



## Switchgrass

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**Switchgrass is a perennial grass native to North America which can produce high biomass yields at low input levels. The principal markets for switchgrass are electricity and heat production.**

### Introduction

Switchgrass (botanical name *Panicum virgatum*) is a native species of North America, the species is a common component of tall grass prairies and it is likely that it has been grazed for millennia. However, only recently did it become a crop in the sense that it was intentionally planted or managed. Its potential as an energy crop was subsequently recognised by the US Department of Energy and considerable work has been carried out to ascertain the best varieties and management techniques.

With renewed concerns over fuel security and partly in response to mitigate the impact of climate change, there is now considerable interest in crops as a source of fuel.. Good energy crops use radiation, water and nutrients very efficiently to yield large amounts of biomass and have good pest and disease resistance. These characteristics are displayed by switchgrass. In addition, as switchgrass is a grass with a perennial growth habit, soil disturbance is only necessary in the first year of a fifteen-year cycle.

Switchgrass has yet to be grown or tested in Ireland. However, EU research shows that switchgrass can be grown throughout Europe and can be used to produce inexpensive biomass under low input conditions, and at a very low environmental impact. Recent research in the UK shows that switchgrass can be grown throughout the UK with no serious pest or disease problems and with a profitability which competes with miscanthus.

### Planting

Switchgrass will grow on a wide variety of soil types and tolerates pH values between 4.9 and 7.6. Seed can be sown with a conventional seed drill. Alternatively, seed may be direct drilled or broadcast. Rolling both before and after sowing is highly recommended as a fine firm seedbed is desirable, sowing depth should be no deeper than 10mm.

Switchgrass seed displays a high level of dormancy which can be broken after proper storage. Consequently, only buy certified seed which has had a germination test. Seed rate should be between 10 and 20kg/ha.

Switchgrass should be sown when the soil temperature is warm, best results will be achieved when soil temperatures are greater than 10°C and when there is some moisture in the seedbed, but not when it is too wet. If switchgrass is sown



too early the seedlings will not be able to compete with weeds as the grass needs high temperatures to grow. In Ireland, sowing should normally take place in May. Switchgrass varieties which have been grown successfully in north west Europe include cave in rock, kanlow, shelter and carthage.

### Weed control

Weeds can be a major obstacle to switchgrass establishment. Compared to other grasses such as perennial ryegrass, growth is slow in the first year and seedlings compete badly with weeds. Most switchgrass crops will require some form of weed control in the first year.

A contact herbicide is generally used several weeks ahead and again just before seeding. Glyphosate, paraquat and hormonal herbicides (2,4,D, Dicamba, MCPA) are often used.

For post-emergence broadleaf weed control, 2-4 D and Dicamba are often recommended as long as the seedlings are sufficiently mature (five leaves). However, low rates are recommended as full rates may result in seedling damage. Other broadleaf herbicides which have been used include: Bentazon, Ioxynil, Bromoxnil, Mecoprop-P, Metsulfuron, MCPA and Chlorsulfuron. Grass weeds are harder to suppress and mechanical mowing of weeds just above switchgrass height is recommended.

## Pest and disease control

Diseases and insect plagues have not been a problem in new or established stands, varieties have been found to have a high level of resistance. Grazing by rabbits and hares may be a problem in some instances. In general, diseases have not been a problem in switchgrass crops grown in Europe although crops should still be inspected at regular intervals.

## Nutrient requirements

Switchgrass is very thrifty in the way that it uses nutrients and does not have high fertilisation requirements. Fertilisation is not recommended in the first year as the switchgrass crop does not need the extra nutrients in the early stages of growth. Additionally, fertilisers can stimulate weed competition. In subsequent years, switchgrass generally shows no response to N fertiliser or only up to a level of 50kg/ha. It appears that the effect of N fertiliser is largely site specific and is mainly effective on poorer soils. N fertiliser if used should always be used sparingly as lodging may be enhanced and any unused N fertiliser may contribute to weed competition in the following spring. Fertiliser application should be delayed until later in the growing season when it is less likely to stimulate weed competition. Phosphorus and potassium should only be applied if soil availability is low.

## Harvest

Switchgrass can be harvested using conventional grass harvesting machinery, mowing and baling. Crops grown for biomass should be harvested in winter or early spring. Leaving switchgrass in the ground over the winter will allow the crop to dry, the crop needs to be dry if it is to be stored before end use. Additionally, the nutrient content in the crop decreases over the winter period and this improves the quality of the biomass when it is used for combustion.

Depending on the soil type optimal productivity is reached after two to three years (dry soils) and four to five years (heavier soils). Yield in the first year may be low and uneconomical to harvest, yield in subsequent years will build and on good sites can be expected to exceed 10 t/ha of dry matter.

## Problems

Switchgrass establishment can be difficult. Good germination can be achieved by using certified seed, proper seed bed preparation and by not sowing too early. However, good weed control will be necessary in the first growing season to ensure that switchgrass seedlings survive into the second year.

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Lodging can be a problem in switchgrass crops and can affect biomass yield. There are differences in the degree of lodging between varieties. Less susceptible varieties do not lodge to the same degree and will lodge later than more susceptible varieties. Most crops appear to be able to recover from mild lodging. Varieties which have been reported as less susceptible to lodging include cave in rock and kanlow.

## Markets

At present, the production of electricity and heat are the largest potential markets for switchgrass. The Government has set a target that 30 per cent of peat burned in the three peat fired power stations will be replaced by biomass by 2015. This will require growing approximately 80,000ha of energy crops and this could include switchgrass. Switchgrass can be burned to produce heat or electricity, its combustion characteristics are similar to miscanthus although ash content can be higher. Pellets are manufactured from switchgrass in Canada and used for home heating. Other potential markets for switchgrass include use as a reinforcing fibre, conversion to biofuels and pulping to produce printing and writing papers.

## Conclusions

Switchgrass is an energy crop which offers growers an alternative to miscanthus and other energy crops. Although biomass yields are unlikely to be as high as miscanthus and willow, unit production costs are better than miscanthus as a result of low establishment and input costs. Switchgrass has not been grown in Ireland although problems are not envisaged as it has been grown successfully throughout the UK and north west Europe.

Good crop husbandry is essential during the establishment phase where good seedbed preparation and timely weed control is necessary for the crop to survive into the second growing season. The crop will take three to four years to build up to full yield potential which can be expected to be 8-10 tonnes of dry matter per hectare. Switchgrass should remain productive for at least fifteen years after establishment. Lodging can be a problem although this can be alleviated by using varieties which are less susceptible. Harvesting can be carried out with conventional grass harvesting equipment.

Supplying biomass to the peat burning power stations is the largest potential market for switchgrass. Pellets for heat production can also be produced from switchgrass.

