# Maize Best Practice

## Growing and Agronomy Guide

www.kws-uk.com

SEEDING
THE FUTURE
SINCE 1856

KWS

# About KWS

KWS is one of Europe's leading maize breeders, specialising in the production of hybrids to suit all growing situations for both livestock and AD.

Our UK focus is to select maize hybrids capable of consistently achieving top on-farm performance.

As part of the KWS Group, we benefit from the combined resources and expertise of an organisation with a 160-year pedigree and which invests 15% of its annual turnover in research and development.

**From the team at KWS UK**

# Introduction

This guide is intended to help farmers and advisers to get the most out of their maize crop.

We are happy to provide expert advice on varietal choice for specific farm situations; please do not hesitate to get in touch if you require any assistance!

# Contents

# Site Selection

**Consider field aspect and exposure – tree lines can prevent seedbeds drying from wind exposure and help retain heat units**

> **Site selection has a key role in determining maize yield and quality. The easiest way to increase yield is to avoid sowing maize on non-performing fields. The genetic advancement of modern hybrids will not be realised if site selection is poor.**
>
> **John Burgess, KWS**

Maize favours sheltered fields with a south-facing aspect, which will permit earlier drilling and maintain soil temperature for longer in early spring.

Sheltered fields also offer higher retention of heat units and radiation into the canopy, benefiting total yield potential.

- Avoid sowing in open, exposed fields. A tree line will help to reduce wind speed and limit soil surface moisture losses.
- Wind exposure will decrease crop height – particularly evident in unsheltered fields with no tree line.
- Well-sheltered fields offer protection against storm damage and minimise crop senescence close to harvest.

Recommended maximum altitude 1,000 feet (300 metres) above sea-level. Reduced seed rates can enhance ripening speed at high altitudes.

# Soil Type

Maize favours sandy/sandy loam soils, a well aerated soil structure and no compaction.

- Clay soils have a high water-holding capacity and are slow to warm up in spring. However maize can be successfully grown on heavier clay loams, typically where the clay content does not exceed 25%, although earlier drilling is recommended.
- Chalk is unsuitable, as it is slow to warm up in spring and can reflect sunlight. However chalk downland soils can support maize if soil depth is sufficient.
- Poorly aerated soils will limit root formation and can cause premature crop senescence.

**Heat Unit Recommendations**

Variety selection should be based on estimated heat units received and soil/field conditions. Typically, hybrids with FAO ratings of 150 to 160 (ultra-early) require up to 20% fewer heat units than later hybrids with an FAO rating of 200+ (mainstream).

**Maize Heat Unit Tool**

KWS' online tool enables you to check your predicted harvest date based on the FAO of your selected hybrids and the average heat units for your location. Find it at www.kws-uk.com.

- Enter your full UK postcode
- Enter your sowing date - day and month (for example 23/4 (April) or 23/5 (May)
- Your predicted harvest date will be based on the crop reaching a grain kernel moisture content of 35%

# Variety Selection

## Forage; AD; CCM; Crimping


### Maize for Forage

- High dry matter
- 30%-plus starch
- Limit choice to a maximum of 180-190 FAO (maturity rating) range
- For TMR diets, ultra-early hybrids help to ensure an all-year-round supply, by bringing harvest forward into early September

The high protein content of mainly grass-based rations can be offset with a high starch maize variety. High maize inclusion diets should contain some later-maturing hybrids, which offer superb energy yields and moderate starch, thereby reducing the risk of acidosis.

### Maize for AD

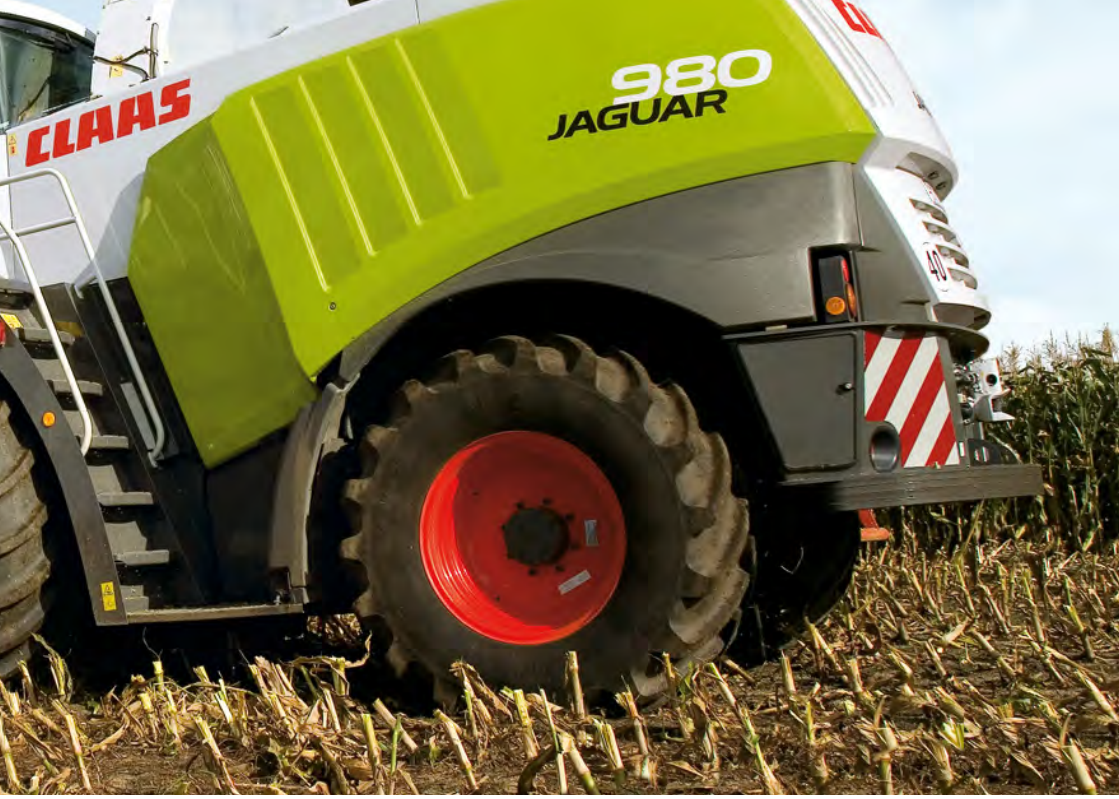
- Use a range of FAO varieties to spread drilling and harvest workload
- Target high freshweight yield and good disease resistance

### Maize for Corn Cob Mix (CCM)

- Requires a compact or semi-compact hybrid with an FAO of 150-210, as well as a grain:stover ratio of 50%-plus and good standing power

### Maize for Crimping

- Ultra-earlies are not recommended, due to the risk of brackling
- As with CCM, a grain:stover ratio of 50%-plus is desirable, together with good standing power




> **The consideration of end use should be a priority, when it comes to choosing the right varieties. The KWS maize breeding programme has responded to demand for increased flexibility, by developing new hybrids suitable for a range of purposes. These include AD, forage, corn cob mix and crimped grain.**

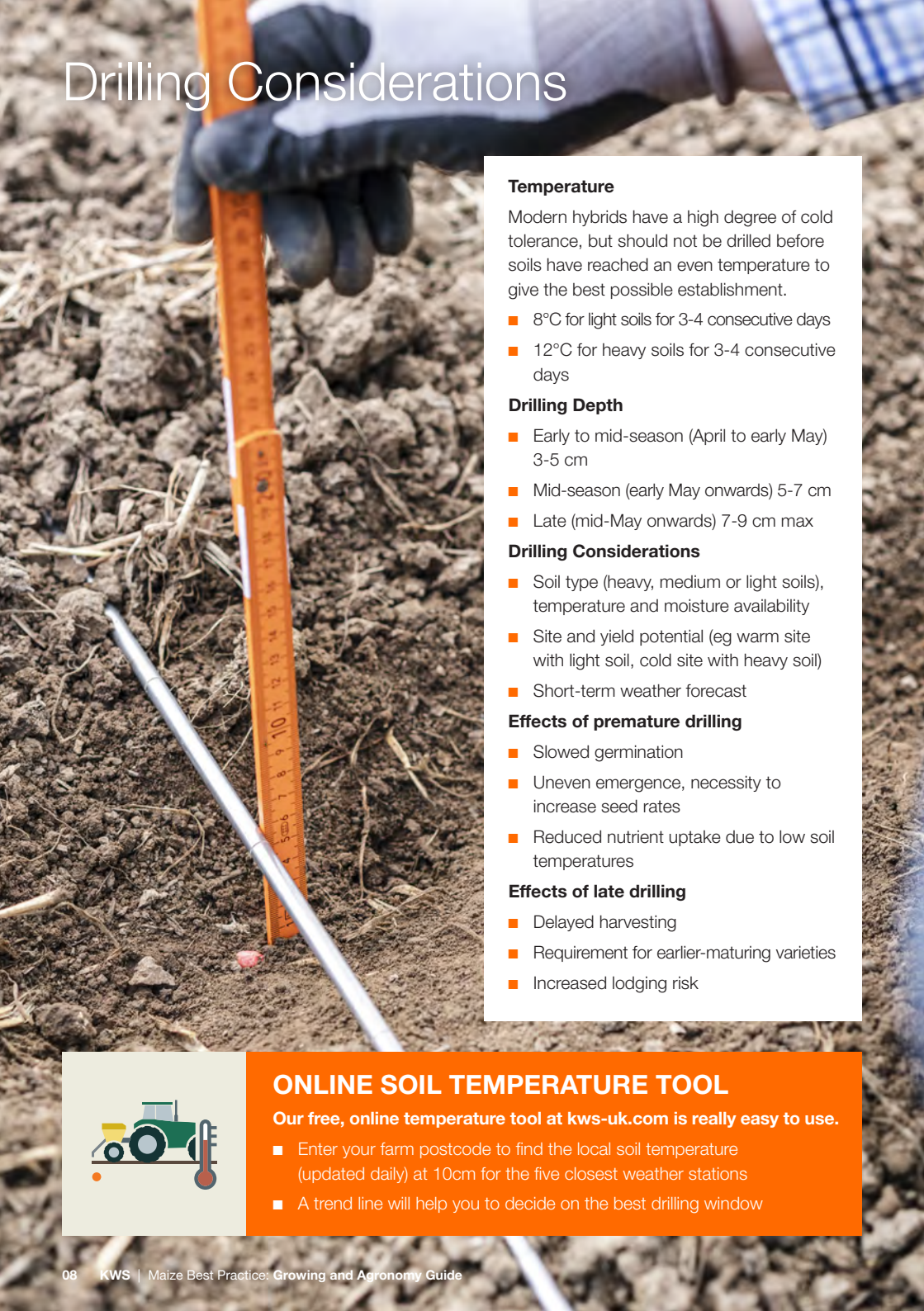
## ? DID YOU KNOW?

**Selected modern KWS maize hybrid varieties offer a cost-effective starch source for your ration and also match AD plant requirements.**

## ? VARIETY FACTS

**Varieties in the higher FAO range do not have the degree of cold temperature tolerance found in lower FAO varieties (classed as ultra-early or early)**

# Drilling Considerations



**Temperature**

Modern hybrids have a high degree of cold tolerance, but should not be drilled before soils have reached an even temperature to give the best possible establishment.

- 8°C for light soils for 3-4 consecutive days
- 12°C for heavy soils for 3-4 consecutive days

**Drilling Depth**

- Early to mid-season (April to early May) 3-5 cm
- Mid-season (early May onwards) 5-7 cm
- Late (mid-May onwards) 7-9 cm max

**Drilling Considerations**

- Soil type (heavy, medium or light soils), temperature and moisture availability
- Site and yield potential (eg warm site with light soil, cold site with heavy soil)
- Short-term weather forecast

**Effects of premature drilling**

- Slowed germination
- Uneven emergence, necessity to increase seed rates
- Reduced nutrient uptake due to low soil temperatures

**Effects of late drilling**

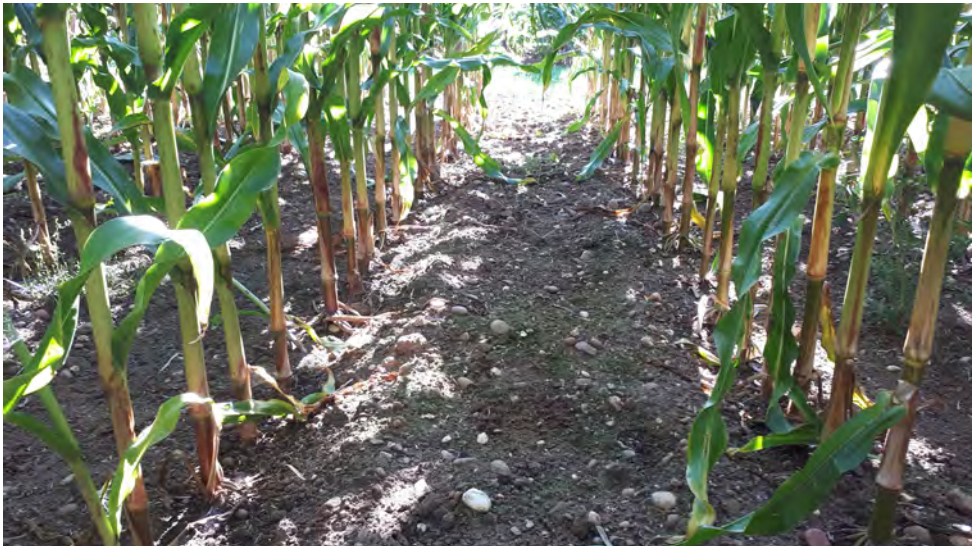
- Delayed harvesting
- Requirement for earlier-maturing varieties
- Increased lodging risk



## ONLINE SOIL TEMPERATURE TOOL

**Our free, online temperature tool at kws-uk.com is really easy to use.**

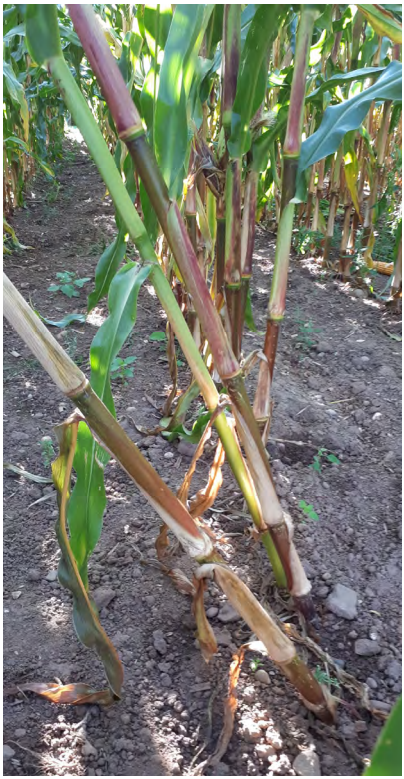
- Enter your farm postcode to find the local soil temperature (updated daily) at 10cm for the five closest weather stations
- A trend line will help you to decide on the best drilling window



**Plant spacing is 'fixed' at the point of drilling, so uniformity is essential**

**Seed Placement**

- Accurate placement ensures: optimal root formation; good stem strength and uniform light interception
- Plant inter-row spacing is known as 'coulter deposition distance'
- Eliminate double plants as they lead to: weak root structure; increased competition; two smaller ears and yield and maturity irregularities
- Ensure buttress roots are covered on 90% of the plant stand for optimal root anchorage



**Buttress roots found above the soil surface indicate that seeding depth is too shallow; an important consideration for drought tolerance on light soils and lodging resistance on highly fertile soils (right)**

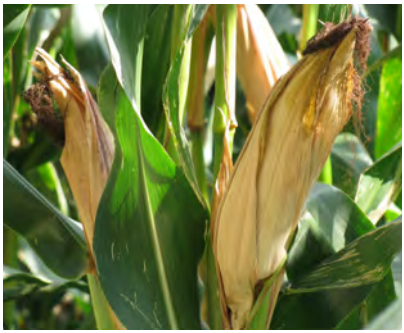
# Row Spacing and Seed Rates

**Recommended seed rates**

Consider:

- Site and yield potential (exposed or sheltered site and available heat units)
- Drilling date and expected emergence (depending on seed bed conditions)
- Harvest technique (silage with a 'kemper' style header, CCM or grain maize at 75cm or 50cm row spacings)
- Target starch content and variety interaction
- Ripening speed
- Available water supply (eg dry conditions in low rainfall areas)

**Seed rate reduction will enhance ripening speed and boost total starch content, but farmers and advisors should consider all elements across the total maize area to determine optimum plant populations (right)**



**Seed Rate Table**

Standard rates based on the desired plant population (assuming 5% field losses)

| Plants/ha (acre) | Units*/ha (acre) | Deposition distance (cm) | |
|---|---|---|---|
| | | at 75cm (30") | at 50cm (20") |
| 85,000 (34,000) | 1.8 (0.72) | 14.9 | 22.4 |
| 90,000 (36,000) | 1.9 (0.76) | 14.1 | 21.2 |
| 95,000 (38,000) | 2.0 (0.81) | 13.3 | 20.1 |
| 100,000 (40,000) | 2.1 (0.85) | 12.7 | 19.0 |
| 105,000 (42,000) | 2.2 (0.89) | 12.1 | 18.1 |
| 110,000 (44,500) | 2.3 (0.93) | 11.5 | 17.3 |
| 115,000 (46,500) | 2.4 (0.98) | 11.0 | 16.6 |

1 unit = 50,000 seeds

**? DID YOU KNOW?**

**Seed rate and row width operate independently of each other.**

Target baseline plant population will depend on end use

| | |
|---|---|
| Silage – sheltered site | 100 – 110,000 plants/ha |
| Silage – exposed site/late planting | 90 – 95,000 plants/ha |
| CCM | 95 – 100,000 plants/ha |
| Crimped grain maize | 85 – 90,000 plants/ha |
| Dried grain maize | 75 – 85,000 plants/ha |
| Biogas – short season hybrid (FAO 180 -) | 100 – 110,000 plants/ha |
| Biogas – long season hybrid (FAO 200 +) | 85 – 95,000 plants/ha |

### Pros/Cons of 50cm v 75cm row widths

Typical yield responses are difficult to measure for silage. The main effects are differences in starch content and dry matter for the same hybrid at equal harvest time.

Closer row spacing produces a denser crop with higher freshweight yields and is best adopted on favourable sites. Thicker crops also show a faster dry-down over standard row widths, but care should be taken to avoid excess plant numbers, which may cause lodging.

#### Advantages

- Faster row closing and inhibition of weeds
- Reduced erosion risk
- Minimal risk of excess residual nitrogen
- Ability to tramline
- Drill utilisation between crops
- Does not preclude crimping/CCM or dried grain maize harvesting

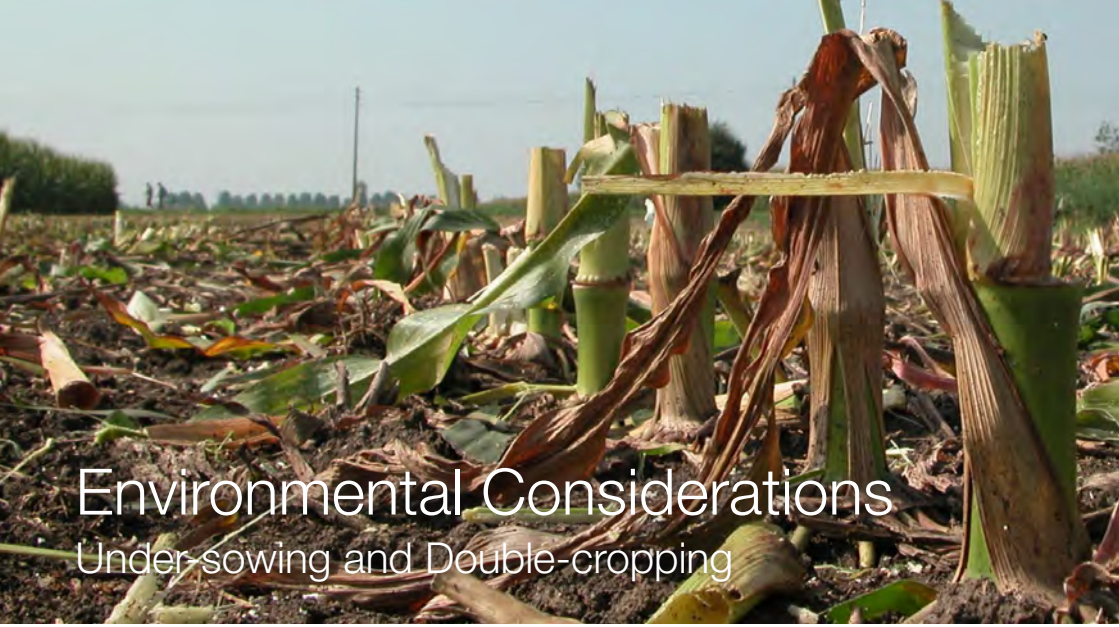
#### Disadvantages

- Higher risk of seed bunching if using a non-precision drill
- Potential for increased lodging on exposed sites
- Overall higher drilling cost
- Necessitates possible adjustment of starter fertiliser (DAP/MAP) rates

**Drilling at 50cm row widths does not change the volume of seed planted, only the spatial placement**

**Narrow rows require a significant increase in seed deposition distance between plants**

**A recent innovation means grain maize headers are now capable of 50cm row spacings, enabling narrow rows to be harvested for CCM or crimped/dried grain maize.** *(Image courtesy Geringhoff)*



# Environmental Considerations

## Under-sowing and Double-cropping

**Under-sowing reduces soil run-off risk and may become mandatory in the future**

> **There is ongoing debate about the introduction of compulsory under-sowing for maize crops.**
>
> **John Burgess, KWS**

## UNDER-SOWING

### Benefits

- Improves rooting of following crop and minimises soil erosion

### Under-sowing Tips

- Early season sowing – drill when the maize is tall enough to intercept sunlight
- Post-harvest sowing - an early, high-vigour variety will expand the drilling window
- Grass will help to 'mop up' excess soil water
- A spinner is recommended for grass seed distribution
- Grass can be cut or grazed in early season the following year

**? DID YOU KNOW?**

**Under-sowing is already common practice in Denmark and Germany**

> **Environmental concerns over run-off/leaving land bare over winter have highlighted maize under-sowing with grass. It can help with cross-compliance and greening requirements.**
>
> **John Burgess, KWS**

## DOUBLE-CROPPING

### Option One

- Harvest a second crop before maize sowing. Use a short-term westerwold or spring rye

### Option Two

- Try following maize with Westerwold ryegrass or forage rye in early September, to avoid the soil moisture deficit issues which can occur with spring sowing

### Soil Moisture Deficit Considerations

Annual nutrient and water off takes are higher with double-cropping, so inputs and soil moisture levels require careful consideration. Some farmers follow rye with maize, but it is only feasible in the right location because of the risk of poor establishment due to drought.

> **"In the mid 1990s, May was considered too late for maize sowing. However, the advent of new KWS ultra-early and early varieties has expanded the drilling window and opened up opportunities for double-cropping. These varieties require a shorter growing period compared with mainstream types, and are ideal for the system."**
>
> **John Burgess, KWS**

# Fertiliser Requirements

## Digestate; Starter Fertiliser; Top-dressing; Foliar Feed

### Fertiliser requirements

Typical UK Crop Requirements

- **N** 130 – 150 Kg/Ha (N-MAX 150 kg/ha)
- **P** 90 kg/ha
- **K** 200 – 250 kg/ha (depending on yield potential)

Sulphur and soil pH should also be considered (crop sulphur offtake is about 20 kg/ha)

### Digestate

Digestate represents an environmentally friendly form of renewable crop fertilisation; the key is to ensure it is crop-available. Correct application timing will avoid volatilisation.

### Liquid Digestate

- Average DM 3-6%
- Pre -sowing: Inject at depth with a strip-till machine up to 8 weeks pre-sowing
- Post sowing: Apply via a 'drop leg' system
- Take care to avoid field compaction/wet conditions post-sowing
- Latest recommended growth stage: V5 – V7 (5 – 7 leaf stage)
- Application rate average 30 litres/ha (depending on analysis)

**Liquid digestate application pre-drilling via a strip-till system**

**Liquid digestate application at the 4-leaf stage (V4) via a drop leg system**

**Where solid digestate is applied in spring, incorporation should be achieved within 24 hours**

### Solid Digestate

- Average DM 20-30%
- Solid digestate takes time to degrade and become crop-available
- Incorporation is best achieved at depth (20 cm +) to ensure the solid fraction is placed in the root zone
- It can also be applied after cereal harvest and ploughed in ahead of autumn cropping
- Application rate average 25t/ha (depending on analysis)

### Starter Fertiliser

Starter or 'placement' fertilisers deliver clear benefits for maize. However, excess use in certain growing areas has prompted a reconsideration of the ideal product rates and application form.

### Benefits of Placement Fertiliser

- Reduces acute phosphate starvation and corresponding yield loss
- Promotes: early vigour/ear development; early ripening; yields and energy content
- Consistent yield response

### Tips to optimise the application of prilled placement fertiliser ( DAP / MAP)

- Ensure correct placement (high drilling speeds can reduce accuracy)
- Check soil indices before application
- Avoid seedling scorch – do not exceed the typical max DAP rate of 100-125 kg/ha
- Where soil P index is already high, consider a reduced application rate (80 – 95 kg/ha)

**Special formulations of liquid 'POP–UP' P are available for maize**

The concept is increasingly used in the USA as a DAP alternative. Concentrated liquid P is placed in the seed channel for direct availability upon germination.

**Tips to optimise the application of liquid placement fertiliser ('POP–UP' Liquid P)**

- Check the application rate based on manufacturer recommendations, especially where applicators are retro-fitted to the drill
- Check the saline/salt index of the fertiliser makeup to avoid seedling scorch
- Application rates are often dependent on soil type (eg sand/loam)

**Top – dressing**

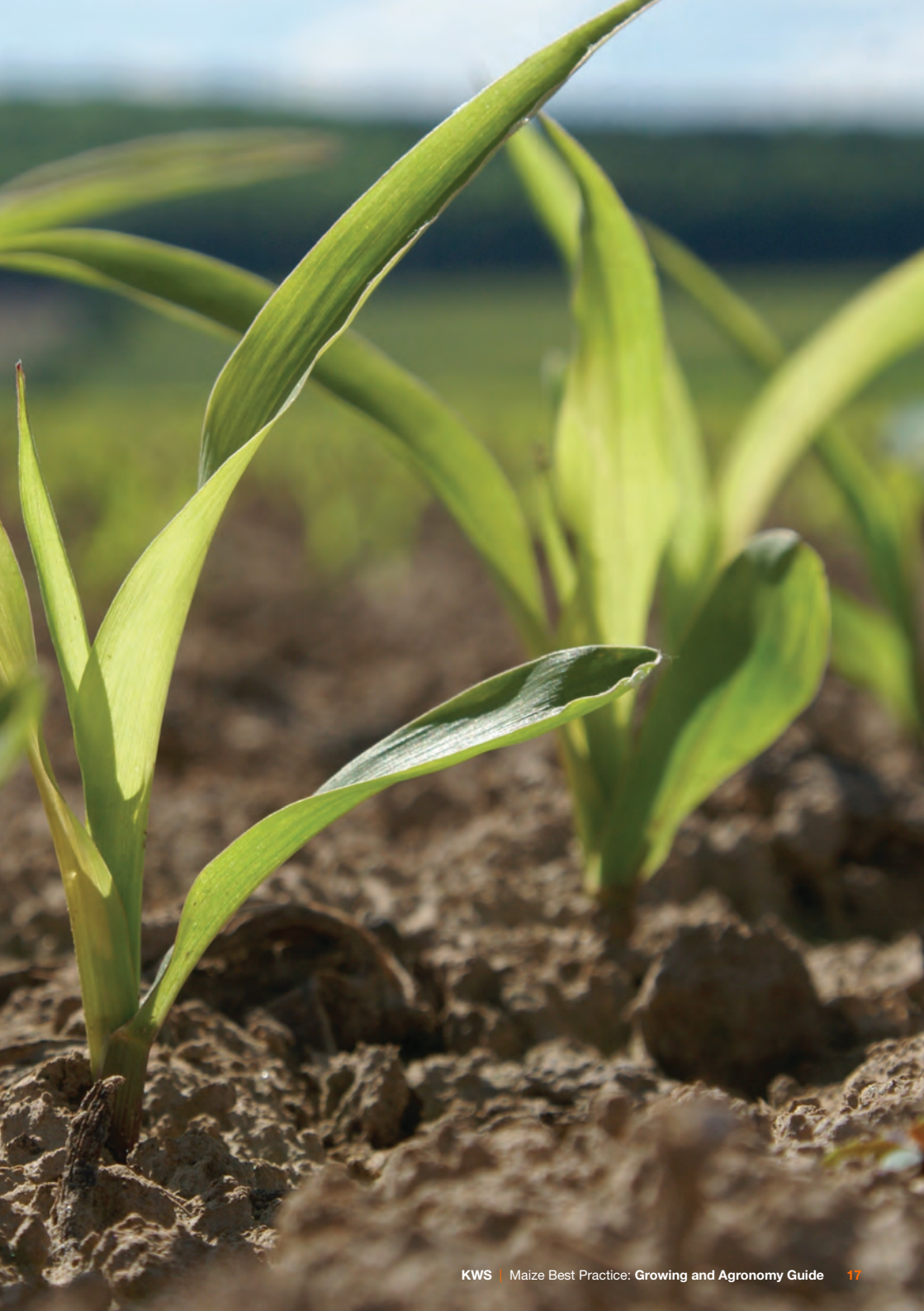
- Ammonium nitrate or ammonium sulphate prills can be applied between rows at V3-V4. Do not apply post V4, to prevent scorching the growing point
- Ensure rain is forecast for root zone access

**Foliar Feed**

- Depending on site and soil type, it may be advisable to add zinc, manganese and boron to correct any soil nutrient deficiencies as the season progresses
- Applications are timed when the growing point may be under nutritional/cold stress.

**Nutrient Build-up – Avoid Excess Phosphate Levels**

- Avoid over-application; rates may become restricted due to environmental concerns
- Even if target P index has been achieved, the nutrient may be inaccessible as P is highly immobile in the soil
- DAP/MAP rates can be cut from 125kgs to 65-70kgs/ha, by drilling later at higher soil temperatures
- Consider seed rate and the effect it may have on product rate
- Consider liquid 'POP–UP' P in the future



# Crop Rotation, Pests/Diseases and Nutrient Build-up

### Crop Rotation

Continuous maize cultivation can cause a higher incidence of leaf diseases and insect damage, particularly in high heat unit areas.

### Important Crop Rotation Considerations

- It takes two years for maize stubble to degrade
- After three continuous years, future crop yields will be affected by low K (potash) unless corrected
- Continuous maize may exacerbate weed infestation, especially Black Nightshade (solanum nigrum)
- The most common diseases Northern Corn Leaf Blight (NCLB/helminthosporium turcicum), and Eyespot (kabatiella zeae) shed spores which survive on maize trash.

> **"A rise in the UK maize acreage has increased the number of cases of NCLB, Eyespot and ECB (European Corn Borer) damage. Crop rotation is therefore of paramount importance, especially in areas of intense cultivation."**
>
> **John Burgess, KWS**

## Northern Corn Leaf Blight *(helminthosporium turcicum)*

### Factors favouring the disease

- Mild to warm and humid areas, generally after flowering
- Contaminated stubble of infested crops (resting spores, mycelia)
- Ambient temperatures between 18-27°C
- Humidity greater than 95% (dew/mist)

### Management

- Rotate crops on infested fields
- Ensure stubble is finely chopped and incorporated
- Select tolerant varieties, especially late maturing hybrids – FAO 200+
- If the disease appears early, with about 30% of plants affected, use a fungicide programme containing triazoles and/or strobilurins

## Eyespot

*(kabatiella zeae)*

### Disease Facts

- Early infestation (8-leaf stage onward)
- Symptoms only appear at an advanced vegetative stage
- Spores on contaminated leaves are spread by the wind
- Favours cold temperatures

### Management

- Choose varieties which are robust and suited to the region
- Ensure stubble is finely chopped and incorporated into soil
- If the disease appears early and around 30% of the plants are affected, use a fungicide programme containing triazoles and/or strobilurins

## Smut

*(Ustilago maydis)*

### Disease Facts

- First symptoms appear during the 8-10 leaf stage and the entire vegetation period is affected
- Soil infested with spores (which may survive in soil for 10 years)
- Spread by wind, rainfall and insects
- Damage stress increases vulnerability (hail, heavy rain, storms, drought, frit fly)

### Management

- Maintain good soil structure management and avoid continuous maize

## European Corn Borer

*(Ostrinia nubilalis)*

### Pest Facts

- The frost-resistant larvae remain in maize stubble (stalk/cob residue)
- Adult moths emerge late June/July
- Buff-coloured, with brown wing markings
- Moth activity and movement depends on adequate temperature
- One generation/year in the UK

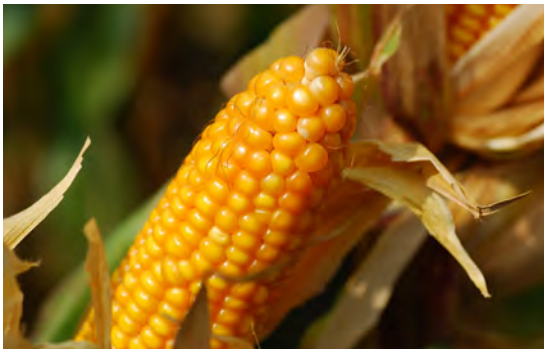
### Management

- Cultural practices: chopping and incorporation of crop residues, where the larvae hibernate until spring. These practices will eliminate roughly 75% of larvae.

# Harvesting

## Assessing Crops for Harvest Readiness

| Grain maturity | | Description | Cob DM (%) | Whole plant DM (%) |
|---|---|---|---|---|
| Milk |  | Grain immature Avoid premature harvesting | 10-15 | < 20 |
| Soft dough |  | Grains become firmer. Husks remain green | 20-28 | 20-27 |
| Hard dough |  | Silage maturity reached at 'hard dough' stage. Reduced risk of clamp effluent | 30-45 | 28-32 |
| Hard ripe |  | Grain at 'hard ripe' stage. Crop ready for late cut silage or CCM | 48-50 | 33-35 |
| Fully ripe |  | Grain fully matured Husks died back Ready for crimped maize or late cut CCM | 65-70 | 36-45 |



### Cob Ripeness

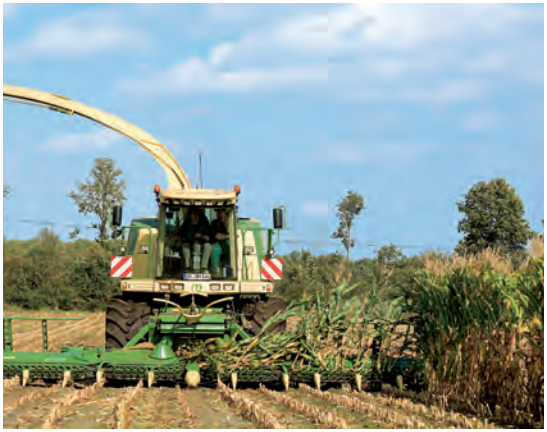
Assess the level of senescence on the silk, then break the cob in half and discard the top part.

- Take your thumbnail and attempt to slice into a kernel
- Inside you may see a very high level of starch and very little moisture, this indicates that plants are harvest-ready

### Stover Ripeness

Examine the stover. A fully mature plant will show a high level of stem-reddening. Break the stem at the proposed cutting point. Normally this will be above the first node, but below the second node.

- Crack the stem and wring out the material. Very little sap leakage will indicate harvest readiness
- A green stem with visible fluid will need more time before harvest
- Raise cutting height if stover ripeness cannot be achieved in due time



### Effects of harvesting too early

- Lower yield
- Reduced energy, starch and ME (lower intake potential)
- Higher risk of clamp effluent (requires a longer chop length)
- Poor dry matter intake and palatability (acidic silage)

### Effects of harvesting too late

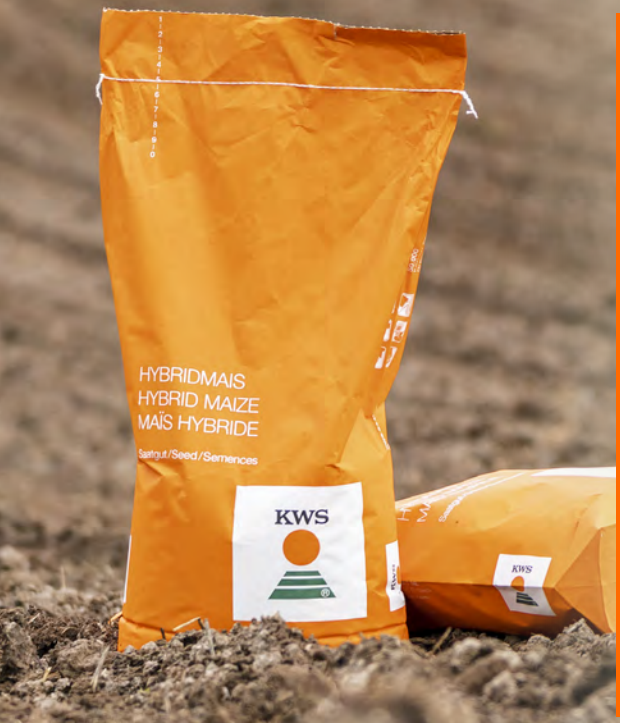
- Higher harvesting costs and increased field losses
- Low digestibility and palatability
- Excessive dry matter and poor clamp stability
- Difficult clamp consolidation (requires a shorter chop length)
- Soil damage/compaction

# Why choose KWS Maize Seed?

- Outstanding yield and quality performance
- Varieties consistently achieve top-ranking positions
- Varieties to suit all farm situations
- Superb harvest date flexibility
- AD growers – wide range of options for spreading workload
- Forage growers – early-maturing varieties bring forward silage clamp access dates

**“Ultra-early and early KWS varieties require a comparatively short period to reach maturity. Therefore they can be harvested before the bad weather sets in, without a significant yield penalty. Later-maturing types can be considered where an early harvest date is not critical.**

**John Burgess, KWS**




## Maize Growth Stages

### Vegetative (V) stages

- **VE emergence**
- **V1 first leaf**
- **V2 second leaf**
- **VN leaf collars present**
- **VT lowest branch of tassel visible**

### Reproductive (R) stages

- **R1 one or more silks extend outside husk leaves**
- **R2 kernels resemble ‘blisters’ with clear liquid**
- **R3 kernels filled with milky fluid**
- **R4 inside of kernels has ‘doughy’ consistency**
- **R5 dent forms on kernel and milk line moves towards kernel tip**
- **R6 physiological maturity**

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