



HIGH SUGAR GRASS

**New varieties developed by IGER for
more efficient meat and milk production**



Grass is the mainstay of British dairy, beef and lamb production, viewed by farmers and consumers alike as the most natural feed for ruminants.

However, agriculture has entered a new era in which efficient, home-grown forage production must go hand-in-hand with environmental considerations.

High Sugar Grass varieties, bred by the Institute of Grassland and Environmental Research, are a new generation of grasses designed to meet these needs in the 21st century.

Higher Quality Forage For A New Era Of Livestock Production

Having spent several decades enhancing the agronomic characteristics of grass - such as yield, persistency and disease resistance - plant breeders are now looking at new ways to improve herbage varieties.

At the Institute of Grassland and Environmental Research, the potential benefits of higher quality forage for sustainable livestock production were foreseen more than 20 years ago. IGER's scientists discovered that grasses with high levels of water soluble carbohydrates (sugar) could be used more efficiently by livestock. As a result, they began to develop ryegrasses with improved quality characteristics.

The first fruits of this breeding programme are High Sugar Grasses - varieties bred to contain particularly high levels of water soluble carbohydrates. Several HSG varieties developed by IGER have been rigorously tested through independent Recommended List trials and are now approved for use throughout the UK. The first HSG grass varieties and

mixtures are available commercially through British Seed Houses (see back cover).

Extensive research over 20 years has now been completed to show how new HSG varieties improve performance and profitability of milk, beef and lamb production.

Early research with existing varieties includes:

- Grazing trials in the 1980s on six commercial dairy farms and six commercial beef farms, over two seasons;
- Sheep studies at two IGER research stations over three grazing seasons;

Recent research with improved varieties, combining good disease

resistance with high yield, includes:

- Zero grazing trials to verify the benefits of feeding high sugar grass to dairy and beef cattle;
- Nutrition studies to identify the digestive mechanism that allows ruminants to utilise HSG varieties more efficiently than recommended control grass varieties;
- Field-scale grazing trials to monitor animal performance on HSG swards;

This leaflet summarises the results of this work including initial findings from the on-going LINK sustainable livestock production project at IGER, sponsored by DEFRA, the Meat and Livestock Commission, the Milk Development Council and Germinal Holdings.



The Science Behind High Sugar Grasses

Cattle and sheep are actually poor converters of grass protein into milk and meat. When grazing ordinary grass, livestock use only about 20% of protein from the herbage for production - most of the rest is wasted in faeces and urine. This is not only financially costly, but also detrimental to the environment.

A major reason for these losses is the imbalance between readily available energy and protein within the grass. Proteins are rapidly broken down when feed enters the rumen. However, when the diet lacks readily available energy, the rumen microbes can use less of the nitrogen released from the feed, so much of it is absorbed as ammonia and eventually excreted.

Grass cell walls consist of the complex carbohydrates, cellulose, hemicellulose and lignin. Although these components can be broken down, this takes time and the carbohydrates are not, therefore, available early on, when grass protein is broken down in the rumen.

Water soluble carbohydrates in grass are the sugars found *inside* the plant

cells, rather than in the cell walls themselves. They become a source of readily available energy soon after forage enters the rumen, allowing rumen microbes to process more grass protein. This protein can then be used in the production of meat and milk.

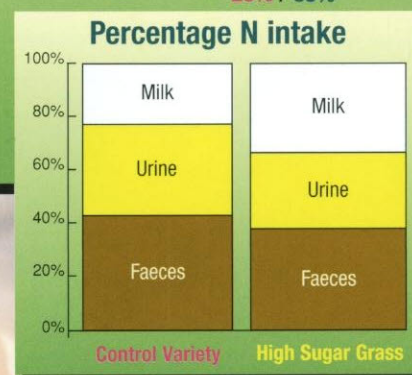
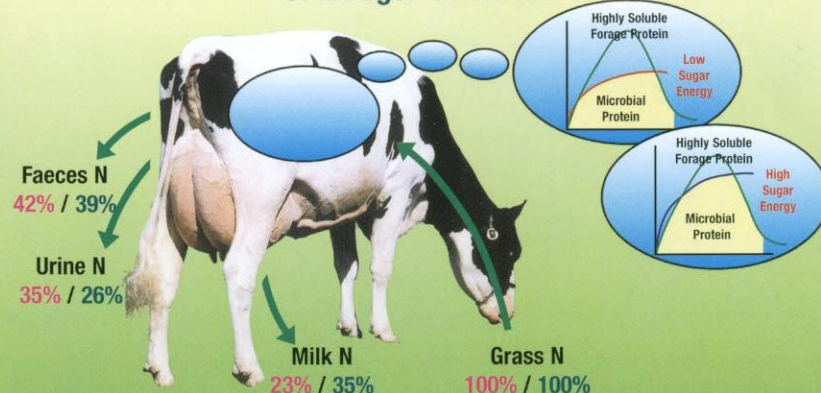
Through this mechanism, HSG varieties, with high levels of water soluble carbohydrates, can significantly improve the utilisation of protein in grass.

Research at IGER has shown that HSG varieties have consistently higher levels of sugars than standard varieties throughout the grazing season. Water soluble carbohydrate levels up to 50% higher have been recorded in some HSGs. However, studies have shown even a small difference in the level of water soluble carbohydrates can have a big effect on ruminant performance.

Several trials involving dairy and beef cattle, as well as sheep, have demonstrated significant performance benefits from feeding HSG varieties.

Results from these trials are summarised in the following sections.

How High Sugar Grass improves the efficiency of nitrogen utilisation



High Sugar Grass For Milk Production

Results of several studies conducted on commercial dairy farms and by IGER at its dairy unit near Aberystwyth, show that grass protein is used more efficiently for milk production when extra energy is provided by feeding HSG varieties.

Animals were fed either an experimental HSG or a recommended control ryegrass variety. Both grazing and zero-grazing techniques were used in the assessments.

The main advantages of feeding HSG varieties were found to be:

- **Milk yield increased substantially**

In an early study that looked at Italian Ryegrass across six commercial dairy farms, animals averaged 6% more milk per cow over the grazing season.

In recent zero grazing trials with Perennial Ryegrass, the average milk yield of animals fed HSG increased by 2.3kg/day in early lactation and by 2.7kg/day in late lactation, without a detrimental effect on milk quality.

- **Dry matter intakes improved significantly**

Zero grazing trials at IGER completed in 2000 found that dry matter intakes rose by around 2kg/head per day. This is particularly important in low input farming systems where producers want animals to obtain as much of their nutrients as possible from grazed grass.

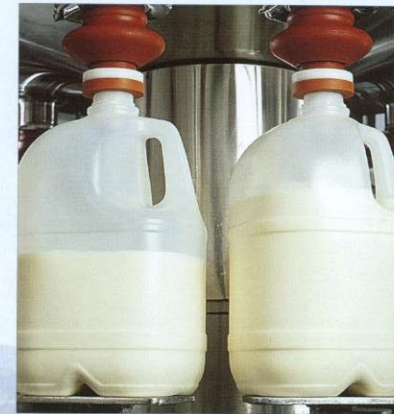
- **Diet digestibility increased**

In the same trial, a 3% improvement in diet digestibility was recorded with HSG. The dry matter digestibility of

the HSG variety was found to be consistently higher than the recommended control variety throughout spring, summer and autumn.

- **The amount of feed nitrogen lost in urine is significantly less**

In three zero-grazing trials involving early, mid and late lactation animals, the amount of feed nitrogen lost in the urine was reduced by up to 24% from animals fed the HSG variety. This has important implications for the environment in terms of nitrogen pollution.

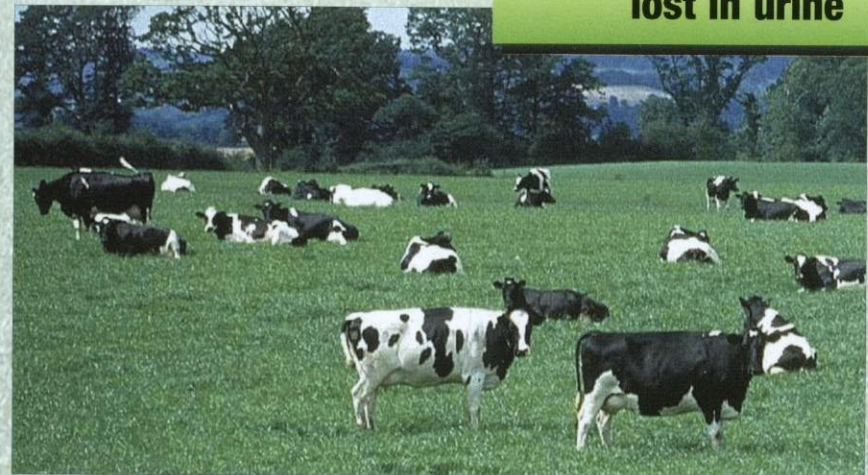


**6% more milk per cow
over grazing season**

**Dry matter intakes up by
2kg/head per day**

**3% improvement in diet
digestibility**

**24% less feed nitrogen
lost in urine**



High Sugar Grass For Beef Production

Grazing trials and a companion zero-grazing study run by IGER at Aberystwyth have shown that when extra energy is provided to beef cattle by feeding HSG varieties, grass protein is used more efficiently and animal performance is enhanced.

Research involved beef steers offered either an HSG variety or a recommended control ryegrass variety. No extra additional feed was given, and grass intakes and live-weight gains were monitored regularly.

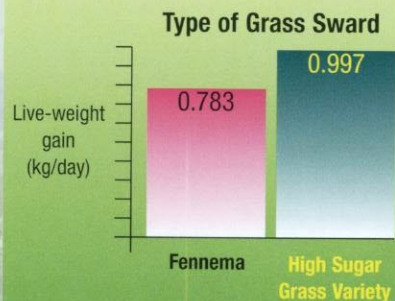
- Dry matter intakes of animals fed HSG increased by around 25%, compared with those fed the control variety;

- Greater intake was achieved because the HSG variety was highly palatable. Additionally, HSG was utilised more efficiently by rumen

microbes and passed more quickly through the rumen;

- Animals grazing HSG recorded average daily live-weight gains of 0.997kg/head per day, which was 20% higher than the gain of cattle fed the recommended control variety;

Performance of Charolais cross steers in grazing trials at Aberystwyth, Summer 2000



- In a separate zero grazing trial, animals fed an HSG variety recorded high levels of growth performance, with an average live-weight gain of 1.3kg/head per day.

- This bonus from HSG was the result of higher forage intakes and greater efficiency of grass utilisation.

- The growth rates of HSG-fed animals were enhanced, so they reached slaughter weights more quickly than those fed the control variety.



**Dry matter intakes
increased by around 25%**

Higher forage intakes

**20% higher daily
live-weight gains**

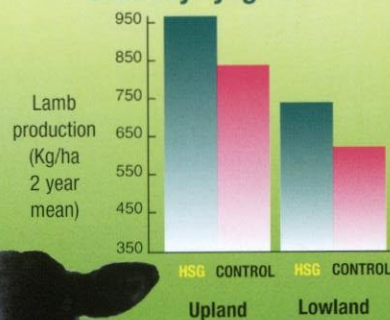
**Slaughter weights
reached more quickly**

High Sugar Grass For Lamb Production

In both upland and lowland situations, IGER's grazing trials have shown HSG varieties to be superior in terms of animal performance, when compared with standard ryegrass swards.

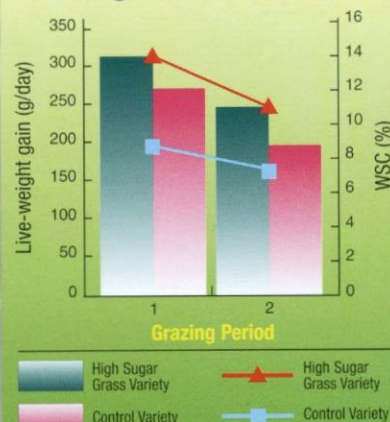
- Initial studies on upland and lowland IGER research farms showed that an early experimental HSG variety supported significantly higher lamb growth rates;

Lamb production comparing High Sugar Grass with an ordinary ryegrass



- In recent trials with Welsh Half-bred ewes and lambs, the live-weight gain of lambs was 20% higher where animals were grazing the HSG variety;

Lamb production on High Sugar Grass Variety



- In the same study, the carrying capacity (stocking rate) of the HSG sward was 20% higher than the standard ryegrass sward;
- Ad lib* forage intake of grazing lambs was higher on the HSG sward.

Higher forage intakes

20% higher live-weight gains

20% higher carrying capacity of HSG sward

On-Going HSG Research Projects

Silage Production

Preliminary lab based trials at IGER indicate that significantly higher levels of sugar are retained in inoculated HSG silage compared with conventional varieties.



Under a new LINK sustainable livestock production project, sponsored by DEFRA, the Meat and Livestock Commission, the Milk Development Council and Germinal Holdings, IGER's scientists will evaluate the performance of dairy cattle fed silage conserved from a recommended HSG variety.

An EU funded (Sweet Grass) project involving IGER, as well as universities and research organisations in Ireland, Germany, Norway and Sweden, will also establish techniques for the conservation of HSG varieties to maximise the quantity of sugar in the

ensiled crop. The effect of co-ensilage of HSGs with legumes will also be investigated.



Grazing Trials

An on-going LINK project at IGER is looking at the performance of HSG varieties throughout the grazing season. The objective of this research is to provide more evidence of the advantages of using HSG ryegrass in low-cost dairy, beef and sheep production systems. The EU funded project outlined above will also develop grazing strategies for using HSG varieties and locally adapted grasses in a range of northern European management situations.



Commercially Available High Sugar Grass Mixtures

All new grass and clover varieties bred by IGER are marketed under the "Aber" prefix. They are exclusively available from British Seed Houses in the UK.

AberHSG (High Sugar Grass) varieties have been tested and recommended with extremely high ratings in recommended list trials conducted by NIAB, SAC and DARD.

AberHSG varieties are now available in three outstanding mixtures:-

AberHSG1-Dual A dual purpose medium term ley, containing AberDart, AberAvon and AberEcho, plus the AberClover blend AberDairy, AberPasture or AberSheep.

AberHSG 2-Hybrids A short term mixture for 3 to 5 years for conservation or rotational grazing, incorporating the AberHybrid Ryegrasses AberEcho and AberStorm, along with AberDart and an Aber white clover blend.

AberHSG 3-Grazing A long term mixture with 100% HSG diploids for improved persistence. Incorporating the first of the new generation AberHSG varieties - AberStar, alongside AberDart and AberAvon, plus the white clover blend AberPasture or AberSheep. (Available from Spring 2005).

It is essential to maximise the percentage of AberHSG in the mixture to achieve the maximum benefit.

Current AberHSG varieties are:

**AberDart Intermediate Diploid
Perennial Ryegrass**

**AberAvon Late Diploid
Perennial Ryegrass**

AberEcho Hybrid Tetraploid Ryegrass

AberStorm Hybrid Ryegrass

**AberStar Intermediate Diploid
Perennial Ryegrass**

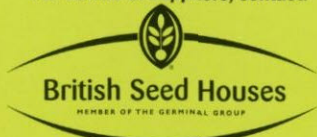
AberStar is the first of a new generation of AberHSG with even more WSC plus even higher DM yields.

**Look for the AberHSG logo
- ask for the genuine article -**



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