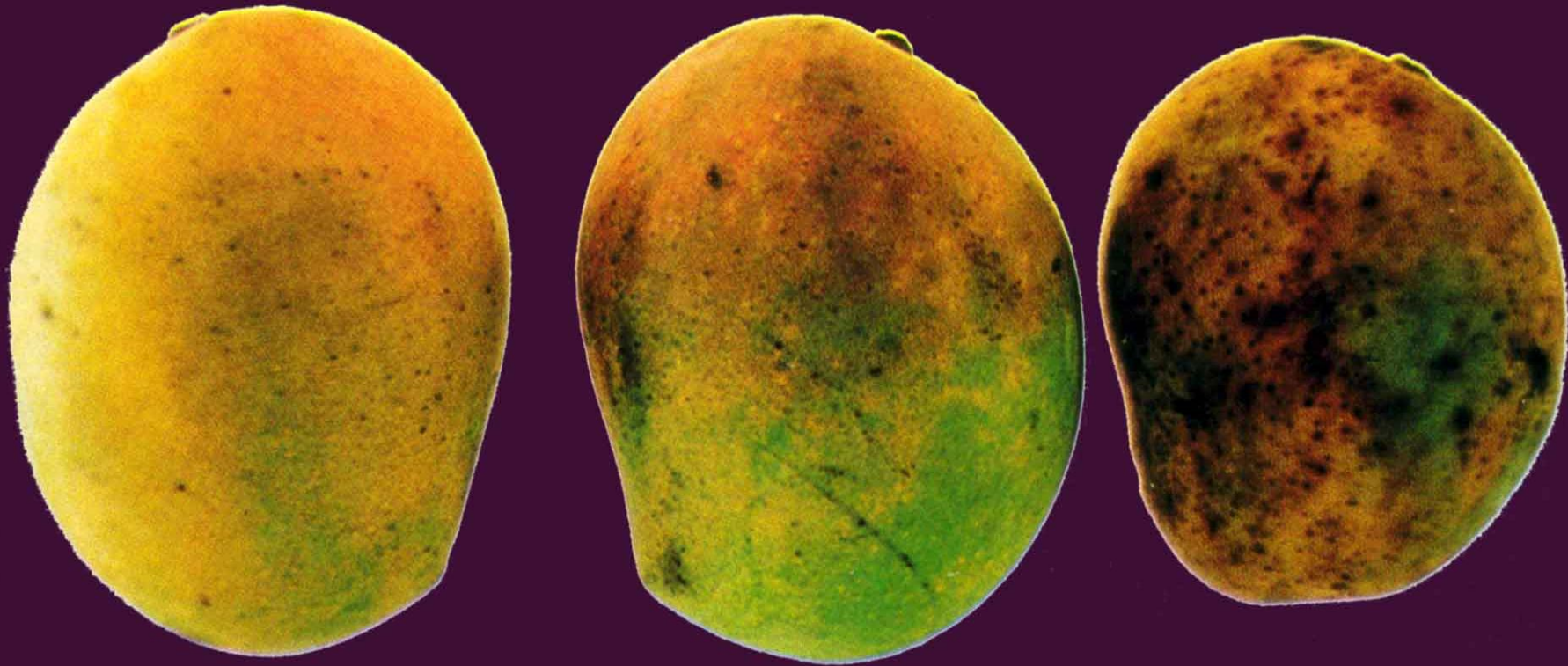


CAUSE : Late harvest of fruits; Heavy nitrogen application.

SYMPTOMS : Affected tissue becoming spongy grey mass extending throughout the fruit; sore odour and off-taste.

REMEDY : Picking fruits early; hastening ripening by ethereal spray; high calcium application.

CHILLING INJURY OF MANGO



CAUSE : Risk of injury at 7 - 13°C.

SYMPTOMS : Brown blotches, greyish discolouration and pitting; uneven ripening; development of aroma and flavour affected; significant increase in susceptibility to decay.

REMEDY : Storing at optimum temperature.

BLOSSOM-END ROT OF WATERMELON



CAUSE : Developed as fruit matures during late summer; characterised by high temperature, low humidity and warm dry winds; also related to calcium concentration in fruit tissues

SYMPTOMS : Cylindrical-fruited cultivars are highly susceptible; symptom being dark sunken area at distal end of the fruit

REMEDY : Lime-deficient soils require gypsum amendment; increasing irrigation frequency for efficient mineral uptake; growing sperical-fruited cultivars

SOLAR INJURY / SUNSCALD OF WATERMELON



CAUSE : Result from ultra-violet radiation or heat or combination of both; inadequate foliage cover to shade maturing fruits

SYMPTOMS : Patchy ground colour or bronzing, discolouration of net; affected area becoming sunken and blotched; injured tissue becoming sunken or wrinkled; flesh quality impaired

REMEDY : Applying white-wash for reflecting sunlight and heat; providing shade

CHILLING INJURY OF PAPAYA



CAUSE : Occur at temperature as high as 15°C.

SYMPTOMS : Small spots of 1 - 2 mm dia., dark olive on green fruits and light brown on yellow fruits, may coalesce forming scaled like areas on skin; breakdown of pulp; increased susceptibility to decay (alternaria rot).

REMEDY : Preconditioning fruits at 10 or 15°C for few days prior to cool storage thus allowing some ripening and reducing chilling sensitivity.

HEN AND CHICK DISORDER OF GRAPES

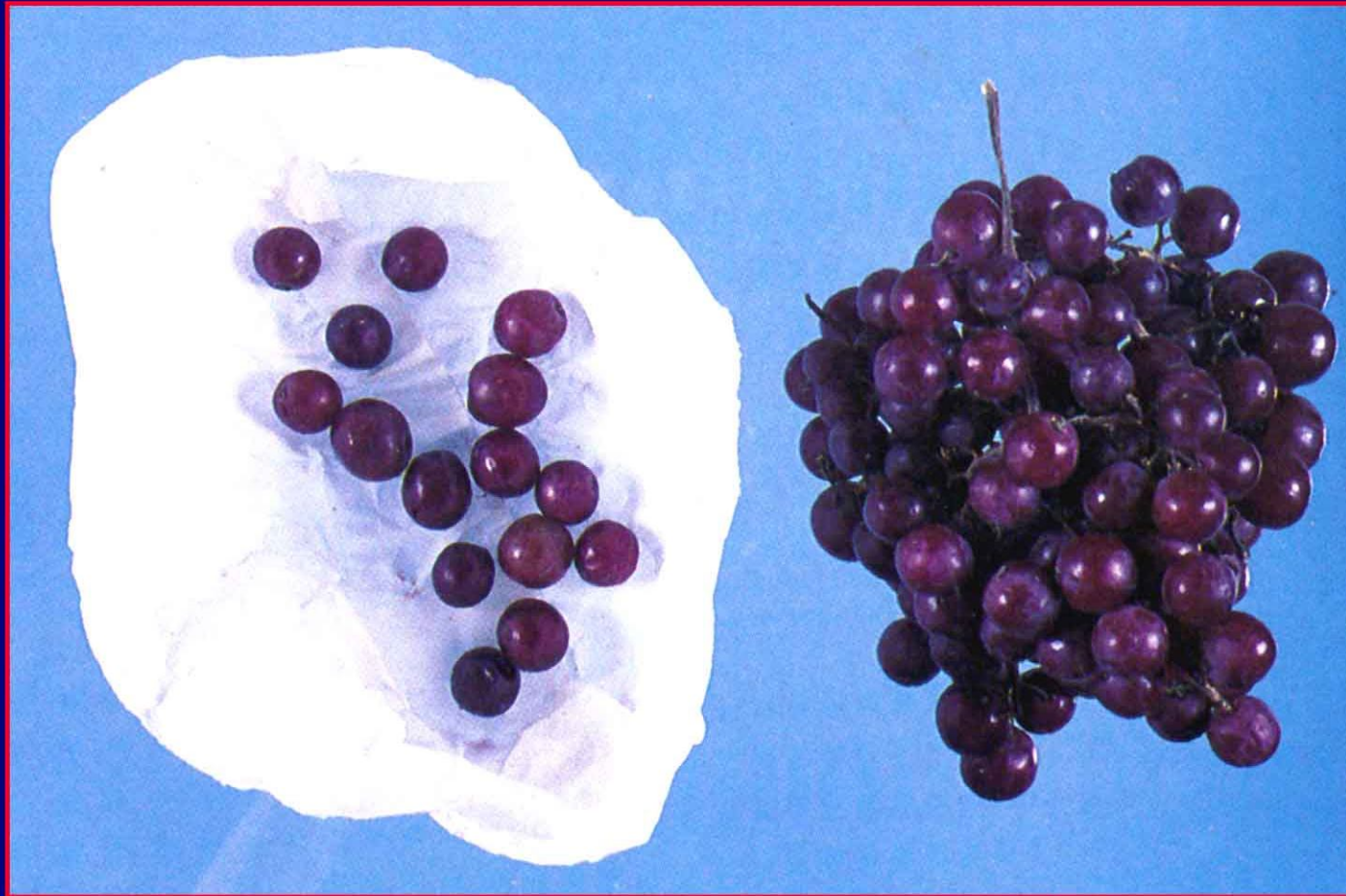


CAUSE : Boron and zinc deficiencies

SYMPTOMS : Degeneration of meristematic tissues; number of bunches per vine reduced; fruits set highly hampered; more number of small and seedless fruits seen surrounding big berries ("Hen & Chicken"); such fruits sour in taste and weigh lesser than normal berries

REMEDY : Foliar spray of 0.3% Boric acid + 0.5% Zinc Sulphate at the onset of fruit development

BERRY DROP OF GRAPES



CAUSE : Moisture stress during growing season; High temperature at harvest; Delay in cooling harvested crop; Seedless berries treated with GA prone to berry drop.

SYMPTOMS : Shorter length of vascular strands torn from interior of berry and project from capstem in the form of “brush”; Excessive ethylene production promoting senescence of connecting tissue; mild freezing causing injury to stem tissues.

REMEDY : Regulated water supply during berry development.

SULPHUR DIOXIDE INJURY OF GRAPES



CAUSE : Severity of injury determined by amount of SO_2 entering the berry at the point of junction between berry and capstem.

SYMPTOMS : Numerous small, sunken, bleached spots on each berry, with clear demarcation between and normal skin; injured berries predisposed to moisture loss and tend to shrivel.

REMEDY : Cultivars tolerance available; grapes to be given cooling before packing to reduce SO_2 emission.

OLEOCELLOSIS / RIND-OIL SPOTTING OF CITRUS



CAUSE : Occurs before harvest due to compression of fruits in contact with one another in same bunch or following a sudden spell of cold weather; physical injury to peel.

SYMPTOMS : Injured areas are firm, irregular in shape and discoloured yellow, green or brown; oil glands appearing prominent because of a slight sinking of tissues between them; lesions of varied size cover much of fruit surface.

REMEDY : Spray of ethereal; refraining from irrigating crop during the month before harvest; avoiding picking fruits too early in season or during early hours of morning.

CHILLING INJURY OF CITRUS



CAUSE : Occurs at temperature between 10 and 15°C.

SYMPTOMS : Fruits possess off-taste; predisposed to decay; brown pitting of rind; discrete, depressed lesions surrounded by diffused brown hallo; internal and external tissues are soft and water-soaked with odor of fermentation.

REMEDY : Storing at above critical temperature reducing moisture loss by applying oil, wax or film; conditioning of fruits by prior storage for few days at higher temperature.

FREEZING INJURY OF CITRUS



CAUSE : Caused by temperature below freezing point of -1.5°C ; occur before harvest during frosty weather; or after harvest due to improper storage / carriage conditions.

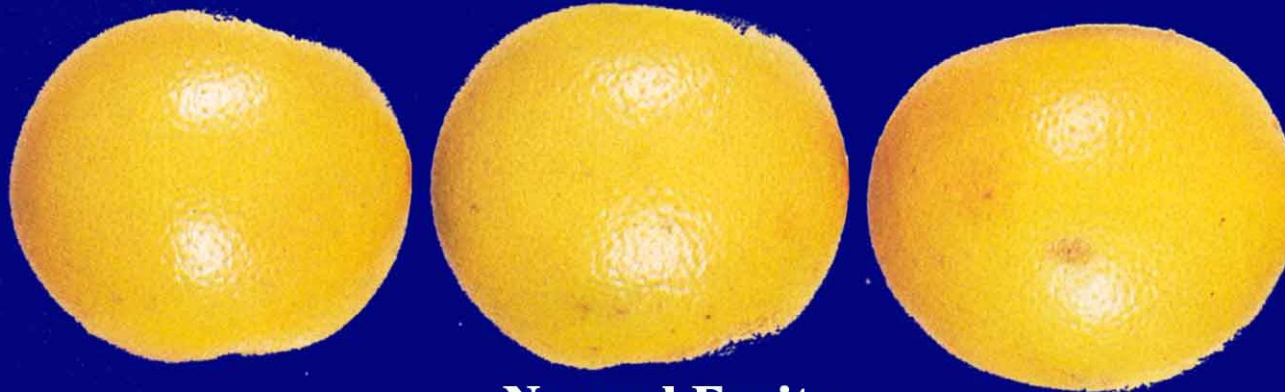
SYMPTOMS : Browning of peel or breakdown; no external symptoms; membranes between segments appear water soaked showing numerous white crystals; tissue dries out and cavities develop

REMEDY : Beneficial application of irrigation water; protecting trees from frost.

PITTING OF GRAPE FRUIT



Pitted Fruits



Normal Fruits

CAUSE : Caused by chilling temperature between 0 - 15°C.

SYMPTOMS : Water soaking, surface pitting, internal discolouration, failure to ripen, accelerated senescence & increased susceptibility to decay. injury results from disrupting normal metabolism

REMEDY : Ascertaining and maintaining appropriate critical temperature in storage; pre-treatment with ethylene; use of post-harvest fungicides; minimizing moisture loss by wax coating

CHEMICAL INJURY OF CITRUS



CAUSE : Caused by improper use of post-harvest fungicides.

SYMPTOMS : Circular discoloured areas resulting from retention of liquid between adjacent fruits; generalised browning / reddening of peel.

REMEDY : Adjustment of pH of spray solution.

CHILLING INJURY / INTRNAL BROWNING / BLACK HEART OF PINEAPPLE



CAUSE : Important disorder leading to rejections in cannery and heavy losses when sold fresh; risk of injury at temperature 7 - 12°C or even higher..

SYMPTOMS : Watery spot at the base of fruitlet arising from core tissue; more lesions develop and coalesce; In severity much of the core and surrounding tissue discoloured brown or even black.

REMEDY : Irrigation during dry weather; harvesting at optimal maturity; dipping the fruit in wax; optimal storage of 25°C.

BITTER PIT OF APPLE

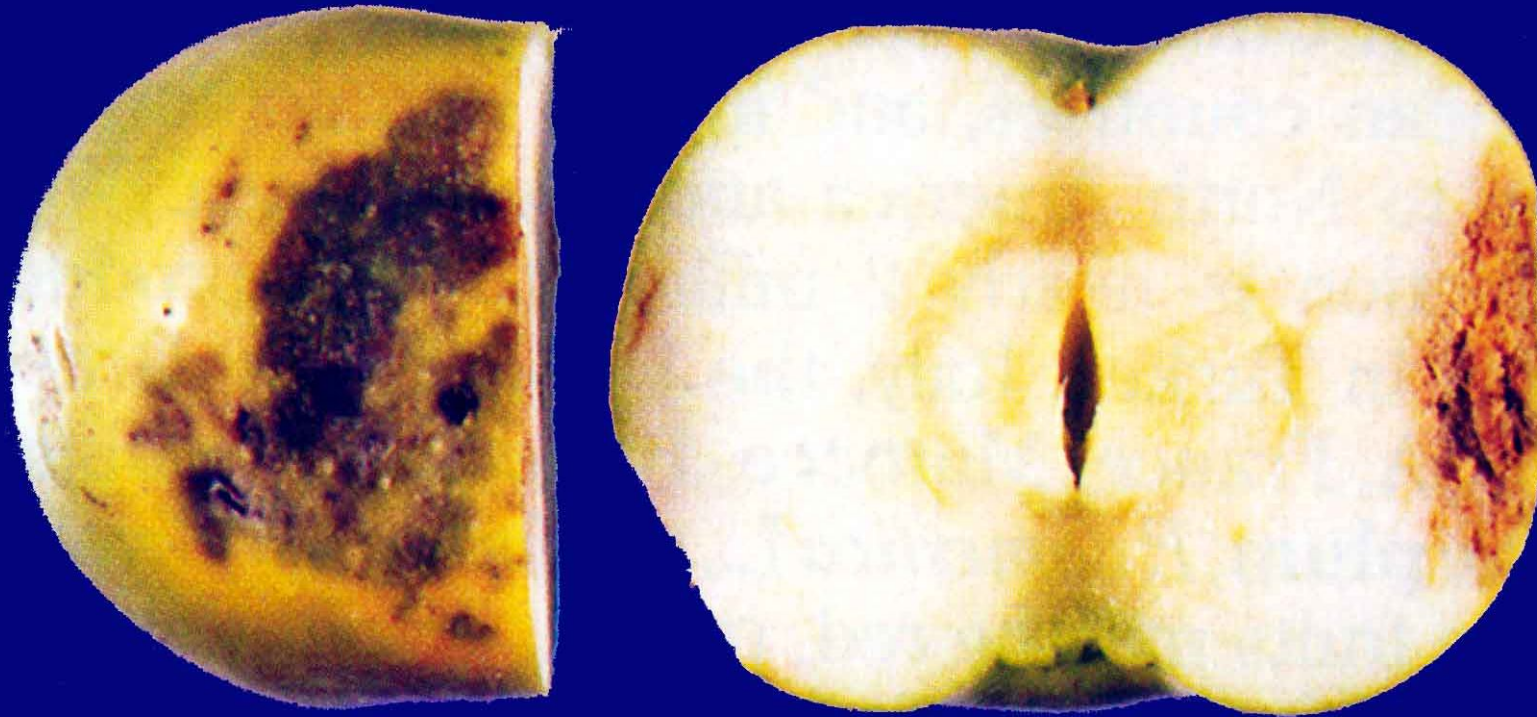


CAUSE : Insufficient Calcium supply due to imbalanced Magnesium or Potassium; Excessive tree vigour; Excessive fruit thinning; Hot dry weather.

SYMPTOMS : Characteristically hard, sunken and discoloured pits (2 - 3 mm dia); Internal lesions; Affected tissues dry, brown and spongy with bitter taste

REMEDY : Several times spray with Calcium compound; Controlled or modified storage atmosphere.

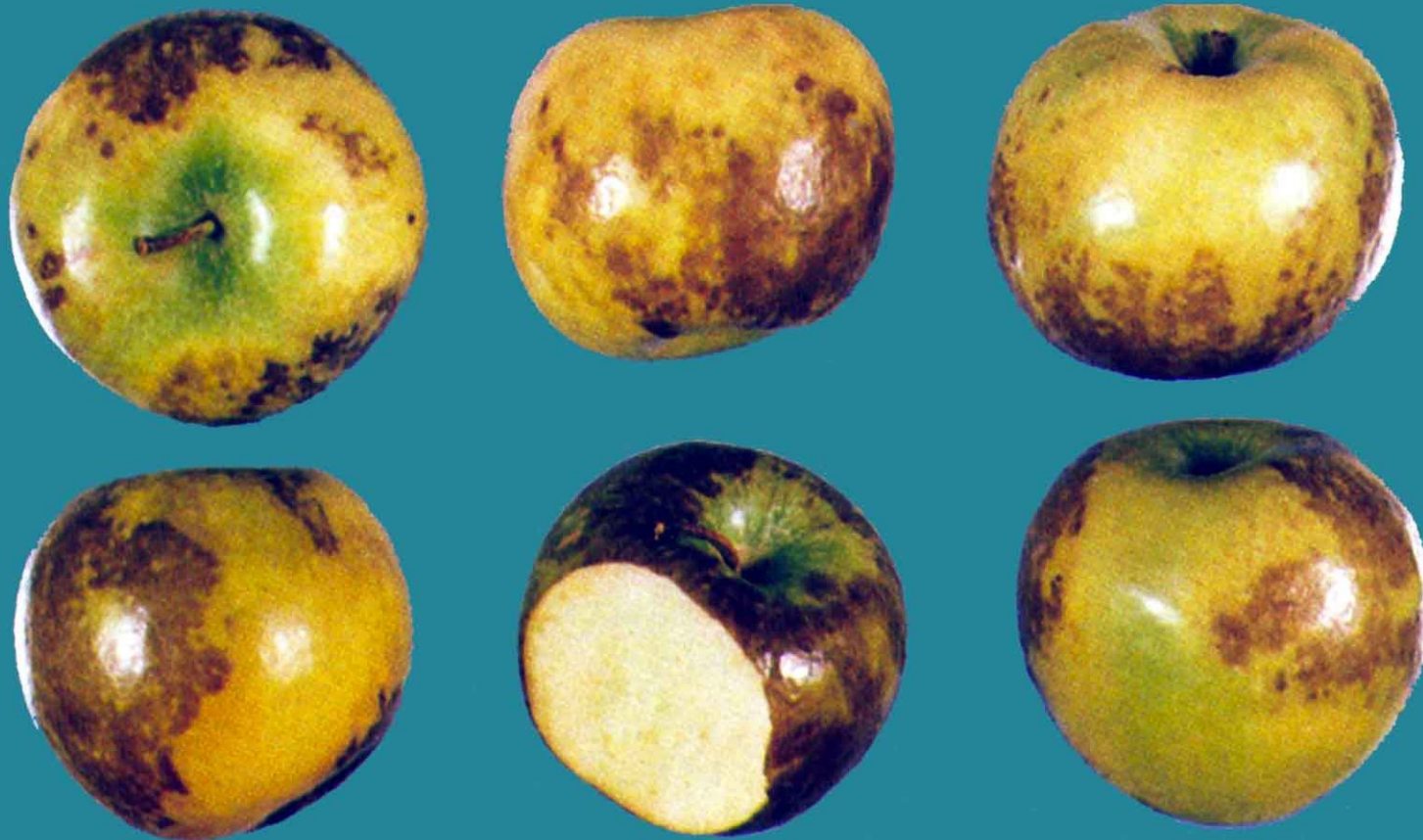
SUN SCALD OF APPLE



CAUSE : Fruits exposed to sun.

SYMPTOMS : Affected skin appearing bleached, darkening to almost black during storage; Developing brown lesions in storage.

SUPERFICIAL SCALD OF APPLE



CAUSE : High nitrogen and low calcium; Fruits harvested after hot dry period; Accumulation volatile products (Farnesene) giving rise to substance injurious fruit skin.

SYMPTOMS : Diffused brown patches on skin randomly distributed; Flesh immediately beneath the skin turning brown.

REMEDY : Harvesting at optimal maturity drenched with diphenylamine; Adequate fresh air ventilation with low oxygen in storage.

BRUISING OF APPLE



CAUSE : Physical injury resulting in brown substances (polyphenols) formation; small fruits affected largely; Cooler temperature and delayed harvesting; Increased respiration.

SYMPTOMS : Sunken pits present mostly on shoulders; bruises flattened and greyish lesions visible externally; affected internal tissue dries out and becomes corky.

REMEDY : Artificial waxing; Appropriate packaging.

CHILLING INJURY / LOW TEMP. BREAK DOWN OF APPLE

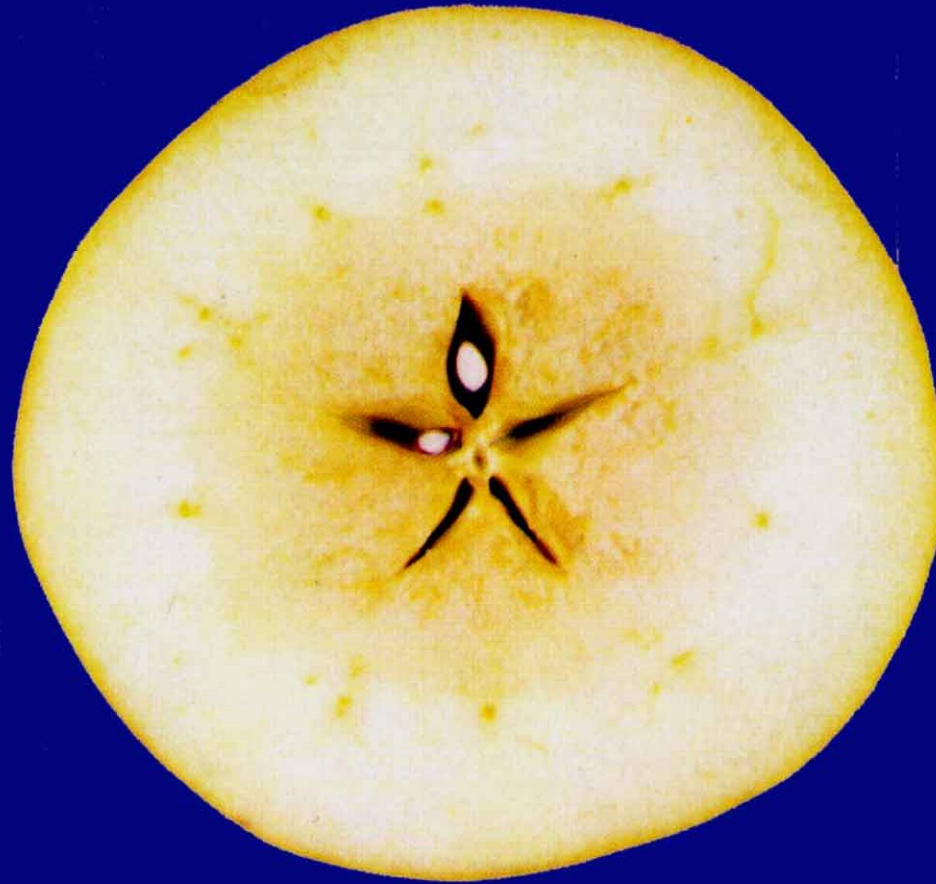


CAUSE : Critical temperature below 2 - 3°C; Lower calcium and phosphorus contents in fruit tissues; Higher humidity and carbon dioxide in storage.

SYMPTOMS : Flesh appear brown and moist; narrow zone of normal tissue immediately beneath the skin turning brown; skin becoming water logged and discoloured.

REMEDY : Storing fruits at temperature above critical; Foliar spray of phosphate and calcium compounds.

BROWN CORE / CORE FLUSH OF APPLE



CAUSE : Results from low temperature injury, carbon dioxide injury or senescence; Heavy N application; Spray of PGR (Daminozide)

SYMPTOMS : Pinkish or brownish discolouration of the core tissue between seed cavities.

REMEDY : Use of an antioxidant (Diphenylamine); Intermittent warming during storage; Removing Ethylene from storage atmosphere.

LENTICEL SPOT / JONATHAN SPOT OF APPLE

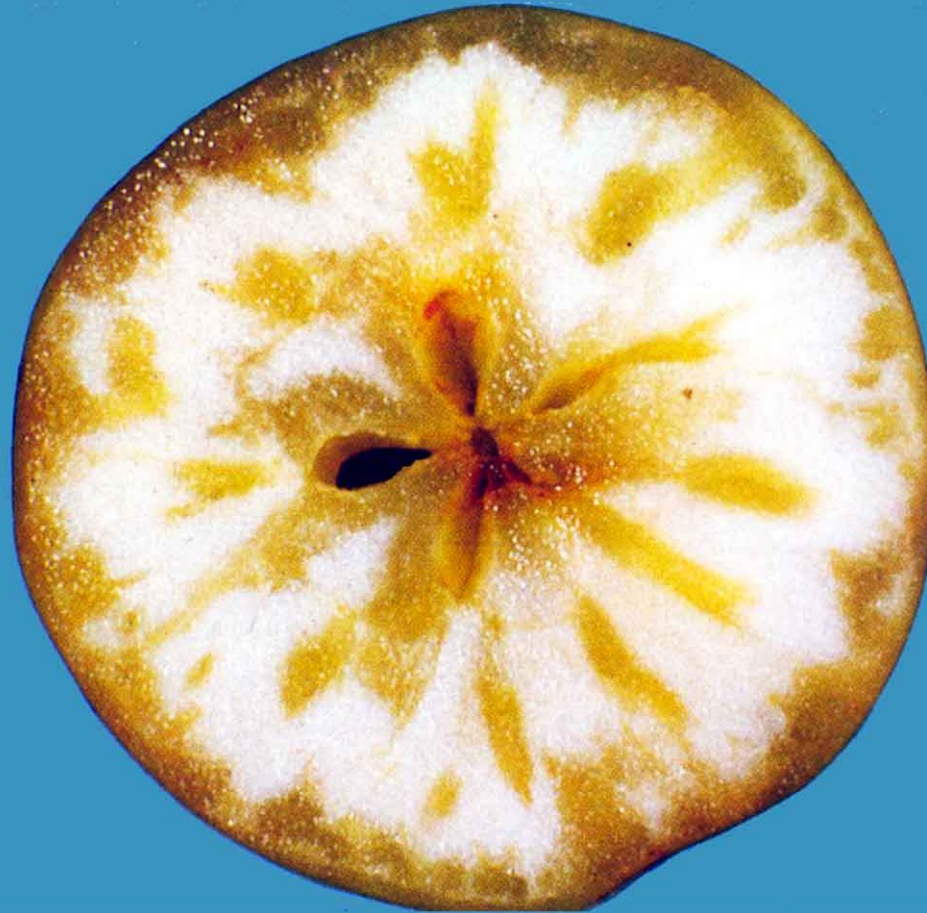


CAUSE : Artificial UV light; Excessive N fertilizer; Early harvesting; Prolonged storage.

SYMPTOMS : Brown to black spots developing on skin; Characterised by haloes surrounding the lesions.

REMEDY : Increased carbon dioxide; low storage temperature; altered fertilizer application.

WATER CORE OF APPLE



CAUSE : Cell sap leakage into intercellular spaces; rapid conversion of starch to sugar; inadequate calcium nutrition; alternation of hot bright days with cold nights.

SYMPTOMS : Translucent areas of tissue present around vascular bundles or scattered in flesh towards calyx - end of fruit.

REMEDY : Right time of harvest; cold storage.

BROWN HEART OF APPLE (Carbon dioxide injury)



CAUSE : Excessive concentration of carbon dioxide in the tissue ($> 3.0\%$)

SYMPTOMS : Affected fruits normal in external appearance; when cut in half patches of brown flesh between core and skin.

REMEDY : Maintaining carbon dioxide concentration below 2% while storage and shipment.

BITTER PIT / CORKY SPOT OF PEARS



CAUSE : Low level of calcium (< 5 mg / 100 gm fresh mass); Excessive potassium uptake; water stress induced by high temperature or inadequate irrigation.

SYMPTOMS : Affected fruits develops small sunken areas near calyx end; skin darker green; Tissues beneath pits becoming brown, dry and corky.

REMEDY : Spray of calcium chloride or calcium nitrate 4 or 5 times during fruit development; Prompt harvest at maturity.

BREAKDOWN / SENESCENT SCALD OF PEAR



CAUSE : Late picking, cooled slowly or stored for longer period.

SYMPTOMS : Develop numerous small brown spots and the entire skin turning brown soon followed by fungal decay; darkening of vascular strands in the neck of pear (vascular browning); aroma and taste seriously impaired.

REMEDY : Harvesting at optimal maturity; Rapid cooling of fruits immediately after harvest.

CHILLING INJURY OF AVOCADOS



Normal



Affected

CAUSE : Low level of calcium; Temperature below critical value resulting in abnormal metabolism;
Presence of ethylene.

SYMPTOMS : Dark patches on the skin; general greyish discolouration of pulp; dark brown dots in the pulp;
Distal end of fruit easily affected.

REMEDY : Storing fruits 10 - 30°C; Withdrawing ethylene from storage atmosphere.

INTERNAL DARKENING OF AVOCADOS



CAUSE : Induced by chilling temperature; improper ventilation during storage; water stress.

SYMPTOMS : Greyish or black discolouration of pulp starting at the distal end and around the stone.

REMEDY : Proper irrigation during early stages of fruit development; Proper ventilation during storage.