

Appendix 1: Report on a fact finding visit to the USA by Peter Waldock.

Pumpkins 'It's all about the handle'

Visit report to the USA to look at Pumpkin production and marketing techniques, early October 2015. The visit was timed to see as much crop production and marketing as possible. The crop was still being harvested on the West Coast but had already been cleared on the East Coast as the season had been poor (wet and cold) and demand was outstripping supply.



The US market is far more developed than the UK with annual production of 49,500 acres and 145 million dollars (£100m) at farm gate (a per head spend of 49.3 cents / .34p per person) The UK per head spend is .087p (based on a 7m and 80m population) and this shows how much opportunity we have in the UK to grow the market. Retailers are very focused on Halloween and there are even 'pop up' Halloween shops just for the season.

The Key states producing pumpkins are

California –	1,922 000 cwt
Illinois -	7,458,000 cwt (figure included canning production for pumpkin pie)
Michigan -	970,000 cwt
New York -	690,000 cwt
Ohio -	1,053,000 cwt
Pennsylvania –	1,050,000 cwt

United States - 13,143,000 cwt

Vegetables USDA, National Agricultural Statistics service January 2015

During the trip I visited growers and breeder's in California, New York, Ohio and Pennsylvania.

Grower size on the East Coast

Average size – 4 – 5 acres with a big grower – 40 acres

Very big growers – 100 acres plus

Couple of vast growers – 2000 and 6000 acres

Fruits are expected to be cleaned or washed as the presence of mud / soil / chemical deposits will downgrade the fruit value.

The biggest market sales volume in retailer ranking is Walmart, Home Depot and Lows. Interestingly all the big retailers are even buying pumpkins on a store by store basis, as well as centrally, and often growers will agree a price with a store manager and supply direct and are sometimes paid cash on delivery. The first deliveries into store will be around mid-September with consumers buying pumpkins over a number of weeks so that by the time they get to Halloween they could have 3 or 4 pumpkins on the porch. Interestingly all the growers and retailers see pumpkins very much as a fresh produce product and not a storage product so understand that it needs to be handled carefully and that they may have a few losses on the way. No 'display until' date was put on anything and once carved the product was only expected to last a day or two.

There is a separate market for hard shelled varieties for painting and a number of stores stocked hand painted fruits at a premium sales value. There are also specialist carvers who will carve amazing things out of a pumpkin in the same way that Ice is carved.



Farm Markets (farm shop selling their own grown produce) are very popular and they will grow for sale. They will have other attractions to encourage the public to make it a family outing. One that I visited grows around 40 acres of fruits to get about 30,000 fruits of over 35 different types and varieties and will generate over the 6 week sales period more income than they generate over any other 12 week period including Christmas. The activities that they had included a maize tepee, tractor rides and a petting small animal area. They aimed at the family smaller child market rather than the 'Horror' aspects of Halloween.



Fruit was sold based on size

Economics

Growers are targeting 70 to 80 bins per acre, with the 1 x 1.2m card bin as used in the UK being the standard size. The fruit size will dictate the bin fill and the value per bin sold is relatively standard at an average of around \$130 to \$140 per bin of the carving types and \$230 per bin for the pie types. This should deliver back to the grower circa \$10,375 per acre and once costs are taken off (\$3,500 per acre) a net yield of \$ 6,300 should be achieved. The costs per bin are around \$10.00 transport to market, \$10.00 to wash and \$18.00 for the card bin. The field breakeven is around 40 bins per acre.

Pollination

All growers are introducing pollinators into the crop. In the East the small and medium size growers are predominantly using honey bees. They to have a working relationship with a bee keeper which is often in the form of the Farm owning the hives and the beekeeper managing the bees and keeping the honey for their efforts. The bees are recognised as being able to travel 3 – 4 miles so the hives tend to be located at a couple of strategic locations on the farm, a rough rate of provision is one hive with 4 supers per 3 acres. Around 60,000 bees are anticipated to be in a hive with 4 supers and the bees must be active from the first female flower opening. If Honey bees are not available, then Bumble bees are being introduced at a rate of 2 per acre but they have to be spread out over the farm and they usually make a tent from 2 pallets to put the hive under for protection. All spraying is done later in the day or at night to minimise the impact on pollinators working in the crop. Once the female flowers are closed for the day the pollinators tend to return to their hive.

Poor pollination will lead to a lower yield, more mis-formed fruits and out-grades / fruit abortion. There is also a recognised solitary bee the eastern Cucurbit bee (*peponapis pruninosa*) which the growers are very proud of and the female bee uses cucurbit pollen only to feed her young.

Cucumber Beetle

The principal pest that growers are spraying against is cucumber beetle of which there are 2 types; the spotted and the striped types. The spotted comes up from the south and is the one that has the biggest crop impact. It tends to be carrying bacteria from the southern cucurbit crops and will quickly infect crops by feeding. The spotted does not tend to overwinter in the east as it is not cold hardy. The striped will overwinter in the eastern cucurbit production areas but is not such a concern as it does not tend to carry the pathogen bacteria which can be so crop destructive. Imacloprid is sometimes being used through the dripper system as a systemic as well as contact pesticide applications to kill the Cucumber beetle as well as any aphid issues that may come into the crop.



(University of Kentucky)

Aphid

Aphid will be carried up country from the south and they are often carrying viruses. The principal viruses are Zukini yellow mosaic, papara ringspot, watermelon mosaic. In the East, viruses will not kill a crop though they can set it back. However growers in the south where is it hotter can lose a crop to virus. The Cucumber beetle controls are recognised as also controlling the Aphids on the crop.

Bacterial wilt

When a plant is infected it will never recover and will not yield fruits of a size or quality to be economically viable. The bacteria spread through the plants vascular system causing it to collapse on hotter days due to the limited water movement in the plant.

Phytophthora

At one point it was thought that Phytophthora would severely restrict cucurbit production in the East. However, growers have learnt to manage the disease by using longer rotation, an awareness of how easily it spreads in water and on contaminated equipment, boots etc. and encouraging good soil health. Infection in the field will lead to plant collapse and an infected fruit will have no shelf life. It will collapse suddenly with tell tale white spores developing on the surface. The breeders are also aware that Phytophthora resistance in the plant would be advantageous and have been working to breed in resistance from wild cucurbits that can grow in affected and waterlogged land without showing symptoms of the disease.

Powdery mildew.

From the 1 acre to the 2000 acre growers they are all spraying every 7 to 10 days against Powdery mildew. They recognise that by keeping the crop clean of powdery mildew they can improve the stalk (handle) and thus enhance the value of their crop (the market won't accept stalk less fruits as its recognised that most fruit collapse comes from poor stalk quality. Some of the growers are putting the fungicide on at an incredibly high volume (almost to a drench volume) and are using nozzle types to ensure that all the plant and fruit surface is being coated.

A twisted stem on the fruit can be a sign that the plant was infected early on with PM.



Downey mildew

Historically growers believed that the Downey mildew was coming up from the southern cucurbit growers each year but they now believe that each year the crops are infected from overwinter protected production in the area. There is a Downey mildew forecasting scheme to predict high risk periods using similar principals to the UK potato blight forecasting models. Growers will sign up to receive this information to allow them to guide their fungicide choice and application dates.

Plant establishment

Nearly all crops are direct drilled as good establishment can be achieved using seed. Most growers are using their corn drill and just filling the alternate hopper to give them a row spacing of 60 inches. Graphite dust is often added to improve the seed pickup as the treatment on the seed surface often make the surface 'shiny' reducing the drill efficiency.

Spacing is driven by bush or vine type.

Small fruit types are drilled at around 4840 per acre with the density reducing based on the final expected size of the fruit. The lowest densities may be as low as 1200 fruits per acre.

Fertiliser program.

Unlike the fungicide programme which all growers were following rigorously, there was a lot of variation in grower approach to fertiliser; from a base dressing and a top up to adding liquid feed in each fungicide spray tank. The comment that one grower made was that if you are taking off 71 bins of 800lb per bin that around 54 tons of crop that you need to feed to produce so if you only put enough Fertiliser on for 30 tons of take-off that's all you will get.

The base dressing applied was generally around 300lb acre of 15:15:15 and then on labour day (4th July and plants just starting to vine) most growers are adding Urea at 100lb acre and accepting that this will cause some plant scorch and timing it for rain.

If the grower is then liquid feeding they are also then applying in every fungicide tank 12:48:8 or similar at 3lb per acre, with the phosphates being key for good quality fruit formation.

During pollination and fruit set, Calbor is also being added to the mix at 1g per 100 gallons water, the boron is considered to be important at this stage to encourage the pollen tube to grow down and optimise fertilisation. Once the fruits are set then only calcium is used due to the Boron sometimes being an issue within the fungicide mixes and the calcium will stop being used once the flowering has finished

Feeding will continue till vine death.

The Fertilizer programme aims to build fruit size and then fruit strength and uniformity

If first female flowers are lost the grower may re-trim the vine in the field using a sharp implement on a stick as the first new break will always have a female flower on it, and this technique allows the grower to catch up.

Rotation examples would be Corn / Soya beans -> Wheat -> Wheat -> Pumpkins with the previous cropping being a key consideration as some herbicides used in corn and soya beans can be detrimental to Pumpkins (24D especially)

Breeders and their most popular varieties -

Breeders currently active in the USA and discussed when on the study tour were;

Rupp seeds – Gold dust, Gold Medal, Jack be little

HM Clause seeds – Gladiator, Cronus, Majestic, Magician, Mystic and Mystic plus, Magic lantern.

Sakata – Fall splendour

Jamie Hoffman – breeding big fruited varieties for the Amish community

Hybrid seeds – Hannibal, Big Doris.

Rupp Seeds, visited on the 2nd October

Rupp seeds are a family owned business based in Wauseon Ohio. Philip Rupp is the president and is the third generation of the family to manage the business, his brother and 2 sisters also have key roles within the company. They market a full range of vegetable seeds but have their own Pumpkin, Squash, Corn, Soya bean breeding programmes. They have also recently taken on a young breeder who has just qualified at UC Davies to keep them right up to date with the current breeding techniques including using Geonomics and mapping. On the trials site they have around 150 different hybrid pumpkin selections as well as storage squashes and butternut's. They also have a replication of the trials on another site. The weather in Ohio is similar to the UK summer weather during the summer months (with a guaranteed hotter period but at establishment it can be quite cool and wet) and some of their speciality material is already grown in the UK being marketed by Tozer seeds.

The USA growers work to recognised variety maturity dates which is something that seed houses in the UK don't currently present as data to growers in relation to Pumpkins. The

Varieties are indexed in bands of 5 days from 80 days to 120 days as is shown on the chart below. The date is from the date of drilling and the seed house states that when growing hybrids, the maturity date can be reliably forecast based on a recognition that increasing or decreasing the heat and sunlight each year can shorten or elongate this time span.

Variety Maturity	Plant date: May 1 st	Plant date: May 15 th
	Harvest range	Harvest range

80 days	July 10 – July 30	July 24 – Aug 13
85 days	July 15 – Aug 4	July 29 – Aug 18
90 days	July 20 – Aug 9	Aug 3 – Aug 23
95 days	July 25 – Aug 14	Aug 8 – Aug 28
100 days	July 30 – Aug 19	Aug 13 – Sept 2
105 days	Aug 4 – Aug 24	Aug 18 – Sept 7
110 days	Aug 9 – Aug 29	Aug 23 – Sept 12
115 days	Aug 14 – Sept 3	Aug 28 – Sept 17
120 days	Aug 19 – Sept 8	Sept 2 – Sept 22

To allow growers to orientate themselves to the above response times the following varieties known in the UK have the suggested maturities: -

Atlantic Giant – 100 + pounds - 120 days

Prizewinner – 50 to 200 pounds -120 days

Gold Medal – 30+ pounds – 95 days

Gold Rush – 20 to 35 pounds – 120 days

Gold Strike – 27 pounds – 120 days

Autumn Gold – 10 pounds – 90 days

Orange Smoothie – 4 to 8 pounds – 90 days

Small Sugar – 5 to 6 pounds – 100 days

The recommendation is that the pumpkin quality will be best when the Pumpkin is harvested nearest the varieties actual maturity. This is a different approach to the UK in that we tend to drill or plant at the earliest date that the weather allows us to (usually from mid May onwards).

Due to differing market demands the premium value is in the larger pumpkin sizes, Large is one of the big volume lines and a large pumpkin will have a weight of 20 to 30 pounds. In the UK this would be at the top or above the large specification that we are working to of a 26cm plus diameter (they breeders were intrigued that we work with all of our retailer customers in diameter as they always work in weight). The mid-size fruits at 12 to 18 pounds fall best into our 26cm diameter specification requirement and the 'pie' types fit well into the UK mid specification of 17 to 26 cm.

The spacings that they are recommending are far lower than we would ever consider economic in the UK the category 1 types (varieties such as Atlantic Giant 100 plus pound) at 605 plants per acre. The category 2 large varieties are at 1210 to 1450 per acre, and the category 3 mid-size at 1450 to 1815 per acre, UK growers will know Small Sugar and Orange Smoothie which are both within this grouping. Category 4 which is 3600 to 4350 plants per acre includes the miniature types such as Jack-B-Quick and is at a lower density than we are growing at in the UK which is at least 4500 to 6000 per acre.

When they are selecting lines from breeding as well as fruit size and colour they are also selecting for the quality of the stalk attachment and the way that the stalk is presented onto the fruit. Stalk attachment is very important in the USA as not only is good stalk attachment recognised as reducing loss (as under the stalk is one of the key entry point for breakdown pathogens) but as most fruits are carried by the consumer by the stalk the stalk must stay attached.

Below are 2 pictures showing the attachment of the stalks, the photo on the left shows a well attached stalk and the photo on the right shows the 'tree root style' stalk presentation



which is being bred towards. This format of stalk attachment is considered superior as it is even less likely to detach and as the crown of the fruit under the stalk is raised, its considered that moisture is less likely to collect at this point, again further reducing the risk of breakdown.

The below left picture shows another breeding line for a smaller fruit and more golden colour. It demonstrates a dark green stalk but not such good stalk attachment. The dark deep green shows that there is powdery mildew resistance within the plant, a full spray programme will still be used on the crop but with PM resistance product quality is deemed to be improved. The fruit on the right has no Powdery Mildew resistance and the visible black spots on the stem are resting spores of PM.

The level of dry matter in the stalk is also considered as, a high dry matter will reduce the stalk shrinking as the fruit cures and thus reduces stalk losses.

Pumpkin Pie is a key part of American culinary culture and I was to learn that most people make their pie using tinned pie mix. The orange types that are grown are only considered for decoration and do not have enough sweetness for pie. For pie, the Meshota types are used and they are a very different product as can be seen below



They are grown using similar techniques to the decorative types but then harvested into wind rows. They are picked up in the field by machine and then pulverised and processed within the canning plant, no sugar is added. The varieties are bred for a good orange flesh colour and easy stalk removal, as otherwise stalks can make their way into the manufacturing process which can cause issues as they are quite hard to mechanically remove. If someone is looking to make a fresh pie mix, they will tend to use butternut squash to get the sweetness rather than a pumpkin.

HM Clause visited on the 8th October

Their Principal breeding station for pumpkins is located just outside of Davies California I met with Ted Superak who has been breeding pumpkins for over 25 years and has bred some of the Clause key varieties in the USA such as Gladiator, Magic Wand, Apollo and Magic lantern as well as their new up and coming variety Cronus. Currently HM Clause have a market share of around 65% in the USA with their varieties and pumpkins features as one of their top 10 products. Ted is working towards retirement but Sarah Smith is taking over the breeding work on pumpkins and is already managing the breeding of squashes as well as Zucchini.

Within their breeding they have precocious yellow material (this colours very early but colour is not necessarily a sign of fruit maturity) and hard shells (Warlock, but being phased out due to customers not liking the hardness when carving). The aim is to have Powdery Mildew resistance in one parent if not in both.

The picture below shows on the left a selection without PM resistance and on the right with full resistance, the importance of this resistance should not be underestimated. On the right is Warty Goblin, a hard shell with warts which are softer tissue and do not cure as the main fruit skin does, this can lead to pressure damage and breakdown issues.



Below is a view across the breeding trials and a picture of a superb example of Gladiator



Other material which stood out on the trials ground is shown below:



Rhea





HMX 4680 (anticipated to be 90 days)



Zeus

PUXP 2722 was also of interest and is a precocious yellow type, 18 plus cm diameter with a response of around 80 days and three fruits a plant.

The Handle (peduncle) is one of the key selection points when looking at new varieties as it must have good size, attachment and colour as this is seen as a sign of PM resistance. Molecular markers are used to ensure the presence of desired attributes within the new crosses with the material then being tested for pureness as this gives uniformity. Once this is achieved then the parent lines are fixed. For the future work is being done to improve the offer that Clause have on Large pumpkins, a better white and as the market in the US is looking for a bigger colour range and more ornamentals to increase the range available of that format of material

Californian pumpkin production

A morning was spent with Bryan Van Groningen which was kindly organised by Karen Arlin of Clause seeds. Bryan is the third generation of the Groningen family to farm in the Californian area and he farms with his Brother, Father and Uncle. They are growing around 1500 acres of pumpkins for the Halloween market, all on Drip irrigation with fertigation and all as fresh lifted. They also have around 350 acres of fancy and decorative types and within the area there is around 4000 acres of pumpkins grown across 3 growers with one of these also being 1500 acres. Bryans crop is in field blocks of at least 70 acres all planted on plastic with drip tape for the irrigation and he rotates the pumpkins following 1500 acres of watermelons which are grown in the reverse season of the pumpkins (2 Cucurbits in one year)



The soil is usually chemically sterilised between the 2 cucurbit crops with the chemical being put through the irrigation system once the beds are formed and plastic laid. He has tried reusing the beds by stripping off the watermelon plants then planting through the same plastic but finds that it gives him too many issues, so it's easier to just start again.

Irrigation is reduced when the fruits near harvest to improve curing as it is recognised that a late irrigation will give a growth spurt and thus reduce the fruit quality. The labour gangs will cut off the fruits around 2 days before they are picked up to allow the cut stalks to be dried in the sun.

The crop will be dusted with sulphur by helicopter twice in its early stages as the temperature will then volatilize the sulphur through the crop production period giving good

fungal pathogen control and reducing the need to spray, with the exception of morning dew later in the season the foliage will often never have any rain or water applied to it.

Left shows windrowed ready to pick up and right the Mexican gangs loading up.



The packing area covered several acres all roofed over and had 4 pumpkin packing lines as well as vast areas for prepared palatainers to be laid out and 6 loading bays. The lines were all dry brushing and then eye graded and manually labelled. The company runs its own branded palatainers that will be used within all the retailers.





There was also a separate building washing, drying and waxing decorative gourds and small pumpkins. Only a very small amount of wax is used to give a shine so respiration is not limited as if it is then breakdown can occur.



L to R – Washer sump tank flowing into a brush chamber with a propane burner located at the end of it for drying. View showing propane burner and inspection belt. Dried pumpkins being waxed using a spray applicator with rollers below it to turn the fruit.




finished product

Appendix 2. Key pathogens isolated from pumpkin samples provided to East Malling Research and Crop Walkers Guide

What we found in the flesh:

Botrytis cinerea (Grey mold)




emr
east malling research

Botrytis recognised as wound pathogen and latent pathogen

What we found in the flesh:

Phoma cucurbitacearum
(*Stagonosporopsis cucurbitacearum*)



emr
east malling research

Gummy stem blight
inoculum in field?

What we found in the flesh:

Fusarium acuminatum



Fusarium entry point
through the stem?
See data later

What we found in the flesh:

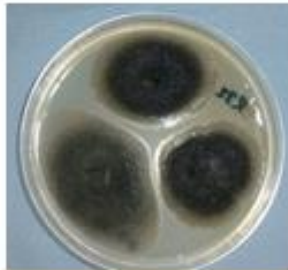
Rhizopus stolonifer and *Mucor hiemalis*
(soft rots)



Soil and debris main sources of inoculum
Well known as a wound pathogen

What we found in the flesh:

Colletotrichum coccodes



Single sample found in survey
Significant in field?



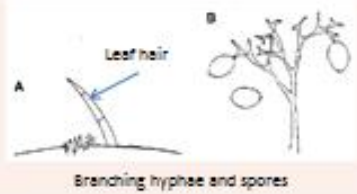
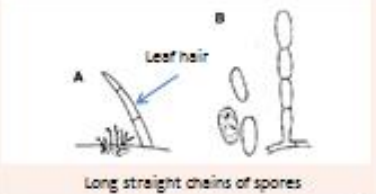


Crop Walkers' Guide

Pumpkin

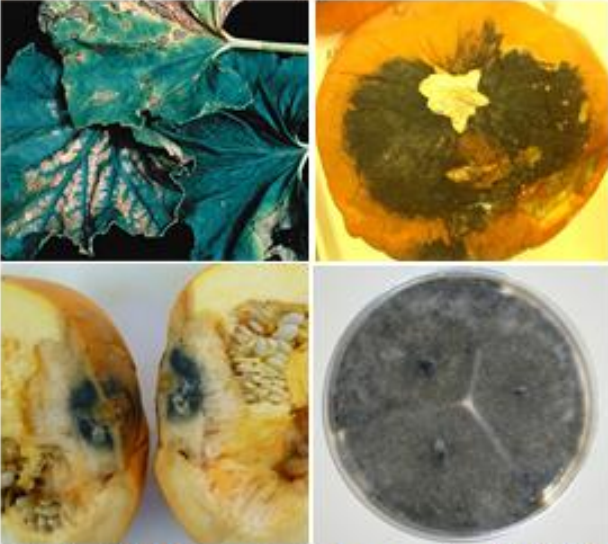
Contents

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Grey Mould	5
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Common name	Downy Mildew	Powdery Mildew
Scientific name	<i>Pseudoperonospora cubensis</i>	<i>Podosphaera xanthii</i>
Lesion colour	Upper surface – yellow Lower surface – downy and grey to purple	White, like talcum powder
Lesion size	Small to large necrotic areas	Small to large, occur on both leaf surfaces, petioles and stems
Lesion shape	Angular	Not angular
Other features	Normally only leaves are infected Leaf stems remain upright after leaf has died	Infected leaves wither and die, and plants senesce prematurely.
Weather	Occurs in wet weather	Prefers warm dry weather
Photographs		
Schematic (10x hand lens)	 Branching hyphae and spores	 Long straight chains of spores

Gummy stem blight/black rot

Phoma cucurbitacearum, syn: *Didymella bryoniae*, *Stagonosporopsis cucurbitacearum*



Affects leaves, stems and fruits

Circular tan to dark brown spots on leaves

Gummy exudate may be found on stem cankers, on which the fruiting bodies may appear as black specks

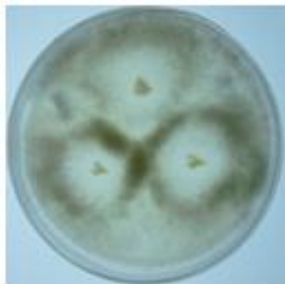
Small water-soaked spots develop into large lesions on fruit which exude a gummy material. The spots contain conspicuous black fruiting bodies.

Survives on diseased vines and crop debris. Moisture is more important for disease development than temperature

*Top Left: Foliar symptoms of gummy stem blight of melon, Photo credit T. A. Zitter

Grey mould

Botrytis cinerea



Botrytis recognised as wound pathogen and latent pathogen

Requires moist conditions and normal temperatures

Infections occur in the flowers, damaged fruit and cut stems

The infected area is soft, water-soaked and yellowish, later becoming covered in grey mycelium and spores, or black resting bodies

Overwinters on plant debris

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Fusarium Rot

Fusarium acuminatum



A pre and post-harvest rot

Dry, white-cream spongy rot with white halo, sometimes producing light pink to cream coloured aerial mycelium

Normally found at the stem or blossom end of fruit, or where it is in contact with the ground

High temperature and high humidity encourage growth

The fungus can penetrate directly under moist or wet conditions, wounds facilitate entry

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Soft Rots

Rhizopus stolonifer and *Mucor hiemalis*



Rhizopus and *Mucor* are wound pathogens. In the absence of wounds can cause a superficial mould on the stalk surface.

Cause water-soaked, rapidly expanding lesions. Softening of fruit leads to fruit collapse (NB tissue does not disintegrate like in bacterial rots)

There may be no external mycelium until the skin is broken, when a coarse white mycelium and black sporangia develop

Grows at relatively low temperatures and humidity. Soil and debris are the main sources of inoculum



Rhizopus stolonifer



Mucor hiemalis

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Anthracnose

Colletotrichum coccodes



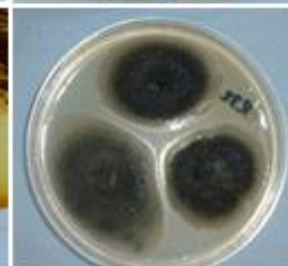
Rarely occurs in pumpkin

Various symptoms on leaves—small water-soaked circular lesions which turn yellow or irregular shaped lesions which turn brown or black

On fruit there are circular sunken lesions which can expand, and turn black in moist weather

High temperature and high humidity required for infection

Sources of inoculum include crop residue and possibly seed



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Pumpkin Growth Stages

Stage	Plant Development Stage	Growth stage	Description
0	Germination/sprouting/bud development		
1	Leaf development (main shoot)	10 11 13 19	Cotyledons completely unfolded First true leaf expanding First 3 leaves expanding First 9 leaves expanding
2	Formation of side shoots/tillering	21 22 23... ...29	First side shoot visible (>3cm) 2nd side shoot visible (>3cm) 3rd side shoot visible (>3cm)... ...9th side shoot visible (3cm)
3	Inflorescence emergence (main shoot)		
6	Flowering (main shoot)	60 61 62 63... ...65 67 69	First male flowers open First male flowers fall Female flowers open About 30% flowers open... ...About 30% flowers open Flowers fading, majority of petals fallen End of flowering, all petals fallen
7	Development of fruit	72 73 76... ...79	Ovary growing Fruit about half final size Fruit about 60% final size... ...Fruit about 90% final size
8	Maturity of fruit and seed	81 83 86 87 88 89	Most fruits still green 30% fruits final colour Most fruits final colour Some stems dying off Skins hardening Harvest
9	Senescence		

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Crop Walking Assessment Sheet

Date	Farm	Field	Variety	Growth stage (see pg. 9) more than one can be used

Pathogen	Score*	Observations
Downy mildew (pg. 3)		
Powdery mildew (pg. 3)		
Gummy stem blight black rot (pg. 4)		
Grey mould (pg. 5)		
Fusarium rot (pg. 6)		
Soft rots (pg. 7)		
Anthraxnose (pg. 8)		
Other		

* Infection score: 0 = absent, 1 = localised, minor infections, 2 = 30% field infection, 3 = widespread, severe infection.



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Appendix 3: 2016 Field Observations for trials to test effect of crop nutrition and fungicidal control against powdery mildew and *Phoma*.


Note: Early observations of Downey mildew noted in some plots were subsequently confirmed as Powdery mildew following laboratory tests.

Field Observations Oakley Farms, Cambridgeshire


Crop walk date	27/07/2016	Oakley Farms
Variety	Harvest Moon	
Field	By road	
Drill date	19th May	
Pathogen		
Downy mildew	none	
Powdery mildew	none	
Gummy stem blight black rot	none	
Grey mould	none	
Fusarium rot	none	
Soft rots	none	
Anthraxnose	none	
Other		
Pest Presence	None	
Nutritional status	good	
Growth stage	stage 60 (some fames present also)	
Fruit colour stage	na	
Fruit size	na	
General comments	Crop clean of weeds Male flowers about to open some females also present No PM noticed but PM present in general area on other crops	
Recommendations	apply Signum as per EMU (1.5kg / ha) at between growth Stage 63 and 69 (30% full flowering and petal drop) Justification - to give the plant Protection against Powdery mildew plus protect against Phoma entering through the flower wound Within the application Boron at 1l ha and Calcium at 1l ha to assist with Fruit set and fruit cellular structure development and full trace elements	

Crop walk date	08/08/2016		Oakley Farms
Variety	Harvest Moon	Harvest Moon	
Field	sprayed area	unsprayed area	
Drill date	19th May	19th May	
Pathogen			
Downy mildew	none	up to 4mm patches on older leaves as per	
Powdery mildew	none	none	
Gummy stem blight black rot	none	none	
Grey mould	none	none	
Fusarium rot	none	none	
Soft rots	none	none	
Anthracnose	none	none	
Other			
Pest Presence	None	None	
Nutritional status	good	good	
Growth stage	stage 72 though mixed stage	stage 72 though mixed stage	
Fruit colour stage	na	na	
Fruit size	overies forming up to 8cm	overies forming up to 8cm	
General comments	Crop clean of weeds		
	Overies forming, only single fruits notices not 2's		
	PM only on older leaves unsprayed area, some wind damage		
Recommendations Apply Nimrod (600ml) / hato coincide with the passing of 14 days from the last Signum application Include a full foliar feed with Calcium at 1l ha and copper oxychloride at 2.0 kg ha plus Manganese Justification - to continue to manage the risk of Powdery mildew in the crop, strengthen the fruit cell structure and increase the crop copper levels			

Crop walk date	18/08/2016		Oakley Farms
Variety	Harvest Moon	Harvest Moon	
Field	sprayed area	unsprayed area	
Drill date	19th May	19th May	
Pathogen			
Downy mildew	none	up to 4mm patches on older leaves as per picture	
Powdery mildew	none	none	
Gummy stem blight black rot	none	none	
Grey mould	none	none	
Fusarium rot	none	none	
Soft rots	none	none	
Anthraco nose	none	none	
Other			
Pest Presence	None	None	
Nutritional status	good except top corner next to farm build	good	
Growth stage	stage 76 plus or minus	stage 74 though plus or minus	
Fruit colour stage	na	na	
Fruit size	12 - 22 cm	8 - 12 cm	
General comments	Crop clean of weeds Some manganese deficiency on a possible lower patch within the sprayed area near farm buildings PM only on older leaves unsprayed area, no change in level since last visit		
Recommendations	apply Signum as per EMU (1.5kg / ha) post the heavy rainfall at the weekend to provide continued PM protection and to reduce the risk of secondary Phoma infection Include Calcium at 1l/ha and manganese as per the label recommendation Justification - to continue to manage the risk of Powdery mildew in the crop, strengthen the fruit cell structure		






sprayed area fruit
manganese deficiency sprayed area
sprayed area leaf



unsprayed area fruit
unsprayed area leaf

Crop walk date	01/09/2016		Oakley Farms
Variety	Harvest Moon	Harvest Moon	
Field	sprayed area	unsprayed area	
Drill date	19th May	19th May	
Pathogen			
Downy mildew	up to 5mm patches	all of older leaves, up to 30% of younger	
Powdery mildew	none	none	
Gummy stem blight black rot	none	none	
Grey mould	none	none	
Fusarium rot	none	none	
Soft rots	none	none	
Anthrachnose	none	none	
Other			
Pest Presence	None	None	
Nutritional status	OK	OK	
Growth stage	85	84	
Fruit colour stage	na	na	
Fruit size	18 - 24cm	12 - 18 cm	
General comments	Crop clean of weeds		
Recommendations	No further applications at this stage		

sprayed and unsprayed boundary

Field observations from Dan Mackleden, Kent

Crop walk date	05/07/2016	Dan Mackelden Ltd	
Variety	Harvest Moon		
Field	Sevington		
Drill date	TBC		
Pathogen			
Downy mildew	none		
Powdery mildew	none		
Gummy stem blight black rot	none		
Grey mould	none		
Fusarium rot	none		
Soft rots	none		
Anthraco nose	none		
Other			
Pest Presence	None		
Nutritional status	good, an addition application of Calcium nitrate may be beneficial to push		
Growth stage	stage 5		
Fruit colour stage	none present		
Fruit size	NA		
General comments	Hand weeding in progress		

Recommendations

Apply Signum as per EMU (1.5kg / ha) at between growth Stage 63 and 69 (30% full flowering and petal drop)

Justification - to give the plant Protection against Powdery mildew plus protect against Phoma entering through the flower wound

Within the application Boron and Calcium as per the manufacturers bottle recommended rate will assist with Fruit set and fruit cellular structure development

Crop walk date	18/07/2016	Dan Mackelden Ltd	
Variety	Harvest Moon		
Field	Sevington		
Drill date	TBC		
Pathogen			
Downy mildew	none		
Powdery mildew	none		
Gummy stem blight black rot	none		
Grey mould	none		
Fusarium rot	none		
Soft rots	none		
Anthracnose	none		
Other			
Pest Presence	None		
Nutritional status	plants look good		
Growth stage	within a few days of growth stage 6 (male flowers opening)		
Fruit colour stage	none present		
Fruit size	NA		

General comments	Hand weeding in progress
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Recommendations

Signum as per EMU (1.5kg / ha) applied 21st July	at between growth Stage 63 and 69 (30% full flowering and petal drop)
Justification - to give the plant Protection against Powdery mildew plus protect against Phoma entering through the flower wound	
Within the application Boron and Calcium as per the manufacturers bottle recommended rate will assist with Fruit set and fruit cellular structure	
1l calcium and 1l boron per ha also applied	




Crop walk date	05/08/2016		Dan Mackelden Ltd
Variety	Harvest Moon		
Field	Sevington		
Drill date	TBC		
Pathogen			
Downy mildew	slight - up to 4mm patches on occasional plant		
Powdery mildew	none		
Gummy stem blight black rot	none		
Grey mould	none		
Fusarium rot	none		
Soft rots	none		
Anthraxnose	none		
Other			
Pest Presence	None		
Nutritional status	Patches with yellowing leaves, Manganese and phosphates recommended		
Growth stage	varying between 72 and 75,		
Fruit colour stage	none present		
Fruit size	up to 12cm in diameter, crop quite uneven		
General comments	Some volunteer barley patches present quite a bit of wind damage		

Recommendations

Nymrod asap as per EMU as the Signum protection has ended plus add copper oxychloride as per label recommendation

full trace elements foliar feeds inc additional (1l ha) Ca, Magnesium and phosphate as some manganese / phosphate deficiency showing

To keep the plants clean of Powdery mildew and to ensure fruit keeping quality is achieved



Crop walk date	20/08/2016	
Variety	Harvest Moon	
	sprayed	unsprayed
Field	Sevington	
Drill date	TBC	
Pathogen		
Downy mildew	none	none
Powdery mildew	slight - up to 5mm patches on occasional plant	patches from 5mm to partial leaf
Gummy stem blight black rot	none	none
Grey mould	none	none
Fusarium rot	none	none
Soft rots	none	none
Anthracnose	none	none
Other		
Pest Presence	None	None
Nutritional status	Ok, slightly discoloured	Ok, slightly discoloured
Growth stage	varying between 79 to 81,	varying between 79 to 81,
Fruit colour stage	starting to turn	none present
Fruit size	18cm to 28 cmin diamater, crop quite uneven	18cm to 24 cmin diamater, crop quite uneven
General comments	Some volunteer barley patches present quite a bit of wind damage	
Recommendations		
Potassium Bicarb at 5kg / ha plus silica wetting agent at recommended rate		
Include Calcium, Mn and MG (bitter: To keep the plants clean of Powdery mildew and to ensure fruit keeping quality is achieved		
Justification - to continue to manage the risk of Powdery mildew in the crop, strengthen the fruit cell structure		

