

Introduction

Straw is a by-product resulting from the growing of commercial crops, primarily cereal grain. Ireland's area under cereals amounts to almost 300,000 hectares and yielding approximately 1.1m tonnes of straw. The traditional markets for straw include, animal bedding, animal feed and chopping and plough back to increase soil carbon content. Straw has been used in other EU countries for decades as a combustion fuel for both heat and electricity production.

The Irish government and the EU have made clear their wish to promote the use of increasing amounts of biomass for the production of energy. They have set overall targets for renewable energy production (16% of total consumption by 2020), and a specific target for heat (12% substitution) in the Irish 2007 Bioenergy Action Plan. Both targets are far in excess of what is being produced from biomass at present. Cereal straw is a biomass material that is in plentiful supply in Ireland. An SEI-commissioned study in 2005 estimated that of a total straw production of 1.2 - 1.5 million tonnes, 80-320,000 tonnes could be available for energy use. Traditionally straw prices have been very volatile, but fixed-price contracts are likely to be more attractive to growers now than they have been in the past.

Straw Harvesting

Winter crops of Barley, Wheat, Oats and Oilseed Rape would become available from July – August. The spring sown crops would become available in late August to end of September. Straw is normally baled in round or square bales and transported from the field to storage or directly off-farm. Straw may also be recycled to the soil to improve soil structure and increase soil organic matter content.

Straw Production 2010

Type	Hectares	t/straw/*ha (DM)	t/grain*ha (DM)	t/straw total
W. Wheat	85,400	4.2 (3.6)	9.6 (7.89)	401,380
S. Wheat	42,300	3.0 (2.5)	6.4 (5.28)	160,740
W. Barley	21,100	4.2 (3.6)	8.3 (6.8)	80,180
S. Barley	114,000	3.6 (3.0)	6.5 (5.36)	364,800
W. Oats	18,024	4.7 (4.0)	7.8 (6.4)	72,096
S. Oats	4,083	3.9 (3.3)	5.9 (4.8)	13,065

* Straw at 15% moisture and grain at 18% moisture

Straw use

Straw can enter any of the following markets:

- Animal feed (Barley)
- Mushroom compost (Wheat)
- Animal bedding (Oaten, Barley, wheaten)
- Chopping to return to soil (mainly on winter crops)
- Energy

Weight of Straw Bales

Small square bale	15kg
4 x 4 round bale	150 kg
5 x 4 round bale	240 kg
8 x 3 x 2 (square)	150 kg
8 x 3 x 3 (square)	450 kg
8 x 4 x 4 (square)	625 kg

Source, Teagasc figures



Energy Value of Straw per tonne at 15% Moisture

Type	Calorific Value (Mj/kg)	Energy Content (kWh)/tonne	Heating Oil Equivalent (Litres)	Ash Content (kg)/tonne
Wheat Straw	14.4	4,032	396	57
Barley Straw	14.7	4,116	406	48
Rape Straw	14.3	4,004	393	62
Meadow Hay	14.3	4,004	393	71

Source, Teagasc figures

Straw for Energy

For the use of straw as fuel, its use in boilers might possibly lead to corrosion problems on heat exchange surfaces. There are a number of boiler manufacturers who will apply their boiler warranty to straw. Straw is a CO₂ neutral fuel and that is the reason why it can play a role in the energy supply chain. Straw has been used as an energy fuel in Denmark since the early seventies.

Straw used for fuel purposes usually contains 14 – 20% moisture that vaporises during burning. The remaining dry matter consists of less than 50% carbon, 6% hydrogen, 42% oxygen, and small amounts of nitrogen, sulphur, silicon and other minerals e.g. alkali (sodium and potassium) and chloride.

It has been known for a long time that straw that has been lying in the field which has been exposed to rain has a reduced content of corrosive material.

Straw Chemical Composition

Straw	C	H	O	N	K	Ca	Mg	P	S	Cl
Barley	47.5	5.8	41.4	0.46	1.38	0.49	0.07	0.21	0.089	0.40
Triticale	43.9	5.9	43.8	0.42	1.05	0.31	0.05	0.08	0.056	0.27
Rape	47.1	5.9	40.0	0.84	0.79	1.70	0.22	0.13	0.270	0.47
Wheat	45.6	5.8	42.4	0.48	1.01	0.31	0.10	0.10	0.082	0.19

Source, Teagasc figures



Straw bales being fed into shredder and combustion chamber.

Boilers

There are a number of boilers developed which can handle the more complex chemistry of straw for combustion. Batch – fired boilers are available equipped with combustion air fans to control the air supply. Boiler plants for straw can be used for on-farm heat generation and for district heating. Straw can be presented in chaffed, pellet or whole bale form depending on the boiler technology.

Oilseed rape straw removes fewer nutrients than cereals and so is less 'valuable'. However, it has a high calorific value and burns very well. There is a batch boiler available which uses a buffer tank to store the hot water between peak heat deliveries.

Summary

- Considerable quantities of straw are potentially available for energy use.
- There are a number of biomass boilers available for burning straw.
- Straw can be burned in a number of forms depending on the technology

Further information:

Barry Caslin, Teagasc. barry.caslin@teagasc.ie 059/9170200
 Dr. John Finnan, Teagasc. john.finnan@teagasc.ie 059/9170200

Teagasc,
 Head Office,
 Oak Park, Carlow

059/9170200
www.teagasc.ie