AGRONOmy COMPLETE CROP PRODUCTION SERVICE

frontier

MAIZE

myVARIETIES 2021

A comprehensive guide to the best maize varieties for the UK climate, including advice on successful establishment and growth

Talk to the people that work for the company that makes a difference.

MAIZE

Advantages

High methane yield/ha
Easy storage and handling
Well proven in South UK

Disadvantages

Late harvest in some areas
Soil cross compliance issues
Long retention time

The longer the growing season (the time taken to reach maturity), the greater the dry matter yield. This is the key factor in variety selection. Maximising yield is the driver for profitability, but this yield must be achieved within the physical and practical constraints of the farm and the farming system.

Maize is grown all around the world and so there are many types cultivated that are adapted to very diverse climates. Varieties exhibit a huge range in terms of plant type, time to reach maturity and overall yield potential.

Varieties selected for the UK are a small segment of the total range, but are those that are suitable for the relatively short season and cool maritime climate. Nevertheless plant maturity, and therefore harvest, can easily span 8 to 10 weeks from late September through to the end of November.

Considerations when choosing maize

Location

Maize needs high temperatures over a long summer (heat units) to reach maximum yield and maturity. The further north you are, the fewer potential heat units available, which means the earlier maturity group maize you should grow.

Soil type

Whilst lighter soils generally have lower yield potential, they can lend themselves to earlier drilling and possibly later harvesting, allowing for the use of later maturing varieties. In high rainfall areas, these factors can allow excellent yields for varieties suited to light soils.

Altitude

Increasing altitude reduces the available heat units, which limits the variety choice to earlier maturing types.

Field aspect

A field facing south west will likely get to the required soil temperature before one facing north east and so can be planted earlier.

Place in rotation

If an autumn sown crop follows maize, then earlier maturing types must be chosen, whereas a semi-continuous maize rotation does not restrict maturity type.

Total area/speed of harvest

A range of maturity types can spread the harvest period to match the capability of machinery and labour. Maturity types can also even out the effects of soil type and sowing date, condensing the harvest period where high capacity contractors are used.

Compaction

Soil compaction can easily steal 50% from yield. Make sure the variety maturity choices you make don't cause unacceptable compaction for the following maize crop.

Drilling dates

Maize can be drilled from early April through to June, depending on variety and as long as the soil temperature is constantly above 8°C.

Harvesting dates

Harvest generally starts from mid-September and can run until early November with a dry matter between 30-35% depending on maturity of the crop. Each variety has an FAO number, which is an expression of a range of factors used to measure crop maturity. A higher number indicates a longer growing season and whether more heat units are required for the variety to reach grain maturity.

Seed rates

Maize is sold in 50,000-seed packs and precision drilled. Seed rates will vary depending on the time of drilling as changing the seed rate can have an impact on the harvest date. End use will also affect the seed rate. For example, for optimal grain and starch yields, a target plant population of 90,000 plants/ha is required, although for fresh weight yield this is closer to 110,000 plants/ha. Unlike with cereals, seed rates should be reduced as the drilling date moves later.

Markets and end users

Forage and grain maize has traditionally been grown for livestock feed, but is now increasingly being used as a feedstock for anaerobic digestion (AD).

Maize silage is clamped and fed directly to cattle whilst grain is either crimped and fed or sold into feed mills to add to rations.

Some grain maize can be used for human consumption (polenta) but this is not a large part of the UK market.

Due to the prevalence of dairy units in the area, the bulk of maize production has historically been in the west. With the establishment of large AD plants in the east and south of England, maize has become a part of many growers' rotations.

Contents

Agronomy

Rotation

In standard arable rotations, maize can fit well. A spring drilled crop, it will help to spread drilling and harvest workload. Another advantage of spring cropping is the ability to use a total herbicide on black-grass. Due to the late drilling of maize compared to sugar beet or spring barley, several flushes of black-grass can be achieved before establishment.

On very heavy land thought has to be given to seedbed preparation; ploughing may be necessary to produce a tilth and it is important to address any soil structure improvements, as maize can be sensitive to areas of severe compaction.

Maize can be grown as a continuous crop across multiple crop years, when grower requirements demand. This is most often seen on livestock farms where arable land is limited and on land used to supply AD plants, where maize is often seen as the best option for maximising output.

Another way of maximising energy crops has been to follow an early maturing maize variety with a forage rye to achieve two crops in one year. Careful attention needs to be paid to variety choice and drilling dates for this to be achieved.

Weed control

The key to maize weed control is to get an application on early, as maize is not a competitive crop during its early growth stages.

Crop protection regimes rely on pre-emergence herbicides, followed by a mix of post-emergence products at the 2-4 leaf stage.

Where no pre-emergence application occurs, two post-emergence applications may be necessary; an early application at the two leaf stage and a follow-up herbicide at the 5-6 leaf stage, to coincide with optimum foliar feed timing.

Diseases

As the area of maize grown in the UK has increased, so too has the presence of diseases such as maize eyespot and leaf blight, which can have a significant impact on yield.

A strobilurin application late on in the crop's life (tassel emergence) has been shown to protect against eyespot and it is claimed that it increases palatability and aids with harvest timing.

Maize eyespot (Kabatiella zeae) can reduce yield by up to 50%. Incidence in the UK is variable but more often in the west when temperatures reach 10-12°C with prolonged wet weather. Trash from previous crops will be a source of infection, so rotation, ploughing and variety selection will reduce the incidence of eyespot.

Nutrition

Careful management of maize nutrition is required for optimal performance; nutrient uptake throughout the growing season is very high and therefore soil nutrient levels must be sufficient to meet this demand. Precision soil analysis from SOYL can help to both show and address the variability within a field.

Maize has a phenomenal speed of development, production of biomass and ultimate yield potential that needs to be understood to develop the correct nutrition programme. Forage maize grown for animal feed is often grown on land that has received high and frequent amounts of manures which aids this growth whereas AD maize is often grown without organic manures and in soils with more moderate-to-low nutrient status. Both of these scenarios can pose different challenges in forming the most appropriate nutrition programme.

Potassium

From 235kg K_2O/ha for index 0 down to 110kg/ha for index 3.

Potash is extremely important due to the large biomass created by maize crops. The stem of the plant almost lignifies and this requires vast amounts of potash. Also, due to the size of the crop, there is a high demand for potassium ions in the regulation of water and nutrients through the plant. Uptake of potash peaks at flowering and will be a significant yield driver to crop performance. A fair proportion of the total potash uptake will be returned to the soil during senescence but the fertiliser programme and soil supply must be sufficient to meet peak demand and you must take account of the very significant potash offtake. Ideally, MOP should be applied in the autumn if large amounts are required. The application of manures or digestate can help to meet some, or even all, of this crop requirement, but it is vital that laboratory analysis is used to accurately determine the nutrients supplied.

Sulphur

Sulphur is essential for protein and chlorophyll production and enzyme activation. It is also required for the plant to fully utilise nitrogen, so shortages result in stunted, pale plants.

Nitrogen

The N-max for all maize crops is 150kg N/ha and this level of available nitrogen (from organic sources and applied fertiliser) is often required in AD situations. Lower rates can potentially be used in livestock situations where the background fertility may be much higher, but this does need to be carefully calculated. Any sites with a history of regular manure applications would benefit from a Soil Mineral Nitrogen test to try and quantify how much nitrogen the soil is going to supply.

Foliar Nitrogen – Nutrino Pro

Uptake or demand for nitrogen peaks at crop flowering. One of the best ways to deliver nitrogen without jeopardising crop safety at this time is by applying 20-30l/ha of Nutrino Pro at the 8-10 leaf stage. An application of Nutrino Pro at this stage will be the most efficient, crop-safe and long-term source of nitrogen, along with magnesium, sulphur, and biostimulants specifically designed for use with maize. Nutrino Pro is a source of nitrogen and must be taken into account when calculating the crop's N-max.

Foliar nutrition

At the 5-6 leaf stage, a maize crop sets the number of kernels around the cob. This is a vital stage for crop development and adequate nutrition is essential to create healthy crops that can grow to their maximum potential. Applying a foliar feed at this stage can provide significant benefit in the resulting dry matter yield.

Symptoms of phosphorus deficiency

A product such as IntraCrop ProGrAm can suit all soil nutrient levels and compliment an existing fertiliser programme, due to its broad spectrum nutrient cover and the inclusion of biostimulants that support nutrient assimilation and reduce crop stress. An alternative would be ProLeaf M Boost, which provides direct foliar nutrition and would suit soils with lower levels of background nutrition, in particular phosphorus.

Phosphate

From 115 kg P_2O_5/ha for index 0 down to 20kg/ha for index 3.

Rapid root growth is crucial to maize establishment. A placed application of starter fertiliser at drilling is strongly recommended; products containing ammonium sulphate, such as DAP or Maize Trace, have shown significant benefits to crop cover early in the season. In livestock situations land can often have high P indices due to historic manure applications so little additional P may be required, although low rates of applied phosphate can still be beneficial. If your indices are low then consider higher rates of placed fertiliser and/or organic manure applications prior to drilling.

With and without Maize Trace starter fertiliser

Maize Trace

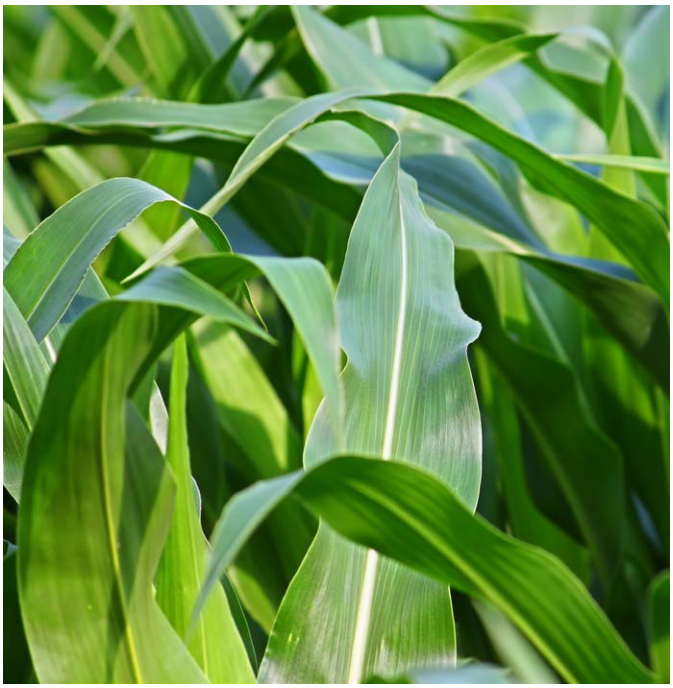
Maize Trace is an NP starter fertiliser which includes manganese, boron, zinc, copper, and sulphur. Manganese is an essential micronutrient with many functions including photosynthesis, protein and enzyme production and water management. Deficiency of manganese in maize can also reduce root mass, meaning there are fewer root hairs for nutrient and water uptake. Boron is important for nutrient transfer within the plant, particularly in maize to satisfy the huge demands during key growth stages. It is also required for pollen production, and even a minor deficiency can result in "nosing" in the cob and even blind grain sites. Zinc may only be required in small quantities, but it is essential for normal growth and development and has several important functions: enzyme reactions, photosynthesis, DNA transcription and auxin activity. Deficiency can affect the final yield and crop uniformity. Copper is important for plant fertility. Cobs make up 60% of plant weight and copper will help maximise cob production. Deficiency can also lead to a delayed harvest.

Maize Trace delivers all of these essential nutrients in one efficient application, placed next to the maize seed for optimum uptake to drive early establishment and maximise growth through the season.

Seed treatments

Following the revocation of several maize seed treatments in recent years, including Sonido and Mesurol, treatments now offer fewer options for pest and disease control.

The maize varieties listed in this guide will be coated with two bespoke blends of seed treatment, dictated by the breeder of each variety.



KWS Initio Bird Protect

Components = Redigo M + Korit + Biostimulant and micronutrient blend

A blend of treatments that provide fungicidal control (Redigo M), protection from bird damage (Korit), and also beneficial root development and plant health from a bespoke mix of biostimulants and micronutrients, including zinc and manganese.

Limagrain Korit Pro

Components = Redigo M + Korit + Sedaxane + Micronutrients

Limagrain's treatment blend includes Redigo M and Korit for fungicidal activity and bird protection. Korit Pro also includes the active ingredient Sedaxane, as well as zinc and manganese, to help improve rooting and plant health.

Companion and cover crops

There is a significant opportunity to use companion or green cover crops as part of a maize rotation. Planting a companion crop into the growing maize crop, or planting a green cover after the maize has been harvested, can reduce soil erosion and nutrient loss whilst improving soil structure and health. If needed, the companion or cover crop can also provide useful additional forage in the autumn or early spring.

Remember: timing is key. A companion crop is ideally sown when the maize is at the 5-7 leaf stage and ideally drilled inter-row. Any following green cover crops need to be planted almost immediately to benefit from optimal day length, seedbed temperatures and moisture availability. Suiting the increase in the use of direct and minimum tillage drills on farm, the majority of cover crops can be drilled straight into a stubble, keeping costs and time to a minimum.

A particular focus on establishing a post-harvest green cover should be applied to fields with slopes and those near to watercourses to limit erosion. In both scenarios, species selection needs to be carefully considered to achieve maximum effect.

Key crop options

Species	Description	Seed rate
Ryegrass Companion crop	There are several ryegrass options available. We recommend Westerwolds annual ryegrass as the most suitable in many situations. It is fast growing and can cope well with being shaded by the maize crop.	18kg/ha
Winter rye Cover crop	Provides steady growth through the winter months. A percentage of vetch can be added for improved fodder value. If for grazing or silage then a true forage variety such as Traktor would be most suited. For a following biogas rye crop, we have a wide range of suitable varieties.	100 – 120kg/ha
Mustard Cover crop	An economical, quick-growing crop that will provide effective green cover. It will deliver throughout the autumn months but is frost-susceptible.	14kg/ha
Winter turnip rape Cover crop	Similar to mustard but suited to a later sowing date. It is frost-hardy and will provide greater output for forage.	12kg/ha

Consideration must be given to residual herbicides applied to the maize crop and their persistence after application when selecting the correct cover crop.

Talk to Kings for expert advice on specialist crops.

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Varieties

KEY				
	USE	**Crop end use for forage or anaerobic digestion** (AD)	**Y%**	**Yield as a percentage of the control varieties**
	FAO	**FAO Number**	**ST**	**Starch in tonnes per hectare**
	MAT	**Maturity group** - higher = earlier maturing	**ME**	**Metabolisable Energy yield** (1000s MJ/Ha)
	YIELD	**Yield in tonnes of dry matter per hectare**	**EV**	**Early vigour** 9 = good 1 = poor

Augustus KWS - KWS — Very Early FAO 160

- One of the earliest maturity classes available
- Suitable for marginal sites or later sowing
- Excellent ME and starch levels give one of the highest energy densities on the Recommended List

USE	Forage	**Y%**	93
FAO	160	**ST**	6.14
MAT	11	**ME**	11.97
YIELD	16.7	**EV**	7.1

KWS Calvini - KWS — Very Early FAO 170

- Exceptional yields for an early maturing variety
- The highest yield, starch, and ME of any Maturity Group 9 variety
- A reliable performer on all sites and soil types
- A standout variety for early vigour

USE	Forage	**Y%**	102
FAO	170	**ST**	6.19
MAT	10	**ME**	11.74
YIELD	18.2	**EV**	7.7

Glory - Limagrain — Very Early FAO 170

- A well established variety known for consistency
- Excellent feed quality with high starch, ME, and digestibility
- Reliable yields, though somewhat behind newer alternatives

USE	Forage	**Y%**	97
FAO	170	**ST**	6.12
MAT	9	**ME**	11.83
YIELD	17.5	**EV**	7.4

NEW FOR 2021 Saxon* - Limagrain — Early FAO 175

- Has shown extremely high potential during the first year of NL trials
- Very high dry matter yields; in excess of 1T/Ha ahead of comparable varieties
- Very good early vigour and standing ability

USE	Forage	**Y%**	105
FAO	175	**ST**	6.12
MAT	9	**ME**	11.70
YIELD	18.9	**EV**	7.5

Autens KWS - KWS — Early FAO 170

- Provides very high yields of dry matter
- Narrowly behind KWS Calvini on yield, starch, and ME
- Later maturing than an FAO of 170 would suggest, we class Autens as Maturity Group 8, significantly later than Calvini

USE	Forage	**Y%**	101
FAO	170	**ST**	5.9
MAT	8	**ME**	11.70
YIELD	18.1	**EV**	7.4

Equity - Limagrain — Early FAO 180

- A sister variety to farm-favourite Glory
- Slightly later maturing; approximately five days later in comparison to Glory
- High dry matter yields are offset by slightly lower starch and ME

USE	Forage	**Y%**	99
FAO	180	**ST**	5.7
MAT	8	**ME**	11.60
YIELD	17.7	**EV**	7.5

* Saxon is in its second year of National List trials. The data shown is from the 2019 results.

Varieties

KEY				
	USE	**Crop end use for forage or anaerobic digestion** (AD)	**Y%**	**Yield as a percentage of the control varieties**
	FAO	**FAO Number**	**ST**	**Starch in tonnes per hectare**
	MAT	**Maturity group** - higher = earlier maturing	**ME**	**Metabolisable Energy yield** (1000s MJ/Ha)
	YIELD	**Yield in tonnes of dry matter per hectare**	**EV**	**Early vigour** 9 = good 1 = poor

Aurelius KWS - KWS — Medium FAO 180

- A high-yielding option with good dry matter yields
- A possible companion variety for KWS Calvini or Autens
- A variety with "medium" maturity, making it one of the later options for forage

USE	Forage	**Y%**	101
FAO	180	**ST**	5.73
MAT	8	**ME**	11.65
YIELD	18.2	**EV**	7.4

Ambrosini - KWS — Late FAO 220

- A dual purpose variety suited to forage or AD use
- An FAO of 220 puts it into the medium Maturity Group 6
- A good compromise between earlier maturing forage varieties and high-yielding but later maturing biogas varieties

USE	Forage/AD	**Y%**	104
FAO	220	**ST**	5.44
MAT	6	**ME**	11.30
YIELD	18.8	**EV**	7.3

Keops* - KWS — Late FAO 210

- A biogas variety for use in anaerobic digestors
- "Early" by AD standards
- Allows for a spread of harvest dates when teamed with later maturing varieties

USE	AD	**Y%**	-
FAO	210	**ST**	9.22
MAT	7	**ME**	-
YIELD	26.52	**EV**	-

Fabregas* - KWS — Late FAO 220

- A mainstream biogas variety, balancing yield and maturity
- Consistently high yields, in excess of 50t/ha
- A benchmark AD variety for many growers

USE	AD	**Y%**	-
FAO	220	**ST**	8.57
MAT	6	**ME**	-
YIELD	23.68	**EV**	-

Amaverde* - KWS — Late FAO 220

- A biogas variety for use in anaerobic digestors
- Produces up to 2.5t/ha more dry matter yield than Fabregas
- Good early vigour and early flowering make it an option for later planting

USE	AD	**Y%**	-
FAO	220	**ST**	9.48
MAT	6	**ME**	-
YIELD	26.05	**EV**	-

Amaroc* - KWS — Late FAO 240

- A very late maturing biogas variety
- Suitable for favourable sites, including light and drought-prone soils
- A good partner to Keops or Fabregas to help spread harvest dates

USE	AD	**Y%**	-
FAO	240	**ST**	9.45
MAT	5	**ME**	-
YIELD	25.47	**EV**	-

* AD variety data is taken from a separate data set and is not directly comparable to forage variety data

Alternative feedstocks

BEETS

For profitable AD, the aim is always to produce the highest gas output per unit of area. Beet crops offer an excellent substrate and consistently produce the highest yields and energy levels.

Advantages

Highest possible yield in t/ha
Short retention in AD plant
Easy to grow – well proven

Disadvantages

Needs careful storage and washing
Can be a late harvest

RYE

Rye is a high-value feedstock. It is often used on its own or it is mixed with beet or maize silage to provide an alternative nutrient source for the AD bacteria and to help stabilise gas output. Rye is grown primarily like any other cereal with all normal cereal machinery (except harvest).

Advantages

High yield with high dry matter
Can be grown in all parts of the UK
Good for dry or drought-prone areas
Good partner for maize in a mix
Early harvest –July

Disadvantages

Needs short chop at harvest
Not a break in a cereal rotation

GRASS

On mixed farms or in the wetter parts of the UK grass can be attractive for AD. It can also help with a broad rotation, early harvests, labour peak demands and in reducing black-grass levels.

Advantages

Suits the west of the UK
Useful on mixed farms

Disadvantages

Low methane yields/ha
High machinery cost as needs two cuts

In the UK, there is now a substantial demand for beet crops to supply livestock feed, sugar production and biogas digestion. There is a wide range of varieties that needs careful consideration.

Yield is the key consideration, but many fodder growers also need a low dry matter % depending on livestock and feed system type. For sugar and energy beet growers, a crop with a high dry matter percentage is required. Fodder beet varieties in general do not have a high enough percentage of dry matter so they are inefficient per unit area when used in AD.

Growing sugar varieties for energy offers a choice of final market, as well as a range of good quality varieties which are already widely tested in UK conditions to deliver high fresh weight yields and high energy outputs.

Growing beet for energy is broadly similar to that for sugar processing. However, higher nitrogen levels can be used to boost yields for energy crops and close attention needs to be paid to dirt tares. Frontier is a sister company to British Sugar and can offer growers excellent technical advice on variety choice and growing protocols.

Rye is widely grown in northern Europe and is well suited to the climate and soils in the UK. Unlike maize, soil types, location and altitude do not need to be considered. The high yields of quality silage do come from winter hybrid varieties although conventional non-hybrids are useful for early ripening in some situations.

Hybrid rye can have yields at 30% - 50% above wholecrop wheat or triticale. There are high output spring rye varieties available.

Grass is an extremely versatile crop; it is a good source of material for feeding anaerobic digesters, good for crop rotation, good for the environment and also adapts well to many different soil and climate types.

It can be planted in the autumn after a beet or maize crop and be ready for a silage cut in the spring. High yielding species such as tall fescue and advanced grasses together with red clover have a very high yield potential and they can, in many situations, compete with maize. Grass and grass plus clover work very well in an anaerobic digester mixed with slurry, thus improving the yield of gas. Grass is a perennial crop with a good environmental profile, improving crop rotation and bringing long-term benefits to soil fertility.

Frontier works closely with several grass breeders and we can offer a wide range of varieties and species in mixtures suitable for AD. We range from short-term (2 year ley) to long-term (5 year plus ley), and types suitable for light drought soils through to high fertility soils. These include the new advanced types that are fescue and Italian rye grass hybrids.

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